

	<b>BHARAT HEAVY ELECTRICAL LIMITED</b>		Enquiry No. :
	UNIT'S ADDRESS:		Due Date :
	CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL		Supplier Qtn. No.:
	(FROM PURCHASE DEPTT.)		Date :
<p style="text-align: center;"><b>SPECIFICATION CUM COMPLIANCE CERTIFICATE OF CNC LATHE.</b></p> <p><b>NOTE:-</b></p> <ol style="list-style-type: none"> <li>1. Vendor (OEM) must submit complete information against clause no. 24(Qualifying condition). The offer meeting this clause would only be processed (OEM : Original Equipment Manufacturer).</li> <li>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.</li> <li>3. The offer and all documents enclosed with offer should be in English language only.</li> </ol>			
NAME & ADDRESS OF THE SUPPLIER :			
TELEPHONE NOS.:			
FAX NOS.:			
E-MAIL ADDRESS :			
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF CNC LATHE COMPLYING WITH SPECIFICATIONS AS BELOW:			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATIONS	REMARKS
1	PURPOSE & WORKPIECE MATERIAL :				
1.1	<p><b>Purpose (Operations/Jobs involved) :</b></p> <p>A) To rough &amp; finish turn the Steam Turbine Shafts/Rotors (Steam Turbines of different ratings) which are components of high precision.</p> <p>B) To Machine different types of grooves on rotor for blade roots like T-Root grooves.</p> <p>C) To Turn the Taper portions on Rotor.</p> <p>D) To Face the Flange at the end of rotor.</p> <p>E) To machine the Internal and External threads at the end of Rotor, if required.</p> <p>F) To Roll, Polish &amp; Burnish the Rotor Journals.</p> <p>G) When Rotor/Job is held in Chuck &amp; at one steady, it should be able to machine or face easily throughout the length.</p> <p>H) To take runout measurements on bladed rotors.</p> <p>I) The machine shall be used for all types of turning/grooving/threading operations, grinding operations on cylindrical &amp; radial (LH&amp;RH) surfaces, rolling operations on diameter/faces/fillet radii etc. on different types of shafts/rotors.</p>	Vendor to accept			
1.2	<p><b>Work Piece Material: (Material detail, Hardness etc.) :</b></p> <p><b>Work Piece : Turbine Rotor</b> - Forging of high alloy steels like 28CrMoNiV59 &amp; 26NiCrMoV145 and similar other materials which are generally used in power producing equipment having Tensile Strength upto 980 N/mm2 &amp; Hardness 300 BHN.</p>	Vendor to accept			
2	SPECIFICATIONS : (Minimum requirements)				
2.1	CAPACITY & SIZE :				
2.1.1	Max. Turning Diameter	4000 mm or more			
2.1.2	Max. Turning Length	12000 mm or more			
2.1.3	Max. Weight of Work-piece between centers without steady	100000 Kg or more			
2.1.4	Max. Weight of Work-piece:	120000kg or more			
2.1.4.1	In head stock with one steady rest without tail stock support.	120000kg or more			
2.1.4.2	In head stock with two steady rests without tail stock support.	120000kg or more			
2.1.4.3	Only in chuck	Vendor to inform			
2.1.5	Min. & max. bore diameter (at center of flange of rotor)	50mm - 150mm			
2.1.6	Max. boring depth (Sl.No. 2.1.5) from flange face	400mm			
2.1.7	Admit between centers (ABC) / Center Distance {Machine should be capable of facing at maximum length}	12000mm or more			

2.1.8	Center Height					
2.1.9	Swing over bed (SOB)				Vendor to inform	
2.1.10	Swing Over Carriage (SOC)				4500mm	
2.1.11	Distance of center of gravity from face plate, in case the workpiece is held only in chuck (SI.No. 2.1.4.3)				40000mm	
2.1.12	Face plate Diameter. (Drg. To be submitted)				Vendor to inform	
2.1.13	No. of Hard Jaws				4 nos.	
2.1.14	Max. & Min. Chucking Diameters (with single set of jaws).				Vendor to inform	
2.1.14.1	External - Min. 150mm or less, Max. 1100mm or more				Vendor to inform	
2.1.14.2	Internal				Vendor to inform	
2.1.15	Min distance between Head stock & Tail stock				Vendor to inform	
2.1.16	Min and Max facing diameters without Tool holder extension (Tool holder/carrier at its reference position)				Vendor to inform	
2.2	HEAD STOCK :					
2.2.1	Spindle drive power (AC), Minimum				170kw or more	
2.2.2	Spindle Motor & Drive Make: FANUC ai or SIEMENS 1PH series spindle motor with matching spindle drive				Vendor to inform	
2.2.3	Spindle Bearing Type & Diameters (Radial & Axial)				Vendor to inform	
2.2.4	Spindle nose details (Drawing to be submitted)				Vendor to inform	
2.2.5	Spindle speed (Infinitely variable)				Min. 1.0rpm or less, Max. 150rpm or more	
2.2.6	Detail of speed ranges (Selectable through program)				Vendor to inform	
2.2.7	Range of spindle speed at constant power.				Vendor to inform	
2.2.8	Max permissible torque at face plate				Vendor to inform	
2.2.9	RPM at which max. permissible torque is available				Vendor to inform	
2.2.10	Torque/Power/Speed diagram of spindle motor				Vendor to submit	
2.2.11	Head stock center, either 60° or 90° with cover plate to cover the space when headstock center is removed.				Vendor to offer	
2.2.12	Spindle bore diameter and its depth from chuck face				Vendor to inform	
2.2.13	Detail of Hard Jaws, Force Multipliers for easy movement & clamping of jaws, T-slots on chuck etc. (Face plate drawing showing slot position etc also should be submitted)				Vendor to inform	
2.2.14	Clamping force on each jaw				Vendor to inform	
2.2.15	Chuck guard of suitable length to cover the chuck for the length more than jaw's height with motorised movement through push buttons & interlock to prevent chuck rotation when guard is behind chuck face.				Vendor to offer	
2.2.16	Male & Female Gauges/Templates (One Set) for checking the headstock angle should be provided.				Vendor to offer	

<b>2.3</b>	<b>MACHINE BED :</b>					
2.3.1	No. of Guide ways		Vendor to inform			
2.3.2	Bed width across ways		Vendor to inform			
2.3.3	Type of guide ways: Hydro-static Guideways for X and Z axes, (Details should be submitted)		Vendor to offer & submit			
2.3.4	Hardness of guideways		Vendor to inform			
2.3.5	<b>Metallic Telescopic Covers</b> 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. Telescopic covers should be sloping towards chip conveyor.		Vendor to offer			
<b>2.4</b>	<b>FEEDS AND DRIVE SYSTEM :</b>					
2.4.1	Feed range in X & Z axes (Infinitely variable)		0.1 - 4000mm/min or more			
2.4.2	Rapid traverse in X & Z axes (Infinitely variable)		0 - 6000mm/min or more			
2.4.3	Feed motors & drives: FANUC ai or SIEMENS 1FT1FK series AC servo motors with matching AC servo drives		Vendor to offer & submit			
2.4.4	Feed back system for X & Z axes: Heidenhain linear scales (Details to be submitted)		Vendor to offer & submit			
2.4.5	Details of System to ensure zero backlash for X & Z axis		Vendor to inform			
2.4.6	Mechanism for locking X & Z axis (Through brake directly on the feed motor)		Vendor to inform			
2.4.7	Maximum feed force in X and Z axes		Vendor to inform			
2.4.8	Maximum Torque in X and Z axes		Vendor to inform			
2.4.9	Detail of X and Z axes feed mechanism		Vendor to inform			
<b>2.5</b>	<b>STEADY RESTS :</b> (Refer & Consider clause 2.1.4)					
2.5.1	Range of supporting dia for Hydrostatic Steady Rests		Min. 200mm or less, Max. 1500mm or more			
2.5.2	Range of supporting dia for Open force lubricated steady rests		Min. 150mm or less, Max. 1500mm or more			
2.5.3	No. and Range of each Hydrostatic Steady Rest to cover the specified range. Max.weight admitted on each steady rest to be 60Tons or more. (Quantity - 2 Sets complete in all respects)		Vendor to inform			
2.5.4	Vendor to provide Hydrostatic steady rest pads ( 1 no. each, total 10 nos.) for diameters as given below: 250 ( - 0.029 ) , 315 ( h6 ) , 380 ( - 0.036 ) , 400 ( - 0.036 ) , 450 ( - 0.04 ) , 597 ( - 0.044 ) , 599 ( - 0.044 ) , 605 ( h6 ) , 746 ( - 0.05 ) , 747 ( - 0.05 ) mm. Width and design of pads should suit offered hydrostatic steady rests. In case of minor changes in diameters of required pads, vendor shall be informed prior to ordering. Price of each pad is to be quoted separately.		Vendor to offer			

2.5.5	Vendor to provide Pad's constructional details for offered Open force lubricated steady rests. Vendor to also provide Positive clamping of pad supports.	Vendor to offer			
2.5.6	No. and Range of each open force lubricated Steady Rest to cover the specified range. Max.weight admitted on each steady rest to be 60Tons or more. (Quantity - 2 Sets complete in all respects)	Vendor to offer			
2.5.7	Availability of sufficient gap on Top Portion of Steady Rest for job loading/unloading.	Vendor to confirm			
2.5.8	No. of common bases for steady rests for complete supporting range. Common base should suit to both types of offered steady rests i.e. Hydrostatic Steady Rests and Open Force Lubricated Steady Rests. (Quantity of common bases - 2 Sets complete in all respects)	Vendor to inform			
2.5.9	Mounting of Steady Rest on Base shall be through quick-clamping fastener (Details should be submitted) The steady rest unit should be compact with minimum possible total width (along Z-axis) to avoid its obstruction with nearby flanges/faces or carriage/tool post in any way while machining near steady support dia, when the component is supported on steady with other end in chuck considering attached proveout component drawings.	Vendor to offer			
2.5.10	Motorised movement on bedways with positive clamping (Details should be submitted)	Vendor to offer			
2.5.11	Clamping force of base on bedways	Vendor to inform			
2.5.12	Independent, automatic, refrigerated type (with heating also, if required) recirculating (with provision to avoid mixing of oil with coolant) lubrication system , fixed on hydrostatic steady, shall be provided for lubrication between hydrostatic pads and supporting dia of job. Vendor to Provide lubrication system for open force steady rests also. Tank for lubricating oil fixed with steady shall have provision to display alarm on control panel in case of low oil level (Details should be submitted)	Vendor to offer			
2.5.13	Adjustable Chip Protection Guards on steady rests to avoid falling of small chips on hydrostatic & open force steady rest pads.	Vendor to offer			
2.5.14	Mechanism of motion of Side Pads & Center Pad of offered Hydrostatic and Open Force Lubrication Type Steady Rests.	Vendor to inform			
<b>2.6</b>	<b>TAIL STOCK :</b>				
2.6.1	Motorised movement on bed by Push Buttons on Tail Stock	Vendor to offer			
2.6.2	Quill stroke	Vendor to inform			
2.6.3	Quill movement to be equipped with following features :				
2.6.3.1	Presetting, display & automatic control of thrust applied	Vendor to offer			
2.6.3.2	Compensation for thermal expansion of work piece	Vendor to offer			
2.6.3.3	Motorised Drive	Vendor to offer			
2.6.4	Quill diameter	Vendor to inform			
2.6.5	Rapid Traverse rate of tail stock body on bed	Vendor to inform			

2.6.6	Traverse of quill with traverse rate					
2.6.7	Hardened Tail stock centre - For both 60 & 90degree (Drawing to be submitted) as per standard.			Vendor to inform		
2.6.8	Detail of Positive Clamping & Unclamping of tail stock on bed			Vendor to inform		
2.6.9	Max thrust on the Quill			Vendor to inform		
2.6.10	Set of Male & Female Gauges/Templates for checking the angle should be provided.			Vendor to offer		
2.7	<b>CARRIAGE/ CROSSLIDE :</b>					
2.7.1	Z-axis travel			Vendor to inform		
2.7.2	X-axis travel Specify movement along x-axis beyond center i.e. X -negative side also.			2100 mm or More.		
2.7.3	Cutting force available at the carriage			Vendor to inform		
2.7.4	Layout showing extreme positions of the all axes movements			Vendor to submit		
2.7.5	Carriage to clear chuck, tailstock and all steady rests (should be confirmed)			Vendor to confirm		
2.8	<b>TOOL POST :</b>					
2.8.1	<b>Type of Tool Post:</b> Fixed type tool post equipped with two blade/plate type tool carriers mounted on either side suitable for conventional & downturning with additional provision of boring bar holder for boring bars <b>(SI No. 2.1.5 &amp; 2.1.6)</b> and mounting of rolling device, superfinishing device. Grinding attachment shall also be mountable on same tool post/carriage. Offered tooling system should ensure rigid and vibration free machining considering different overhang of tools required for proveout component. Left blade shall be primarily used for all types of turning, grooving, threading, rolling, boring etc. operations using square shank tools in radial/axial clamping, boring bars etc. Right blade shall be primarily used for deep grooving, turning and contouring operations using suitable tools.			Vendor to offer		
2.8.1.1	Thickness of Blades : Left Blade - 120mm, Right Blade - to suit specified requirement of deep grooving/contouring.			Vendor to offer		
2.8.1.2	Positioning of Blades : Through two independent CNC programmable axes using M functions with positioning at steps with minimum overhang of 100mm or less and maximum overhang of 800mm or more.			Vendor to offer		
2.8.1.3	Traverse of Blades : 800mm or more - To suit specified requirements in view of proveout component.			Vendor to confirm		

2.8.1.4	Blades should have provision to accept standard block type cartridges/cassettes/ adapters capable of clamping of square shank tools (40mmx40mm) in radial & axial directions, LH & RH clamping, with holding/grip length of 200mm or more for both upturning and down turning operations and also boring bars (dia 32, dia 40, dia 50 & dia 80). To suit the requirement, RH side blade may be made of different width and clamping as of LH blade and with special tool holder mounting system with agreement of BHEL.	Vendor to offer			
2.8.1.5	Vendor to submit layout of X-axis and axes of blades showing possible recessing depth on maximum turning diameter.	Vendor to submit			
2.8.2	Type of Tool Holders for both Tool carriers, Boring Bar Holder, Mounting of Rolling device / Superfinishing device / Grinding attachment - Preliminary representative drgs./sketches to be submitted by vendor.	Vendor to submit			
2.8.3	Tool shank height for different tool holders - 40mmx40mm for square shank tools, for other type of tool holders - to suit specified requirements.	Vendor to offer			
2.8.4	Provision for coolant to reach upto tool tip in all types of tool holders clamped in all tool carriers for both upturning and down turning operations and also boring bars.	Vendor to offer			
2.8.5	Automatic operation / selection of positioning of tool carriers through CNC program/M codes. While executing CNC program, automatic updation of tool offsets should be there in case of change of projection of carrier.	Vendor to offer			
2.8.6	Additional manual operation/selection of positioning of tool carriers through push buttons or equivalent.	Vendor to offer			
2.8.7	Drawing of tool post showing configuration of the tool post and all tool carriers.	Vendor to submit			
2.8.8	Limitation regarding length & weight of tool / tool holder clamped in different tool holders for troublefree operation	Vendor to inform			
2.8.9	Projection of the tool carriers (without tool holder/cassette) with which the tool carriers can clear all offered steady rests during movement along Z-axis.	Vendor to inform			
2.8.10	Following safety features to be provided for all the tool carriers. * The tool carrier should not go to its reference position unless cassette/tool/cartridge/adaptor, mounted on it, is removed. * Movement of a tool carrier should be possible only when other carrier is at reference position. * Movement of tool carriers should be interlocked with chuck rotation and feed motion in X & Z-axes.	Vendor to offer			

<b>2.9</b>	<b>CONSTRUCTION:</b>				
2.9.1	Vendor to furnish details of material, hardness & constructional details including explanatory drawings of various components/assemblies like Headstock, Steady Rest, Steady rest pads, Chuck, Tailstock, Carriage, Tool post, Machine bed, Feed Transmission system, Feedback system etc.of the machine.	Vendor to inform			
2.9.2	Video/Images on CD/ hard copy explaining the technical features / Literature with photographs, drawings explaining the technical features should be enclosed with the offer	Vendor to submit			
<b>2.10</b>	<b>OPERATOR'S PLATFORM:</b>				
2.10.1	Independent operator's platform should be provided on both sides of tool post with staircases and having sufficient space for left to right & vice versa movement without any obstruction and stepping down for convenient and safe operation from both sides. A 15 Amp. Plug Point (Indian type) with ON/OFF switch is also to be provided on the Platform.	Vendor to offer			
2.10.2	Splash / Chip guards (sliding door type with glass windows) on operator platform for protection of operator, operator's panel and to avoid spillage of coolant & chips on shop floor and operator's platform.	Vendor to offer			
2.10.3	Additionally, Movable Splash / Chip guard should be provided on rear side (opposite to operator's platform) to avoid spillage of coolant & chips on shop floor.	Vendor to offer			
2.10.4	Operator's Platform should clear all steady rests, tailstock and also headstock while working near chuck.	Vendor to offer			
<b>2.11</b>	<b>OPERATION AND CONTROL SYSTEM:</b>				
2.11.1	<b>OPERATOR'S PANEL:</b>				
2.11.1.1	Swiveling and sliding type operator's panel having complete CNC and machine control system with TFT flat colour display 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 offer			
2.11.1.2	An auxiliary pendant, which can be taken near to the chuck for job setting and similar other purposes.	Vendor to offer			



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

<b>2.11.4</b>	<b>HAND HELD UNIT:</b>				
2.11.4.1	Hand Held unit, alongwith sufficient length of interfacing cable is to be offered for handwheel (MPG) operation of individual axis in jog & increment mode and provision for spindle inch in c.w & c.c.w directions	Vendor to offer & details to be submitted.			
<b>2.11.5</b>	<b>UPS FOR CNC SYSTEM: (Only in case of PC based CNC systems)</b>				
2.11.5.1	UPS of 15 minutes for CNC system with inbuilt cooling and charge status display is to be supplied only in case of PC based CNC systems.	Vendor to offer & details to be submitted.			
<b>2.11.6</b>	<b>NOTE BOOK PC (I/O DEVICE):</b>				
2.11.6.1	Note Book PC (Internationally reputed make and latest model) with Windows operating system is to be supplied for bi-directional transfer of program and data between the offered unit and supplied CNC system. The notebook must contain all application softwares for the supplied CNC, PLC and Drives systems along with required interfaces and cables.	Vendor to offer with details.			
<b>2.12</b>	<b>MACHINE LIGHTS:</b>				
2.12.1	Machine Lights for sufficient illumination of complete working area on all sides of operator's platform 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			
2.12.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to confirm			
2.12.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to offer			
<b>2.13</b>	<b>REFRIGERATION UNITS / AIR CONDITIONERS</b>				
2.13.1	Door mounted Air Conditioners with Dehumidifiers of reputed international make who have after-sales spares support in India or of Indian make like Advance/ Werner Finley/ Rittal for all Electrical/ Electronic Panels/ Cabinets including Operator's Panel (One no.of sufficient capacity for each cabinet/ panel considering continuous operation at ambient temperature of 50°C). The blow of cool air from the air conditioners shall not fall directly on the electronic circuits/ modules. ACs must be incorporated with electrical/ refrigeration interlocks.	Vendor to offer and confirm			

2.13.2	ACs unit must be mounted on the movable pendent with well-supported universal-head bolt. Two sets of cut-out labels are mandatory to be supplied with the units. The electrical connection of the AC unit must be with male-female connector, easily disconnected from the AC unit side. There has to be a MCCB to isolate the AC unit from the electrical panel.	Vendor to offer and confirm			
2.13.3	Oil Chiller units of reputed international make who have after-sales spares support in India or of Indian make like Advance/ Werner Finley/ Rittal/ Gem in package should have minimum 50% standby with multiple refrigeration circuits having energy-efficient HFC-based Hermetically-sealed Rotary/ Scroll/ Reciprocating Compressors with independent refrigeration circuits having SS-brazed Plate-type Heat Exchanger, Air-cooled Condenser, Thermostatic Expansion Valve, HP/ LP Switch, Oil Flow/ Anti Freeze Cut-out, etc. The units must have In-line Multistage Gear Pumps (with 100% standby), SS Storage Tank, Valves, NRVs, Filters, Automatic Microprocessor-based Controller with LCD Display, Safety Interlocks, etc. in one complete package. The unit must operate continuously with equal-run-time of Compressor at ambient temperature of 50°C.	Vendor to offer and confirm			
2.13.4	For precise air/ oil temperature with energy-efficient operation, latest state-of-the-art technology features like constab pressure control, variable speed control of fan-motor, hot-gas bypass control, etc. needs to be incorporated in the above Unit (s).	Vendor to offer and confirm			
2.13.5	Unit (s) must be designed to work in extremely harsh industrial environment and needs protection from heat, dust, fumes, corrosive or oily vapours, moisture, etc. The condenser coil must resist dust accumulation & must transfer heat efficiently.	Vendor to offer and confirm			

2.13.6	Vendor to supply the following information about Air Conditioners and Chiller Unit (s) used in the machine: Type of Air Conditioning/ Chiller Unit. - Capacity of the Unit. - Type of Compressor with complete specifications. - Type of Thermostatic Expansion Valve with complete specifications. - Fan size and flow in CFM (cubic feet meter) of the Condenser unit. - Specifications of the Evaporator Unit. - Functional requirement of temperature of cool air/ oil to be maintained between range +15°C to +40°C. - Type of Microprocessor-based Controller with LCD Display with complete functional details. Detailed specifications of all the components fitted in the Unit (s) are to be submitted with BOM, make, etc. in Technical bid. Vendor have to provide leaflet/ catalogue of all the brought-out items, refrigeration accessories and provide schematic layout of the system.	Vendor to specify			
2.13.7	Compressor, Refrigeration Spares Items, PHE (Plate-type Heat Exchanger), Gear Pump, etc. must be available in India and if possible can be repaired, locally. Vendor have to give training to operate, maintain & repair all the individual items and the Chiller/ AC Unit (s) as a whole. Exhaustive training is to be given for electrically integration of the Unit (s) with the CNC machines.	Vendor to confirm			
<b>2.14</b>	<b>HYDRAULIC SYSTEM</b> : Details should be submitted by the Vendor.				
2.14.1	The system should be centralised type . Hydraulic Tank shall preferably be located at floor level. Complete hydraulic system should be designed to avoid any leakage or spillage.	Vendor to offer and confirm			
2.14.2	Make Rexroth / Vickers Sperry or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to offer and confirm			
2.14.3	Filtration System, Details should be submitted. There should be provision of filters in delivery lines of pumps from oil collection tank to main hydrostat / hydraulic systems tanks. Filter elements should be of Make : EPE / Hydac / equivalent Internationally reputed manufacturer.	Vendor to offer and confirm			
2.14.4	Failure indication	Vendor to offer			
2.14.5	Automatic shut off provision, Details should be submitted.	Vendor to offer			

2.14.6	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. keeping in view the specified ambient conditions to be offered with complete details. The temperature of Hydraulic Oil should not go beyond 40 deg. C.	Vendor to offer & submit			
2.14.7	Hydraulic pump capacity (flow / pressure)	Vendor to inform			
2.14.8	Each pump should have an independent motor. Tandem pumps should not be used.	Vendor to confirm & offer			
2.14.9	<b>First filling of all required Oils &amp; Grease etc.</b> to be supplied by vendor for complete machine & its peripherals including transformer & air-compressor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.	Vendor to offer			
<b>2.15</b>	<b>COOLANT SYSTEM :</b>				
2.15.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons as well.	Vendor to offer			
2.15.1.1	Recirculating Type Flood Coolant System	Vendor to offer			
2.15.2	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			
2.15.3	Coolant collection and recirculation system should be leakproof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc. In case, any leakage is found, it shall be corrected by vendor.	Vendor to offer & confirm			
2.15.4	Coolant Filtration System: Recirculating type coolant system with Centrifugal Hydrocyclone System or Vacuum Rotary drum type System and Magnetic Separator.	Vendor to offer			
2.15.5	Paper Filter, in case of grinding facility, with indigenously (Indian) available consumables and its independent selection/operation only during grinding.	Vendor to offer			
2.15.6	Coolant Flow Diagram showing filters, pumps, valves, tanks etc.to be submitted with the offer.	Vendor to submit			
2.15.7	Main Coolant pump & motor details etc. including pressure & flow of coolant for different operations like turning & grinding etc.	Vendor to inform			
2.15.8	Standby Coolant pump & motor should be provided to supply coolant in case of failure of main set.	Vendor to offer			

2.15.9	Coolant Tank Capacity				
2.15.10	Pressure & rate of flow of coolant for different variants should be furnished in the offer. The Pressure should be sufficient for the coolant to reach the tool tip at full pressure.	Vendor to inform			
2.15.11	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			
2.15.12	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to offer			
2.15.13	Coolant tank with pump, valves, filtration system shall be located above the ground. Necessary arrangement for pumping the coolant from pit to main tank with level control shall be provided.	Vendor to offer			
<b>2.16</b>	<b>ELECTRICAL :</b>				
2.16.1	415V with fluctuation +/-10%, 50HZ with fluctuation +/- 3 %, 3 Phase AC (3 wire system without neutral) Power Supply Source will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/ control cabinets, etc., shall be the responsibility of vendor. Requirement of grounding/ earthing with required material (Indian make) details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation. The vendor can take earthing connection from the nearest column of the production shop.	Vendor to accept.			
2.16.2	<b>Tropicalisation:</b> All electrical / electronic equipment shall be tropicalized to suit specified ambient & operating conditions.	Vendor to confirm			
2.16.3	All electrical & electronic control cabinets & panels should be dust and vermin proof	Vendor to confirm			
2.16.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm			
2.16.5	All electrical and electronic panels including operator's panel should 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			
2.16.6	Motors shall conform to IEC or Indian Standards	Vendor to confirm			
2.16.7	All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm			

2.16.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm			
2.16.9	<b>In-cycle hour counter</b> with reset facility for counting spindle & carriage running time, cutting time etc. and display the counted data on CNC display	Vendor to offer			
2.16.10	<b>Tool Storage Cabinets</b> ( 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			
2.16.11	<b>Portable Data Input Output Device :</b> Portable unit or its equivalent (Note Book PC with 1 GB pen drive) 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			
<b>2.17</b>	<b>SAFETY ARRANGEMENTS:</b> Following safety features in addition to other standard safety features should be provided on the machine:				
2.17.1	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			
2.17.2	A detailed list of all alarms / indications provided on machine along with cause and remedy should be submitted by the supplier.	Vendor to confirm			
2.17.3	All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine.	Vendor to confirm			
2.17.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to confirm			
2.17.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to confirm			
2.17.6	Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm			

<b>2.18</b>	<b>ENVIRONMENTAL PERFORMANCE OF THE MACHINE :</b>				
	The Machine should conform to following factors related to environment :				
2.18.1	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. Supplier to demonstrate compliance to noise level, if asked for.	Vendor to confirm			
2.18.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
2.18.3	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			
2.18.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
2.18.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
2.18.6	Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm			
<b>3</b>	<b>CHIP CONVEYOR :</b>				
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 rear side of the machine or at appropriate location (as recommended by the vendor).	Vendor to offer			
3.1.1	Two nos. of Chip Bins of appropriate size of Indian make, with wheels, lifting hooks & handle for movement, should also be supplied.	Vendor to offer			
3.2	Type of chip conveyor	Vendor to inform			
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 confirm			
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. Easy removal & fitment shall be considered while designing layout of machine).	Vendor to offer			
3.7	In case of grinding, provision for flushing out grinding dust to avoid clogging of conveyor's holes should be provided.	Vendor to offer			
3.8	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to offer			



3.9	Layout showing location of chip conveyor should be submitted.	Vendor to submit			
<b>4</b>	<b>ULTRA ISOLATION TRANSFORMER :</b>				
4.1	Indian make Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. shall be supplied	Vendor to offer			
4.2	Make	NEEL or Aplab or Auto Electric or Servomax or of international repute.			
4.3	Model and Rating	Vendor to inform			
4.4	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to submit			
<b>5</b>	<b>PNEUMATIC SYSTEM:</b>				
5.1	<b>AIR COMPRESSOR:</b>				
5.1.1	Independent Air Compressor (of reputed Indian make like Elgi or Ingersollrand) 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 (around 4-5 bar with moisture/oil contents) could be used as and when required. The compressor unit should be suitable for continuous duty.	Vendor to offer			
5.1.2	Make & Model of Air Compressor	Vendor to inform			
5.1.3	Make & Model of Refrigerated Air Dryer	Vendor to inform			
5.1.4	Capacity (Flow, Pressure & KW)	Vendor to inform			
5.2	<b>COMPRESSED AIR POINTS:</b>				
5.2.1	Compressed Air Point with manually ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning should be suitably provided on carriage near tool post.	Vendor to offer			

6	<b>TOOLINGS :</b> * Quantity- one no. of each item should be offered, unless specified. * Ordering quantity for all tooling items shall be decided by BHEL at the time of ordering. * LH - Left Hand / RH - Right Hand. Radial - along X axis, Axial - along Z axis. * All tool holders & boring bars, which are not handy, to have holes for lifting by offered jib crane and suitable no. of eye-bolts are to be offered for the same. * All tool holders/boring bars should be complete with their fasteners, coolant connections and packing plates for clamping for square/rectangular shank tools (as applicable) * Detail of consumables/spares like screws, keys etc., used on offered items, shall be provided by vendor in case of order. * Vendor to accept that final drawings for offered items shall be submitted to BHEL after PO, in case of order, for BHEL's approval prior to their manufacturing & supply.	Vendor to accept & offer				
6.1	<b>TOOL HOLDERS FOR TOOL CARRIERS :</b>	Vendor to offer				
6.1.1	<b>Tool Holders for Tool Carrier no. 1 (LH Blade/Plate on Tool Post towards chuck side) :</b>					
6.1.1.1	Tool Holder for radial clamping of square shank (40mm x 40mm) tools on LH side of tool carrier.	Vendor to offer				
6.1.1.2	Tool Holder for radial clamping of square shank (40mm x 40mm) tools on RH side of tool carrier.	Vendor to offer				
6.1.1.3	Long Tool Holder for radial clamping of square shank (40mm x 40mm) tools on LH side of tool carrier. (Length approx. 400mm)	Vendor to offer				
6.1.1.4	Long Tool Holder for radial clamping of square shank (40mm x 40mm) tools on RH side of tool carrier. (Length approx. 400mm)	Vendor to offer				
6.1.1.5	Tool Holder for axial clamping of square shank (40mm x 40mm) tools on LH side of tool carrier..	Vendor to offer				
6.1.1.6	Tool Holder for axial clamping of square shank (40mm x 40mm) tools on RH side of tool carrier..	Vendor to offer				

6.1.2	<b>Boring Bar Holder for Tool Carrier no. 1 :</b>				
6.1.2.1	Boring Bar Holder with through hole for boring bar dia 60, complete with set of fasteners. Holding length for boring bar in the holder should be sufficient (approx. 4x dia i.e. 240mm) for vibration/chattering free boring operation.	Vendor to offer			
6.1.2.1.1	Reduction Sleeve, dia 60 - dia 50, for Boring Bar Holder	Vendor to offer			
6.1.2.1.2	Reduction Sleeve, dia 60 - dia 40, for Boring Bar Holder	Vendor to offer			
6.1.3	<b>Tool Holders for Tool Carrier no. 2 (RH Blade/Plate on Tool Post towards tailstock side):</b> Suitable special rigid tool holders for deep grooving, contouring, turning etc. for sizes given below should be offered. Standard grooving inserts of widths and grooving depths same or near to specified sizes may be selected with consent from BHEL. Tool holders should be mountable on tool carrier with inserts facing downwards and also, if possible, with inserts facing downwards. Qty. - One no. of each type, complete in all respects including fasteners/insert etc. 1. Grooving Width = 12 mm / Depth = 60 mm. 2. Grooving Width = 15 mm / Depth = 70 mm. 3. Grooving Width = 18 mm / Depth = 80 mm. 4. Grooving Width = 25 mm / Depth = 120 mm. 5. LH & RH , Round Dia 25 mm / Depth = 140 mm.	Vendor to offer			

6.2	<b>TOOLING FOR MACHINING OF PROVE-OUT COMPONENT:</b> All types of required tools, inserts, tool holders / cassettes, adapters, grinding wheels, measuring probes/styli, steady pads (with their manufacturing drawings), special measuring instruments etc. in sufficient quantity for all types of operations like turning, grooving, grinding, boring, rolling, measurement operations etc., as recommended by the vendor & agreed with BHEL for complete proveout machining as mentioned at <b>Sl.No. 20</b> to meet required drawing accuracy & surface finish .	Vendor to offer			
6.3	Additional set of 4 Jaws	Vendor to offer			
7	<b>MEASURING SYSTEMS:</b>				
7.1	<b>Automatic Job Measuring System</b>	Vendor to offer			
7.1.1	Automatic wireless job measuring system comprising of Renishaw make wireless system. The system shall be capable of measuring all the details of the complete rotor after machining 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 offer			
7.1.2	The supplier shall quote probes, stylus, software and measuring cycles for the system. The system shall perform automatic measurement of the following in a Single Program by using the Measuring Cycles. (1) Series of blade groove details ( that include groove position, groove widths, groove depths, neck thickness and inside T-width ) for all sizes of blade grooves on rotor .(2) Series of Outside Diameters (3) Series of Step Positions and Step Widths There shall be a provision for offline measurement programming.	Vendor to offer			
7.1.3	There shall be a provision that, in case of an unwarranted trigger, the machine shall stop automatically to avoid probe damage.	Vendor to offer			
7.1.4	The System shall facilitate formatted display of the nominal, tolerance, actual and deviation results in a Screen. The system shall print the results in a user defined format. The printer required for the same shall be quoted. Sufficient number of ports and driver software to transmit the formatted measurement data independently over LAN and to the supplied printer shall be available.	Vendor to offer			
7.1.5	Suitable accessories to calibrate the Probe for Diameter and Step / Groove/ suspension 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 offer			
7.1.6	Supplier shall furnish the details of the accuracy and repeatability of measurement (of diameters, steps, groove widths, suspensions etc.) on the job by the probe.	Vendor to offer			

7.1.7	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 offer			
7.1.8	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 offer			
7.1.9	Supplier shall prove out the measuring system by measuring all the machined dimensions of 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 offer			
7.2	<b>Laser blade Tip measuring system</b> for measuring both straight and taper blade tip diameters .	Vendor to offer			
7.3	<b>Automatic Tool Offset Measuring System</b> with measuring cycles, calibration system etc suitable for all types of tools recommended for prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to offer			
7.4	<b>Runout Optimization System</b> to perform runout measurement at different stages/diameters/discs of a turbine rotor by probes/sensors, analysis, display & printout of data, computation of correction parameters to reduce eccentricity of whole rotor.	Vendor to offer			
8	<b>DIAGNOSTIC SYSTEM</b>				
8.1	<b>TELE-DIAGNOSTIC SERVICE :</b>	Vendor to offer & inform			
8.1.1	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. The system shall have facility for storing and generating monthly report of alarms occurring on the machine during the period.				

8.2	<b>FAULT DIAGNOSTIC SYSTEM:</b>				
8.2.1	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. PG/PC laptop unit supplied along with machine for debugging and diagnostic purpose of PLC system.	Vendor to offer & submit			
8.3	Help guide should be provided to use both diagnostic systems	Vendor to offer			
9	<b>LEVELING &amp; ANCHORING SYSTEM</b>				
9.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied.	Vendor to offer			
10	<b>TOOLS FOR ERECTION, OPERATION &amp; MAINTENANCE :</b>				
10.1	Special tools and equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc.for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer.	Vendor to offer			
10.2	Test mandrel for checking spindle run-out & alignment of headstock/tailstock etc. should be supplied.	Vendor to offer			
11	<b>ACCESSORIES :</b>				
11.1	<b>ROLLING DEVICE :</b>				
11.1.1	Rolling Device with required tools, rollers & accessories etc. for rolling of Journal diameters, adjacent LH/RH fillet radii with/without taper entry, faces of turbine rotors.	Vendor to offer			
11.1.2	The cylindricity & runout on dia after rolling operation should be within 0.01mm & 0.02mm respectively.	Vendor to confirm & offer			
11.1.3	Details like drawing of rolling tool, catalogue etc. are to be submitted.	Vendor to submit			
11.1.4	Smallest & Largest fillet radii which can be rolled using offered tool.	Vendor to inform			
11.1.5	Smallest & Largest entry angle of fillet radii which can be rolled using offered tool.	Vendor to inform			
11.1.6	Drawings showing mounting details of Rolling Device on tool post	Vendor to submit			
11.1.7	Specifications & source of offered Rolling Tool & Rollers shall be informed by vendor for future procurement of same by BHEL.	Vendor to inform			
11.1.8	In case of special coolant requirements for rolling operation, vendor should offer suitable system. Details to be submitted.	Vendor to inform & offer			

<b>11.2</b>	<b>GRINDING UNIT :</b>				
11.2.1	The Grinding Unit, having a swiveling base, should be suitably mounted on the Tool Post/Carriage to enable troublefree grinding on journal diameters, Journal & flange faces as per drawing accuracy & surface finish. All operations using grinding unit should be programmable for grinding on different surfaces. The grinding Unit should be supplied with its all required accessories for its' mounting/clamping on tool post, coolant supply/connections using same offered flood coolant through Vacuum Rotary Drum Type Filter + Magnetic Separator + Paper Filter and tools for mounting of grinding wheel on the unit etc.. Details with relevant drawings/sketches/catalogue including list of offered accessories to be submitted.	Vendor to offer			
11.2.2	Grinding unit for grinding Journals of rotors as well as tips of mounted blades on turbine rotors. The unit shall be mounted on angular rotating base for grinding the inclined tips of turbine rotor blades. Location of unit shall be suitable for grinding journals at a distance of from chuck face as shown in proveout component or similar.	Vendor to offer			
11.2.4	Provision of Wheel Dressing Device, suitably located for CNC program controlled dressing of wheels for accurate alignment of the wheel with working axis considering all types of specified grinding applications. Location of device is to be informed.	Vendor to offer			
11.2.5	Programmable Grinding Cycles & respective Wheel Dressing Cycles for all types of specified grinding operations should be provided.	Vendor to offer			
11.2.6	Additionally, provision for manual grinding i.e. without CNC program should also be there for grinding on diameters & faces and if possible, for angular tip grinding also.	Vendor to offer			
11.2.7	Details of grinding spindle motor like make, rating, type, torque etc.	Vendor to inform			
11.2.8	Max. and Min. dia of Grinding Wheels for all types of specified grinding applications.	Vendor to inform			

11.2.9	Width of Grinding Wheel					
11.2.10	Min. & Max. Dia. For Cylindrical Grinding				Vendor to inform	
11.2.11	Min. & Max. Dia. For Facial Grinding				Vendor to inform	
11.2.12	Limitations, if any for grinding on journal LH/RH faces.				Vendor to inform	
11.2.13	Swiveling positions of base of Grinding Unit/Spindle				Vendor to inform	
11.2.14	Drawings showing mounting details of grinding unit				Vendor to submit	
11.2.15	Specifications & source of offered grinding wheels shall be informed by vendor for future procurement of same by BHEL.				Vendor to inform	
11.2.16	Sufficient protection to bearing and guide ways from ground dust / slurry to be provided.				Vendor to confirm	
<b>12</b>	<b>SPARES:</b>					
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. The list to include following, in addition to other recommended spares:					
12.1.1	<b>Mechanical &amp; Hydraulic Spares :</b> All types of Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses, Couplings, Springs etc.. Complete seal kit for the machine shall be included in standard spares list. Spare Headstock & Tailstock centers for 90 deg should be provided. Pads for Hydrostatic & Open Force Lubricated Steady Rests (set consisting of one no. of each type of pad i.e side pads and center pad for a diameter for each unit of steady), Spare Pump for supply of oil to Hydrostatic Steady Pads, Spare Pump for Hydraulic System, Spare Thrust Indicator for Tail Stock.				Vendor to offer	
12.1.2	<b>Electrical / Electronic / CNC Spares :</b> All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Emergency switches, Encoders, Scanning Heads for Linear Scales, MMC module, NCU module, Pen drive Unit, I/O Cards for PLC, 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 confirm			
12.3	Recommended Set of Spares (Package of Mechanical & Electrical/Electronic Spares) for all attachments including Air Compressor and Refrigerator type Dryer etc. ( <b>SI.No. 6.1</b> ), Laser Blade Tip Measurement System ( <b>SI.No. 8.2</b> ), Automatic Tool Offset Measuring System ( <b>SI.No. 8.3</b> ), Runout Optimisation System ( <b>SI.No. 8.4</b> ), Rolling Unit ( <b>SI.No. 12.1</b> ), Grinding Unit ( <b>SI.No. 12.2</b> ), Superfinishing Unit ( <b>SI.No. 12.3</b> ) are to be offered with details. ( List showing name & quantity of items is to be submitted.)	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 confirm			
<b>13</b>	<b>DOCUMENTATION :</b> Five sets of following documents (Hard copies) & soft copies (wherever specified) in English language should be supplied along with the machine	Vendor to offer			
13.1	Operating manuals of Machine & CNC system	Vendor to offer			
13.2	Programming Manuals of Machine & CNC system	Vendor to offer			
13.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams. All Hydraulic circuit drawings shall be fixed on the machine on anodised sheet. 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 Air Compressor and Refrigerator type Dryer etc. ( <b>SI.No. 5.1</b> ), Laser Blade Tip Measurement System ( <b>SI.No. 7.2</b> ), Automatic Tool Offset Measuring System ( <b>SI.No. 7.3</b> ), Runout Optimisation System ( <b>SI.No. 7.4</b> ), Rolling Unit ( <b>SI.No. 11.1</b> ), Grinding Unit ( <b>SI.No. 11.2</b> ) 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 floppy.	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. Spare hard disk with complete back-up loaded on it	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. This should include complete backup (on CD) of all cycles/subroutines (provided by both vendor and supplier of CNC System) and any other special programs pertaining to different applications/machining processes/accessories/measuring systems etc. including CNC programs for proveout machining.	Vendor to offer			
<b>14</b>	<b>TRAINING :</b>				
14.1	Four BHEL Persons should be trained at vendor's works for the area & period given below: (a) CNC Programming for the machine, measuring system, grinding attachment, rolling device etc. ( Period 3 weeks ) (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments ( Period 2 weeks ) (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments ( Period 2 weeks ) (d) Operation of the machine & other supplied equipments ( Period 2 weeks ) ) Pre-dispatch inspection ( <b>ref. Sl.No. 20.1</b> ) of the machine shall also be carried out by the team during their stay at vendor's works for the training. Vendor may specify days required for pre-dispatch inspection. BHEL reserves the right to choose no. of persons, field & period of training, out of above, while deputing their engineers for training.	Vendor to offer			
14.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to note			
14.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to confirm			
14.4	Vendor to quote for training on per man per week basis	Vendor to offer			
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 confirm			

<b>15</b>	<b>FOUNDATION :</b>				
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. 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 of the machine.	Vendor to offer			
<b>16</b>	<b>ERECTION &amp; COMMISSIONING :</b>				
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. The available crane capacity at the proposed location of the machine will be 150 Ton. The vendor will ensure to make requisite arrangement for lifting of heavier consignment/ items/ assembly of the machine not getting covered by this capacity.	Vendor to offer			

16.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to offer			
16.3	Successful proving of BHEL component by the supplier shall be considered as part of commissioning. All tests, as mentioned at <b>SI.No. 21</b> (Machine Acceptance) shall form part of the commissioning activity.	Vendor to offer			
16.4	All tools required for performing machine geometry test shall be supplied by vendor.	Vendor to offer			
16.5	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to offer			
16.6	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to offer			
16.7	All Cover Plates required for the machine and its peripherals including pits, if any, shall be supplied and installed by the vendor. The plates may be sourced from India.	Vendor to offer			
16.8	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to offer			
16.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit			
16.10	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.	Vendor to submit			
<b>17</b>	<b>ACCURACY TESTS:</b>				
17.1	<b>GEOMETRICAL ACCURACIES :</b>				
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 & submit			
17.1.2	Head Stock Spindle run out: (Radial & Axial)	≤ 0.015 mm			

17.1.3	All other accuracies to confirm to ISO 1708 (Latest Revision) or Suppliers Test chart whichever is finer.	Vendor to offer			
17.1.4	Tail stock Quill taper run-out	Vendor to inform			
17.1.5	Cylindricity of turning (To suit proveout component)	Vendor to inform			
17.1.6	True roundness of turning (To suit proveout component)	Vendor to inform			
17.1.7	Facial run-outs (To suit proveout component)	Vendor to inform			
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 Works.	Vendor to confirm			
17.2	<b>MACHINE POSITIONING ACCURACIES &amp; REPEATABILITY:</b> Should be measured as per VDI/ DGQ3441/ ISO 230-2 (Latest Revision) using LASER INTERFERO METER.	Vendor to confirm			
17.2.1	Positioning accuracy in X axis (Pa) per 1000 mm	≤ 0.015 mm			
17.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm	≤ 0.015 mm			
17.2.3	Repeatability in X axis (Ps)	0.01mm or less			
17.2.4	Repeatability in Z axis (Ps)	0.01mm or less			
17.2.5	Positioning accuracy over entire traverse in X axis (Pa)	Vendor to inform			
17.2.6	Positioning accuracy over entire traverse in Z axis (Pa)	Vendor to inform			
17.2.7	Total positioning error along X & Z axes per 1000 mm (P)	Vendor to inform			
17.2.8	Total positioning error along X & Z axes over entire traverse (P)	Vendor to inform			
17.2.9	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works	Vendor to confirm			
	Note1: LC of scale should be taken to achieve above	Vendor to note			
	Note 2: Accuracy should remain within specified tolerance over a time period of 24 hours (Maximum temperature variation is 25 degree centigrade during peak summer)	Vendor to note			
18	<b>OPERATING CONDITIONS &amp; THERMAL STABILITY</b>				
18.1	Total machine including CNC system and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply (AC): Voltage = 415V +/-10% , Frequency= 50Hz +/-3% , No. of phases = 3 phase without neutral. Ambient Operating Conditions: Temperature = 5 to 48 degree Celsius , Relative Humidity = 95% max. (Vendor to 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 offer & confirm			

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 accept & 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 accept & 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 accept & confirm			
<b>19</b>	<b>PROVEOUT OF BHEL COMPONENT :</b>				
19.1	Drawings of proveout component are enclosed. Vendor to submit preliminary process, time study & tool list recommended by them along with the offer. Final Job setting plan, Machining process plan & Requirement of Tools etc. for machining of proveout component 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 of 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.	Vendor to offer			

19.1.1	<p>The proveout component shall be one turbine rotor (L.P.Rotor of 250MW Steam Turbine) as per following drawing nos. or similar. The drawings are enclosed.</p> <ul style="list-style-type: none"> <li>* Forging of Shaft - drg.no. 1-10301-46999</li> <li>* Shaft - drg.no. 0-10301-46000</li> <li>* Groove Plan - drg.no. 9-10304-46051</li> <li>* T-Groove - drg.no. 4-10107-46012</li> <li>* T-Groove - drg.no. 4-10107-46014</li> <li>* T-Groove - drg.no. 4-10204-46014</li> <li>* T-Groove - drg.no. 4-10304-46011</li> <li>* T-Groove - drg.no. 4-10304-46012</li> </ul> <p>Note: Groove Plan - drg.no. 9-10304-46051 shows both casing and rotor parts. Only rotor part is to be considered.</p> <p>Above drawings should be treated as BHEL property. Strict confidentiality is to be maintained and under no circumstances these drawings or copy of these must be transferred to third party without permission of BHEL. These drawings must not be used directly or indirectly in any way detrimental to the interest of the BHEL.</p>	Vendor to accept & confirm			
19.1.2	The proveout machining shall include following operations:				
19.1.2.1	All turning and grooving operations for machining of Shaft including Groove Plan.	Vendor to accept & offer			
19.1.2.2	Grinding operations on journal diameters, faces and flange faces.	Vendor to accept & offer			
19.1.2.3	Rolling operations on journal dia with fillet radii/contours & faces. Rolling operation shall be demonstrated first on allowance available for machining to establish the process and required surface finish.	Vendor to accept & offer			
19.1.3	<p>All operations shall be performed using CNC Programs supplied by vendor. The CNC Programs should consist of generalised parametric subroutines for repetitive type of operations like different operations of T-grooves etc. so that these subroutines could be adopted for other similar rotors by using different parameter's values and calling same subroutines in other main-program. 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.</p>	Vendor to accept & offer			

19.1.4	Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor to accept			
19.5	Vendor shall be responsible, financially or otherwise, for any deviation/ rejection in proveout component to the extent of cost of Casting/Forging, due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc. For such deviation / rejection, commercial condition as informed separately shall be applicable.	Vendor to accept & confirm			
20	<b>MACHINE ACCEPTANCE: (Tests/Activities to be Performed by Vendor)</b>				
20.1	<b>Tests/Activities to be carried out at supplier's works on the machine before dispatch :</b>	Vendor to accept & offer			
20.1.1	Report of the same shall be submitted to BHEL.	Vendor to accept			
20.1.2	Geometrical accuracies as per test chart (ref. SI.No. 17.1)	Vendor to accept			
20.1.3	Positioning accuracies as per VDI-DGQ/3441 (ref. SI.No. 17.2) 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			
20.1.4	Demonstration of all features of the machine, control system & accessories	Vendor to accept			
20.1.5	Machining of test piece as per AFNOR/ISO. Vendor to supply test piece and tooling for it's machining.	Vendor to accept & submit			
20.2	<b>Tests/Activities to be carried out at BHEL works while commissioning the machine :</b>				
20.2.1	Geometrical accuracies as per test chart (ref. SI.No. 17.1)	Vendor to accept			
20.2.2	Positioning accuracies as per VDI-DGQ/3441 (ref. SI.No. 17.2)	Vendor to accept			
20.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept			
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			
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			
20.2.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to accept			
20.2.7	Machining test piece as per AFNOR/ISO. Vendor to arrange Test pieces and tooling for it's machining.	Vendor to accept			
20.2.8	Job Proveout machining as per SI.No. 19.0.	Vendor to accept			



20.2.9	Two weeks supervision of independent operation of machine by BHEL after job proveout	Vendor to accept			
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			
<b>21</b>	<b>PACKING:</b>				
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 dispatched in containers, all small loose items shall be suitably packed in boxes	Vendor to accept & offer			
<b>22</b>	<b>GUARANTEE :</b>				
22.1	24 months from the date of acceptance of the machine.	Vendor to offer			
<b>23</b>	<b>GENERAL :</b>				
23.1	Machine Model No.	Vendor to inform			
23.2	Total connected load (KVA):	Vendor to inform			
23.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to inform			
23.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to offer			
23.5	Total weight of the machine	Vendor to inform			
23.6	Weight of heaviest part of machine	Vendor to inform			
23.7	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to inform			
23.8	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to inform			
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 submit			
23.10	Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to confirm			
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 confirm			
<b>24</b>	<b>QUALIFYING CONDITIONS :</b>				
24.1	Only those vendors, who have supplied and commissioned at least one CNC LATHE of same (SOC i.e. 4000mm, Load Carrying Capacity i.e. 120tons, with Hydrostatic Guideways, At least half of the Admit Between Centers specified which comes to be 6000mm) or higher sizes for similar applications in the past ten years (On the Date of Opening of tender) should quote. The following information should be submitted by the vendor about the companies where similar (referred) machines have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to inform			
24.2	Name of the customer / company where referred machine is installed.	Vendor to inform			

24.3	Complete postal address of the customer.	Vendor to inform			
24.4	Month & Year of commissioning	Vendor to inform			
24.5	Parameters of machine(s) supplied (Swing Over Carriage, Center Distance, Load Carrying Capacity) and application for which the machine is supplied.	Vendor to inform			
24.6	Name and designation of the contact person of the customer.	Vendor to inform			
24.7	Phone, FAX no. and email address of the contact person of the customer.	Vendor to inform			
24.8	Performance certificate from at least one customer regarding satisfactory performance of machine supplied to them. The referred machine should presently be working satisfactorily for more than one year (on the date of opening of Tender ) after its commissioning.	Vendor to submit			
24.9	BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	Vendor to accept & confirm			
<b>25</b>	<b>OTHER FEATURES:</b>				
<b>25.1</b>	<b>NETWORKING:</b>				
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 offer			
25.1.1.1	The machine shall appear as a node in the Entire Network. (Network Neighborhood)	Vendor to confirm			
25.1.1.2	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			
25.1.1.3	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to confirm			
<b>25.2</b>	<b>MACHINE MONITORING SYSTEM (MMS) SIGNALS</b>				
25.2.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals should be sourced from a PLC output card separately.	Vendor to offer			
25.2.1.1	Control ON	Vendor to confirm			
25.2.1.2	Cycle ON	Vendor to confirm			
25.2.1.3	Spindle Running	Vendor to confirm			
25.2.1.4	Feed Active (Any of the axes moving)	Vendor to confirm			
25.2.1.5	M30 (Program Stop)	Vendor to confirm			
25.2.1.6	Alarm Active	Vendor to confirm			
<b>26</b>	<b>OPTIONAL ITEMS :</b>	<b>SHOULD BE QUOTED SEPARATLY</b>			
<b>26.1</b>	Provision of Balancing of Grinding Wheel which shall be mounted on Grinding Unit ( <b>Sl.No. 12.2</b> ) should be provided for carrying out Grinding Operation effectively. Details to be submitted.	Vendor to offer			

<b>26.2</b>	<b>CARDAN SHAFT :</b>					
26.2.1	Suitable Cardan Shaft (Double Jointer Shaft) for driving large size rotor shaft (like proveout component) supported on two hydrostatic steady rests to perform troublefree rough and finish turning/grooving operations on the shaft at required rpm.	Vendor to offer & submit				
26.2.2	The cardan shaft should have provision of torque transmission through universal joint with sufficient safety factor, tubular design of fixed length, flange yoke with face key connection, maximum operating angle 15 deg, no length compensation etc. Details to be submitted.	Vendor to offer				
26.2.3	Length, flange diameters and coupling/fixing details etc.	Vendor to inform				
26.2.4	Provision to avoid axial shifting/movement (along Z-axis) while driving through cardan shaft for machining of rotors is to be offered. Details to be submitted.	Vendor to offer				
26.2.5	Torque transmitted by the Cardan Shaft	Vendor to inform				
26.2.6	Set of Intermediate Flanges ( 2 nos. - one each for chuck side & rotor side ) to suit offered Cardan Shaft & flanges of proveout component with their manufacturing drawings considering clamping of rotor through Cardan Shaft for machining.	Vendor to offer				
26.2.7	Set of Fasteners, Spanners, Torque Wrench etc. required to clamp Cardan Shaft, its Intermediate Flanges etc. with rotor and chuck.	Vendor to offer				
26.2.8	Drg./Catalogue of Cardan Shaft to be submitted.	Vendor to offer				
<b>26.3</b>	<b>STORAGE &amp; HANDLING FACILITY FOR ACCESSORIES/ATTACHMENTS :</b> Suitably located, effective and safe storage stations are to be provided for adequate storage of the accessories like Grinding Unit, Rolling Device, Cardan Shaft & Steady Rests etc., when they are not in use. To be shown on preliminary layout by vendor.	Vendor to offer				
<b>26.4</b>	<b>HYDRAULIC CHUCK:</b> Complete system to have hydraulically operated movement & locking of all Jaws of the offered chuck instead of mechanical force multipliers <b>(Sl.No. 2.2.13)</b> . Technical Details of hydraulic system & its components are to be informed by vendor with relevant drgs. Additionally, Vendor may offer also any other type of system for power operated movement/locking of jaws as an option. Vendor to quote only additional cost.	Vendor to offer & submit				
<b>26.5</b>	<b>SUPER FINISHING ATTACHMENT :</b> Super Finishing Attachment for finishing of Thrust Collars and Journals of Rotors to achieve surface finish of Ra 0.4 microns or better.	Vendor to offer				