

BHARAT HEAVY ELECTRICAL LIMITED					
	UNIT'S ADDRESS: HEEP, RANIPUR HARIDWAR - 249403 UTTARANCHAL, INDIA				Indent No. : 20171377 Date :15.07.2017
<u>SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR CNC 6 AXES PROFILE BELT GRINDING AND POLISHING MACHINE.</u>					
NOTE :-					
1. Vendor must submit complete information against clause no. 5. The offer would only be considered if complying this clause.					
2. The vendor 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. Any changes made to the clauses of the specification cum compliance certificate will be treated as non-compliance and may lead to rejection of the offer.					
SCOPE:	SUPPLY, ERECTION & COMMISSIONING OF CNC 6 AXIS PROFILE BELT GRINDING AND POLISHING MACHINE WITH SPECIFICATIONS AS BELOW				
SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
1.0	PURPOSE & WORKPIECE MATERIAL				
1.1	Purpose: The machine is required for wet grinding and polishing of complete aerofoil section of Steam Turbine Blades having twisted & intricate shape of profile with integral rhomboid root and shroud. The blades will have profile length from 44 mm to 350 mm and finished blade length from 75 mm to 500 mm. Surface quality on finish blade after polishing should be about 0.4 μ Ra or better in longitudinal and axial directions. Input condition will be milled turbine blade with 0.01 to 0.5 mm material allowance. The grinding machine will remove the variable allowance on profile through program and grind the blade to achieve constant quality of blades as per drawing dimensions.	Vendor to accept			
1.2	Work Piece Material: Blade materials are Nickel and chromium based super alloys such as Inconel 617 M , Nimonic 80A etc. having Tensile Strength 1300 N/mm ² , Hardness >= 260 BHN and heavy work hardening characteristics. Apart from above super alloys material like X20Cr13, X22 CrMoV 12-1, X19 CrMovNbN 11-1, X12CrMoWVNbN 10-1-1 having Tensile Strength up to 1050 N/mm ² & Hardness upto 310 BHN. Material standards are attached (HW12784, Annexure: Inconel spec). Documents will be provided to the vendor only after the vendor has signed a non disclosure agreement with BHEL.	Vendor to accept			
1.3	Machine configuration:				
1.3.1	Machine should be of rigid and compact design with solid continuous one-piece machine base having Weldment or Casting type body and the machine concept as well as control design should ensure highest accuracy, repeatability, surface finish & productivity standard.	Vendor to accept			

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1.3.2	Different blades will be held in rotary fixture in a separate rotary axis (C) in horizontal / vertical position in the machine and a belt grinding & polishing head with replaceable belt grinding & polishing holder attachments will wet grind and polish the blade using 5 different axes namely: Longitudinal X axis, Transverse Y axis, Vertical Z axis, Rotary A and B axes. The movement of all linear axis should be through LM Guidways. The LM Guideways should be of Schneeberger / Rexroth / THK or equivalent reputed make having ultra precision accuracy.	Vendor to accept			
1.3.3	Machine shall have an auto adaptive and robust system in grinding & polishing head to control grinding/polishing pressure, controlled via programmable NC proportional valve. The pressure should be changed through program to remove variable material allowances as mentioned in clause 1.1 as per user requirement. Machine will be automatic in all functions. Loading, unloading of the blades will be manual.	Vendor to accept			
2.0	SPECIFICATIONS				
	Configuration of machine's axes suitable for grinding and polishing the twisted and intricate aerofoil sections of blades varying over length of the blade having sizes as per clause no.1.1	Vendor to accept			
2.1	TRAVERSES				
	For vertical blade holding	For horizontal blade holding			
2.1.1	Longitudinal Axis X : 250 mm or more	Longitudinal Axis X : 500 mm or more	Vendor to intimate		
2.1.2	Transverse Axis Y : 250 mm or more	Transverse Axis Y : 250 mm or more	Vendor to intimate		
2.1.3	Vertical Axis Z : 500 mm or more	Vertical Axis Z : 250 mm or more	Vendor to intimate		
2.1.4	Rotary Axis A :	Rotary Axis C :	Vendor to intimate		
2.1.5	Rotary Axis B :	Rotary Axis B :	Vendor to intimate		
2.1.6	Part Rotary Table Axis C for holding of blades	Part Rotary Table Axis A for holding of blades	360 degree continuous		
2.2	Axis Feeds & Rapid Traverses				
2.2.1	Linear X, Y & Z		Vendor to intimate		
2.2.2	Rotational Axis A, B & C		Vendor to intimate		
2.2.3	Positioning uncertainty (P) and Positioning Scatter (Ps) of all linear and rotary axes of the machine (X,Y,Z,A,B & C) may be intimated with reference to International Standard on which these are based. Refer clause no 2.32 .	Vendor to provide & confirm			
2.3	Grinding & Polishing Belt Unit				
2.3.1	6 CNC Axis Station for Grinding / Polishing Head unit for complete aerofoil polishing (Concave, Convex, Leading Edge & Trailing Edge) of Turbine Blades required. All 6 CNC-axes should run interpolated automatically. It should be ensured that the contact wheel is presented to the surface as near as possible to 90° to enable maximum line contact to the blade surface.	Vendor to confirm			
2.3.2	High Speed Grinding /Polishing head unit driven by servomotor with variable Programmable RPM having resulting cutting speed (V) 25 m/s or more with pressure controlled via programmable NC proportional valve for grinding and polishing of blade profile with wide range of contact wheels depending on blade radius and profile length as mentioned in clause 1.1.	Vendor to confirm			
2.3.3	No. of Grinding & Polishing head	One or more			
2.3.4	Grinding & polishing head position	Vendor to inform			

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2.3.5	Grinding & Polishing head maximum speed	Vendor to inform			
2.3.6	Grinding & Polishing head Power	Vendor to inform			
2.3.7	Machine Total Load	Vendor to inform			
2.3.8	Grinding & Polishing head Torque	Vendor to inform			
2.3.9	Vendor to offer balancing of grinding & Polishing head.	Vendor to inform and submit details			
2.4	Belt details and Changing time				
2.4.1	No. of variant of abrasive belt with dimension and grit size (mention each type, belt Length X width X Thickness) suitable for grinding & polishing the types of blades mentioned in clause no. 2.25 and of blade size and blade material mentioned in clause no. 1.1 & 1.2.	Vendor to offer & provide the details			
2.4.2	Vendor to submit the complete address with phone nos. and email id of atleast two suppliers of types of belt used in the machine.	Vendor to inform & submit details			
2.4.3	Abrasive Belts shall be recommended for wet grinding & polishing of blade material as per clause 1.2.	Vendor to intimate			
2.4.4	Belt Change Time (Manual)	Vendor to inform			
2.4.5	Machine operation should be possible with or without referencing machine axes.	Vendor to confirm & provide details			
2.4.6	Provision of manual changing of belt in the grinding & polishing head should be possible with push button mounted at convenient location.	Vendor to confirm & provide details			
2.4.7	Automatic front access door for loading of jobs and belt change.	Vendor to confirm			
2.5	Contact wheel and contact wheel holder details				
2.5.1	Vendor to provide the complete details, drawing and material of contact wheels, rollers and contact wheel holder suitable for grinding & polishing the types of blades mentioned in clause no. 2.25 and of blade size and blade material mentioned in clause no. 1.1 & 1.2.	Vendor to offer & provide the details			
2.5.2	Vendor to submit the complete address with phone nos. and email id of atleast two suppliers of types of Contact wheels, Rollers & Contact wheel holder used in the machine.	Vendor to inform & submit details			
2.5.3	In case any alignment device is required for contact wheel alignment, the same may be offered. Complete instruction manual to be provided	Vendor to confirm			
2.5.4	Nos. of variant of contact wheel (mention each type)	Vendor to provide details			
2.5.5	Contact wheel, roller and abrasive belt should have high life. Performance, life expectance of each item shall be discussed during technical discussion which will be subjected to acceptance of BHEL. In this regard, vendor to submit the consumption pattern of the above said items for the blades mentioned in clause no. 2.25 and of blade size and blade material mentioned in clause no. 1.1 & 1.2..	Vendor to accept & provide detail			

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2.6	Coolant System & Grinding dust Conveyor System				
2.6.1	Water miscible Coolant supply system should have proper coolant collection & Gravity type paper band filtration system with magnetic separator unit and recycling of coolant after proper filtration.	Vendor to inform details of coolant system offered			
2.6.2	Following parameters of coolant system to be furnished:				
2.6.3	Coolant Tank Capacity	vendor to inform			
2.6.4	Pump pressure for external coolant supply	vendor to inform			
2.6.5	Viscosity at 40 degree Celsius	< 4 mm ² /sec..			
2.6.6	Filtration purity	20μ or better			
2.6.7	The coolant system should be "ON" & "OFF" through program as well as switches provided on operator control panel.	Vendor to confirm			
2.6.8	Vendor to ensure proper flushing of coolant by suitable nozzle(s) on the grinding head during operation.	Vendor to confirm and submit details.			
2.6.9	Filter paper roll sufficient for operating Filtration system uninterrupted for 2 years with the machine running 3-shift everyday.	Vendor to confirm and inform complete specifications of the filter roll.			
2.6.10	Coolant tank shall be provided with manholes for ease of cleaning of tank. Also, a coolant discharge valve shall be provided at ground level for the purpose of emptying the coolant tank completely during tank cleaning. Vendor to submit details of the same.	Vendor to confirm & submit details			
2.6.11	Elevated Scraper type or other suitable dust conveyor system (if required) integrated with coolant system located at side of the machine shall be provided for transportation of grinding dust from machine to the Dust Collection bin with optimised layout	Vendor to confirm & submit details			
2.6.12	Suitable bin/ container for collection of grinding dust/ slurry from machine coolant filtration system should be provided with castor wheels with suitable mobility and unloading / dumping facility.	Vendor to confirm and submit details.			
2.6.13	Waste paper collection bin (if used) of suitable size for atleast 3 shift continous operation required to handle sludge carrying dust.	Vendor to confirm and submit details.			
2.7	Machine Enclosure with Access Door				
2.7.1	Machine should have rigid structure with durable cabinet, vibration dampening system and sound dampening enclosure with interlocked doors in the belt chaging area and workpiece loading area and access door at operator's panel. Enclosure shall have large safety glass viewing window like "VISIPOINT" or "ROTO CLEAR" or equivalent camera firmly mounted in work area with suitable operator panel display for clear visibility of the job and ongoing process, if required.	Vendor to inform & confirm			

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2.8	Machine Lights				
2.8.1	Machine light should be provided for illumination of complete encapsulated working area for clear visibility.	Vendor to confirm			
2.8.2	Tube lights or equivalent should be provided in the electrical cabinets for maintenance purpose.	Vendor to confirm			
2.8.3	Minimum 3 coloured signal light displaying operational status of the machine and visible from distance.	Vendor to confirm			
2.9	Load Monitoring Device				
2.9.1	The machine shall have system for continual measurement of grinding head power and display of same should be incorporated in operator panel display.	Vendor to inform with details			
2.10	Electrical Control Cabinet & Operator's Panel				
2.10.1	Electrical Control Cabinet & Operator's Panel shall be fitted with proper cooling arrangement for working environment having temperature up to 45 degree Celsius. Electrical cabinet shall be provided with a 220V, 5 Amp socket for maintenance purpose.	Vendor to confirm			
2.11	Hand Held Pendant				
2.11.1	Hand Held Pendant with all relevant features such as Axis Selection Switch, Direction Selection, Emergency Stop, belt changing along with sufficient length of interfacing cable shall be offered.	Vendor to confirm			
2.12	Other Technical Features				
2.12.1	In case of any Hydraulic system required:	Vendor to confirm			
2.12.1.1	Hydraulic System should be centralised. Hydraulic Tank shall preferably be located at floor level.	Vendor to confirm and submit details			
2.12.1.2	Make Rexroth / Vickers/ Hawe or equivalent reputed manufacturer. (Details to be submitted),	Vendor to confirm and submit details			
2.12.1.3	Display of Hydraulic oil level during machining should be incorporated in operator's control panel with proper indication for requirement of top up in time. Relevant alarms should be displayed in operator's panel for oil level.	Vendor to confirm and submit details			
2.12.2	In case of any Compressor Cooling System required: Closed loop compressor Cooling System for the machine, servo-/torque motors, recirculating lubricating oil, hydraulic system oil etc. shall be offered.	Vendor to confirm and submit details			
2.12.3	Centralized Automatic Lubrication System for lubrication of all moving and rotating parts with alarm / interlocks in case of lubrication failure.	Vendor to confirm			
2.12.4	Air Dryer Unit of appropriate capacity to arrest moisture and other suspended particles etc. at input of machine, in order to provide dry and clean air for machine operation.	Vendor to confirm			
2.12.5	Compressed air point with provision of adjustable pressure, manually operated ON / OFF valve and sufficient length of flexible piping with air gun for cleaning of dust in fixtures and working area shall be provided.	Vendor to confirm			

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2.12.6	Coolant Flushing Gun with sufficient length of pipe for manual cleaning of workpiece & machine area shall be provided.	Vendor to confirm			
2.12.7	Mist / Flue Gas Extraction System: Machine shall have Mist Extraction System/ Flue Gas Extraction System with all connections and installation at convenient location.	Vendor to confirm and submit details			
2.12.8	One set of special maintenance/ calibration tools for geometrical accuracy tests including calibration mandrel, granite block, cylinder dial gauges, Universal Dial stand (03 Nos.) with dial having 2 micron resolution (03 Nos.) and other special tools as required for service and maintenance of the machine shall be offered.	Vendor to confirm and submit details			
2.12.9	All the measuring system components (for position feed back) either in motor encoder or sclae (if used) will be Heidenhain make only.	Vendor to confirm and submit details			
2.12.10	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, Voltage Stabilizer, Isolation Transformer, control cabinets etc. shall be supplied by the vendor.	Vendor to confirm			
2.13	First Filling of Oils & Lubricants				
2.13.1	First filling of all required Oils , lubricants, & Grease etc. for the machine and auxiliary system to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.The vendor shall also submit estimated annual consumption of all these items on three shift working basis.	Vendor to inform			
2.14	CNC System				
2.14.1	The machine shall be equipped with latest Siemens SINUMERIK 840D SL CNC Control with latest Windows based Operating system. The CNC control 840D SL will have PCU 50.5 or higher version with intel technology 2.4 GHz or higher, 8 GB RAM or higher & NCU 720.3B PN or higher (with BOP). Numerical control extension NX15.3 or higher (if needed). It should consist of OP 015AT Operating panel having 15 inches or higher TFT colour display and Machine control panel (MCP) 483C PN or higher. It shall have MF-II PC key board (equivalent or higher) or the latest available successor with mouse on a folding / sliding tray or Full CNC Keyboard with Qwerty keys and Mouse/Trackball. The operator Panel configuration will be as per Rittal VIP 6000 or equivalent. Layout showing complete details of the panel should be submitted. All standard features should be listed in technical offer. Also all available optional features of CNC 840D SL system shall be offered & item wise price to be indicated in commerecial offer.	Vendor to offer and confirm and submit details			
	The CNC system should have following features:				
2.14.2.1	Intel i5 processor, 2.4 GHz clock speed (or higher), 8 GB RAM (or higher), 3GB cache or higher rating available with Siemens at the time of submission of offer.	Vendor to confirm and submit details			

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2.14.2.2	Hard disk of 80 GB (easily replaceable) or of higher rating available with Siemens at the time of submission of offer.	Vendor to confirm and submit details			
2.14.2.3	DDR3 (8 GB) RAM or of higher rating available with Siemens at the time of submission of offer.	Vendor to confirm and submit details			
2.14.2.4	RS232-C interface for I/O device, Port COM1(V.24), COM2 (V.24), LPT1 Parallel Interface for Printer(Brother Model HL-2250D), 2 Nos. USB PORTS (min.) for I/O devices, VGA, MPI interface & 32GB memory stick (2 Nos.) along with necessary driver CDs, 2 Channels and Expansion slots. In case of non-availability of COM1(V.24), COM2(V.24), LPT1 parallel interface, RS232-C etc., if not provided by CNC system manufacturer at the time of supply, suitable separate ports/connectors/convertors for networking with LAN, data input/ output, telediagnosics, printer shall be provided to ensure functionalities as per tender specifications.	Vendor to confirm and submit details			
2.14.2.5	Access lock on operator panel.	Vendor to confirm and submit details			
2.14.2.6	Co-ordinate system transformation.	Vendor to confirm and submit details			
2.14.2.7	Co-ordinate system rotation.	Vendor to confirm and submit details			
2.14.2.8	Helical/ Spline interpolation.	Vendor to confirm and submit details			
2.14.2.9	Scaling	Vendor to confirm and submit details			
2.14.2.10	Vacuum -ventilated steel sheet built-in housing.	Vendor to confirm and submit details			
2.14.2.11	SITOP power, DC-UPS Module 15 with AKKU module to ensure automatic unattended shutdown of the system in case of power failure or even in normal machine shutdown.	Vendor to confirm and submit details			
2.14.2.12	Latest version of Step-7 pre-loaded on PCU for on-screen diagnostic alongwith licensed copy of installation CD of Latest version of Step-7/ Simatic Manager (with comments in English language only).	Vendor to confirm and submit details			
2.14.2.13	Display of PLC AWL format on Note book for PLC Diagnostic (with comments in English language only).	Vendor to confirm and submit details			
2.14.2.14	2 TB USB Hard disk (1 No.) with driver softwares for CNC System back-up and restoration in case of Hard disk failure.	Vendor to confirm and submit details			
2.14.2.15	Machine should have provision for axes positioning via motor encoders in case linear scales/external rotary encoders for linear/rotary axes are installed.	Vendor to confirm and submit details			

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2.14.2.16	In case of failure of PC, machine software should be able to be installed and run in other PC also. For this purpose vendor shall provide sufficient licence files/ dongle. The Liscence Softwares, Operating System and all suitable drivers shall be provided by the Vendor in original for the above purpose.	Vendor to confirm and submit details			
2.14.2.17	Details of Standard features. List to be submitted.	Vendor to specify			
2.14.2.18	Features of CNC System required for proveout of jobs or foreseen by the vendor as required.	Vendor to specify			
2.14.2.19	Details of optional features, recommended by vendor, to be submitted.	Vendor to submit			
2.14.2.20	Details of other optional features	Vendor to specify			
2.14.2.21	The CNC system shall also have all other features required for:				
2.14.2.21.1	Programming & machining of prove out components as mentioned at point no. 2.39 below.	Vendor to confirm and submit details			
2.14.2.21.2	Machine Networking at point no.2.17 below.	Vendor to confirm and submit details			
2.14.2.21.3	The machine operator should be able to download generated NC programs on computer to the specified folder in the work piece directory of the machine in CNC mode after specifying the drawing no. of the blade (name of 11 digits) through network.	Vendor to confirm			
2.15	CAM SOFTWARE:				
2.15.1	PC based CAM Software working on window 7 or higher system shall be offered with complete details (Detailed brochures, writeup). For this purpose, vendor to provide a suitable PC with latest configuration.	Vendor to offer			
	The software shall have following features:				
2.15.2	A suitable PC based CAM software capable of generating tool path for grinding & polishing for Leading edge, trailing edge, pressure side & suction side of aerofoil of turbine blades, simulation along with integrated customised post processor to generate the NC program of grinding & polishing of blade Profile for the offered machines.	Vendor to confirm			
2.15.3	The software should be capable of accepting the profile data of the blade in the following ways for generation of tool path & part program.	Vendor to confirm			
2.15.3.1	BHEL supplied STRAK data format.	Vendor to confirm			
2.15.3.2	IGES format from leading CAD system such as IDEAS , Pro-Engineer, Unigraphics, AUTOCAD etc.	Vendor to confirm			
2.15.3.3	Provision for accepting profile coordinates in simple & suitable ASCII (Text) file.	Vendor to confirm			
2.15.4	Further , the correctness of the STRAK / ASCII interface shall be demonstrated by the vendor through input of all the above mentioned Blade geometry in their offered CAM software (using BHEL supplied data) during pre-acceptance at vendor's works as well as BHEL, Hardwar during commissioning of machine.	Vendor to confirm			
2.15.5	Further, this capability of the CAM software shall be demonstrated by the vendor through preparation of program (one no. for each type) from sample blade & profile drawings of BHEL during training period at vendors work as well as at BHEL, Hardwar during commissioning of machine.	Vendor to confirm			

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2.15.6	The software should include graphical display of blade profile & simulation of tool path on screen.	Vendor to confirm			
2.15.7	In case of breakdown of any PCs on which the CAM software shall be loaded, the supplier shall immediately take required action for facilitating loading of the software on another PC after intimation of IP address of the new PC by M/s BHEL.	Vendor to confirm			
2.15.8	All necessary modules of the CAM software required to meet the above capabilities of CAM software & for generation of part programs for grinding & polishing of proveout blades shall be offered with item wise price.	Vendor to confirm			
2.15.9	The party shall provide full technical support & up gradation of the offered CAM software during the warranty period. The technical support shall include trouble shooting through telephone, E-mails & visit of their experts if required.	Vendor to confirm			
2.15.10	The backup of the software shall be provided on pen drive or external hard disk.	Vendor to confirm			
2.15.11	The party shall conduct complete trials during pre- acceptance at supplier's works as well as during commissioning of machines at BHEL,Hardwar on all machines to demonstrate successful implementation of full capabilities of the offered system.	Vendor to confirm			
2.15.12	The party shall carry out complete customization, prepare all the required master programs, provide all necessary logics so that the access of geometrical data, successful conversion, processing & generation of NC programs suitable for grinding , programs is carried out automatically.	Vendor to confirm			
2.15.13	Vendor to offer 3 numbers of licenses / dongle to install and smooth working of software on BHEL PC's.	Vendor to confirm and offer			
2.16	SIMULATION SOFTWARE				
2.16.1	The party to offer 3D simulation of the NCs programs (generated from the offered CAM software) for visualising clearly the avoidance of collision / interference of grinding tool with machine components. The simulation software shall be loaded on BHEL PCs.	Vendor to confirm			
2.16.2	The party shall completely integrate their offered CAM software with the offered simulation software. The following features shall be provided:	Vendor to confirm			
2.16.3	Complete 3D model of the offered machine shall be built for simulation software & the same shall be loaded on BHEL PCs.	Vendor to confirm			
2.16.4	All necessary customization needed either in offered CAM software for smooth & error free 3D simulation of the NCs programs (generated from the offered CAM software) shall be done by the party. The complete 3D simulation of tool path / NC program shall be completely demonstrated during pre-acceptance at vendor's works as well as at BHEL,Hardwar during commissioning of the machine showing clearly the avoidance of collision / interference of grinding tool with machine components.	Vendor to confirm			
2.16.5	The complete 3D simulation of tool path /NC program generated from the offered CAM system on the blade model shall be completely established on BHEL's PC loaded with offered software .	Vendor to confirm			
2.16.6	The back up of the above data shall be provided on external hard disk or pendrive	Vendor to confirm			

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2.17	MACHINE NETWORKING:				
2.17.1	Machine control should have necessary hardware & software so that it is ready for interfacing with gigabit Ethernet Local Area Network with 100MB / sec. Speed available on machine on UTP cables for NC program & other related DATA transfer . This network to be connected to Wide Area Network / Internet. It should cover following features:	Vendor to offer			
2.17.2	The machine should appear as a node just as any other PC in the entire network (Network Neighborhood).	Vendor to confirm			
2.17.3	The program transfer should be simple copy & paste method just as it is done in case of PCs.	Vendor to confirm			
2.17.4	The networking should be capable to transfer programs from/to machine across the network in CNC mode.	Vendor to confirm			
2.17.5	All necessary Anti-Virus measures shall be incorporated.	Vendor to confirm			
2.17.6	The above Networking features shall be completely demonstrated and established on all the supplied machines by the vendor during pre-acceptance at vendor's works as well as at BHEL, Haridwar during commissioning of the machines.	Vendor to confirm			
2.18	TELE DIAGNOSTIC SERVICE				
2.18.1	Tele-diagnostic service should be provided through either international telephone lines OR SIM Card 3G/4G modem OR LAN OR WLAN. Required Hardware/Software for the supplied CNC system to use any of the above methods (whichever used by the vendor) should be provided to access both CNC and PLC. Tele-diagnostic service should be provided free of charge for the guarantee period. Terms and conditions for the service after guarantee period should be informed by vendor. Help guide should be provided for use of the system/service.	Vendor to offer			
2.19	FAULT DIAGNOSTIC SYSTEM				
2.19.1	Supplier's own diagnostic system with required software and hardware installed on the CNC system which shows detailed cause and remedy for the faults on the CNC System display indicating the element /device causing the fault. Vendor should also offer a PC note book along with Simatic S7 software (licensed copy), Ghost software, necessary communication cables, PCMCIA card / Adaptor (for Communication with MPI port) for diagnostic/ back-up & restoration purpose. The Note Book PCs should be loaded with complete Electrical Circuit/Wiring Diagrams/Schemes, Mechanical Assembly drawings, Hydraulic Circuit Diagrams, Machine Layout, Operation and Maintenance Manuals, Machine Alarm list along with Help text, On-Line display of PLC user should be available on the note book PC. Help guide should be provided for use of the system. Details are to be submitted.	Vendor to offer & submit details			
2.19.2	Machine should have provision to switchover from position feedback system -2 (direct) to Position feed back system-1 (Motor encoder) through PLC program/ HMI screen (for service personnel only) in case direct feedback system is used/installed in the machine.	Vendor to offer			
2.19.3	Help guide to use both diagnostic systems (tele-diagnostic at clause no.2.18 & Fault diagnostic at clause no.2.19) shall be provided.	Vendor to offer			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.20	SERVO VOLTAGE STABILIZER				
2.20.1	Oil / Air Cooled Servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer & to provide electrical drawings for the same.			
2.20.2	Make	Neel or Servomax			
2.20.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform			
2.20.4	Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted)	Vendor to inform			
2.20.5	Spares Package for Servo Voltage Stabilizer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted. Offered package should also include items mentioned below in addition to the recommended parts: 1). Variacs- 2 nos. of each type. 2). Correcting servomotors- 3 nos. of each type. 3). Control cards- 2 nos. of each type. 4). Control transformer- 4 nos. each type. 5). Contactor- 1 no. of each type. 6). Fuses- 3 nos. of each type. 7). Overload- 1 no. of each type.	Vendor to inform			
2.20.6	Detailed Maintenance manual of stabilizer with all drawings of assemblies/sub-assemblies including Electrical circuit diagrams and items part list shall be provided.	Vendor to offer			
2.21	ULTRA ISOLATION TRANSFORMER				
2.21.1	Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer & to provide electrical drawings for the same.			
2.21.2	Make	Neel or Servomax			
2.21.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform			
2.21.4	Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted with Catalogue)	Vendor to inform			
2.21.5	Spares Package for Isolation Transformer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted.	Vendor to inform			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.21.6	Detailed Maintenance manual of stabilizer with all drawings of assemblies/sub-assemblies including Electrical circuit diagrams and items part list shall be provided.	Vendor to offer			
2.22	SPARES				
2.22.1	Mechanical, Hydraulic (if available), Electrical and Electronic spares used on the machine, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years trouble free operation of the complete machine including CNC system and its accessories considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted. The offered package should include items mentioned below, in addition to other recommended spares.	Vendor to offer			
2.22.2	Mechanical, Hydraulic & Pneumatic Spares ((if available): * All types/varieties of pumps used on machines i.e.Hydraulic, lubrication, coolant and oil cooling pumps (1 no. each type) * All types of D.C. Control valves (2 no. each type) * All types of flow control, pressure regulators, pressure reducer valves used on m/c. (1 no. each type) * All types of pressure switches, flow switches and float switches (2no. each type) * All types of Pressure / Pneumatic Gauges (1 No. each type) * All types filters for mist extration (for one year) * All types of seals, O-Rings and Piston rings used in machine (one set of each type) * Accumulator with charging kit if the same is used in the m/c if any (1 no each type) * All types of pneumatic valves (1 no. of each type) * All types of Hydraulic / Pneumatic Hoses (1 set of each type) * Tailstock * Spring balancer for tail stock. * Ultra sound rodent scare sensor * Filter Mist.	Vendor to offer			

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	* All types of Belts, Pulley, Bearings, (2 nos. each type) * All types of roller (2 set each type) * Flexible Bellow Cover (1 No. each type) * Special Oil/ Grease/ Cooling Agent (if any)- Sufficient qty. for 1 year (operation on 2 shift basis). Hydro Motor (1 no. each type as used on the machine) (if used) * Coiled Flexible air/coolant pipes (one set each type) * Coolant Gun (1 No) * Rotary union of table (one set) * Wiper (one set) * Lubrication Cartridge (one set) * Visiport: One number as supplied * Lubrication & hydraulic oil, grease quantity to be supplied for 1 year running. * Flexible drag chain used in machining area: 1 set. * Piston cylinder: One number each type. * Sprocket: One number each type.	Vendor to offer			
2.22.3	Following spare parts of electrical/electronics and CNC system shall be offered itemwise per machine:				
2.22.3.1	PCU with system software and hard disk- 1 no. of the type as used on the machine.	Vendor to offer			
2.22.3.2	Operator panel with display unit - 1 no. of the type as used on the machine.	Vendor to offer			
2.22.3.3	Portable 2 TB or more hard disk with USB interface- 1 no.	Vendor to offer			
2.22.3.4	NCU (as used in the machine) module with NCU box having fan and battery- 1 no. each type as used on the machine.	Vendor to offer			
2.22.3.5	NC/ PLC Input & Output cards (Digital, fast I/O & analogue), CPU, Power supply, Interface board - 1 no. of each type as used on the machine.	Vendor to offer			
2.22.3.6	Machine Control Panel- 1 no. of the type as used on machine	Vendor to offer			
2.22.3.7	ALM/AIM/CSM/SMM/DMM/Power modules for Spindle, X-axis, Y-axis, Z-axis, A-axis, B-axis, C-Axis etc - 1 no. of each type as used on the machine.	Vendor to offer			
2.22.3.8	Grinding Spindle Motor, Axis Servo Motors including Torque Motors (if any) - 1 no. each type as used on machine.	Vendor to offer			
2.22.3.9	SIEMENS UPS SITOP DC-USV-Module with AKKU -1 no. of each type as used on machine	Vendor to offer			
2.22.3.10	Complete position feed back system including linear scales & Heidenhain Transducer/Scanning Head (if used on machine) for X-axis, Y-axis, Z-axis, Heidenhain encoder for the rotary axes including Spindle, Direct Measuring system for all auxillary axes, in-built motor Encoders for Axes & Spindle Motors - 1 no. of each type as used on machine.	Vendor to offer			

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2.22.3.11	Profibus control components including ET200 modules, Profibus connectors, ASI master/ controller, ASI modules (if used) - 1 Nos. of each type as used on the machine	Vendor to offer			
2.22.3.12	Filter and Choke Module: Filter and throttle, High Current noise filter - 1 Nos. of each type as used on the machine.	Vendor to offer			
2.22.3.13	Simatic net card used for external PLC (if applicable) - 1 no. of each type as used on the machine	Vendor to offer			
2.22.3.14	External PLC CPU, Interface module, Input & Output cards (if External PLC is used in the machine)- 1 Nos. of each type as used on the machine	Vendor to offer			
2.22.4	Following spare parts shall be offered as essential spares for the machine				
2.22.4.1	Inductive proximity switch, Reed proximity switch, Light barrier switch, Door safety switch, Magnetic proximity switch, Positioning switch, Sensors connectors with cables, Optical sensors, Analog sensors, Grease sensors etc. 2 nos. of each type as used on the machine.	Vendor to offer			
2.22.4.2	Set of Push Buttons- 2 nos. of each type as used on the machine.	Vendor to offer			
2.22.4.3	Set of Indicating Lamp - 30 nos. of each type as used on the machine.	Vendor to offer			
2.22.4.4	Set of Special Purpose units including Emergency relays, Safety relays, Time monitoring devices - 1 No. of each type as used on the machine.	Vendor to offer			
2.22.4.5	Set of Contactors- 2 nos. of each type as used on the machine.	Vendor to offer			
2.22.4.6	Semiconductor Fuses -10 nos. of each type as used on the machine.	Vendor to offer			
2.22.4.7	Special Fuses - 5 nos. of each type as used on the machine.	Vendor to offer			
2.22.4.8	Circuit Breakers - 1 no. of each type as used on the machine.	Vendor to offer			
2.22.4.9	Main Power Switch - 1 no. of each type as used on the machine.	Vendor to offer			
2.22.4.10	Set of Overloads/ Automats - 1 no. of each type as used on the machine.	Vendor to offer			
2.22.4.11	Machine Status Indicating Lamp (Complete unit) - 6 Nos. of each type as used on the machine	Vendor to offer			
2.22.4.12	Proportional Control Valve Controller 2 Nos. each type (if applicable) as used on the machine	Vendor to offer			
2.22.4.13	Spares Package for Inprocess gauging System (if used)	Vendor to offer			
2.22.4.14	Complete spare parts package for Mist Extraction System/ Flue Gas Extraction System including ionisation wires, electrical motor fan, electrical switch gears etc. of the type as used on the machine.	Vendor to offer and submit item wise list			
2.22.4.15	Spares Package for coolant supply system including Analog & Digital Sensors, Control unit, PLC (I/O Board, CPU, Interface, Net Module), Contactors, Overloads, Special purpose units, Operator panel on Coolant unit (pre-loaded with software) 1 no. of each type as used on the machine (if used on the machine)	Vendor to offer			
2.22.4.16	01 set of spares like compressor, controller, sensors, fan motor assembly will be supplied with each unit of Refrigerant based cooling unit.	Vendor to offer			

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2.22.4.17	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			
2.22.4.18	Repair service contract with supplier of CNC system for service & spares for motor drives, CNC Unit and grinding Spindle should also be offered by the vendor.	Vendor to offer			
2.22.4.19	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			
2.22.4.20	Wear and tear parts (if not offered above)	Vendor to offer			
2.23	DOCUMENTATION				
2.23.1	Four sets of following documents (Hard copies) in English language should be supplied along with the machine.	Vendor to accept			
2.23.1.1	Operating & Maintenance manuals of Machine & CNC system	Vendor to offer			
2.23.1.2	Maintenance manual of the Machine & CNC which includes various service screens & their navigation procedures, displays, Alarm list & Fault diagnostic manuals, Maintenance of the Electronics & Software/ Manufacturer cycle related information.	Vendor to offer			
2.23.1.3	Programming Manuals (Advanced & Standard) of Machine & CNC system	Vendor to offer			
2.23.1.4	Detailed Maintenance manual of machine with all drawings (preferably laminated) of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams.	Vendor to offer			
2.23.1.5	Detailed maintenance manual of chiller unit if used in the machine should include: Capacity of the chiller unit, type of compressor with complete specifications of : thermostatic expansion valve , fan size, flow rate of the condenser unit, evaporator unit(width plate type/coil type), functional requirement of temperature of cooling oil to be maintained between range T1 to T2, type of temperature indicator/ controller used in the chiller unit.	Vendor to offer			
2.23.1.6	Detail assembly drawing of Grinding Head and their attachments.	Vendor to offer			
2.23.1.7	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor to offer			
2.23.1.8	Manufacturing drawings for all supplied contact wheels, wheel holders, fixtures, coolant connections, tailstock center, etc.	Vendor to offer			
2.23.1.9	Catalogues, Drawings and Operation & Maintenance Manuals, Electrical Drawings, of all bought out items, wherever applicable.	Vendor to offer			
2.23.1.10	Detailed specification of all rubber items and hydraulic/pneumatic/lube fittings.	Vendor to offer			
2.23.1.11	Operating and User Manuals, Maintenance Manuals & Catalogues for supplied items, Voltage Stabilizer, Isolation Transformer, belt changer etc.	Vendor to offer			
2.23.1.12	Help guides for tele-diagnostic service and fault diagnostic systems	Vendor to offer			
2.23.2	Three sets of following documents (hard copy wherever applicable) in English language should be supplied along with the machine.	Vendor to offer			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.23.2.1	Final PLC program (External, Internal & Colant unit, wherever used) with comments in English, NC data & PLC data should be provided in hard copies.	Vendor to offer			
2.23.2.2	Complete back-up of hard disk on GHOST CD and clear written Instructions to take back-up and reloading of a new hard disk.	Vendor to offer			
2.23.2.3	Complete Operating Guide, User and Programming manual of offered PC Based CAM Software for Blade grinding.	Vendor to offer			
2.23.2.4	Complete write up regarding integration of CAM Software with Simulation Software.	Vendor to offer			
2.23.2.5	Complete backup of installed software including CNC features on external hard disk (mentioned at clause no.2.22.3.3) for re-installation as and when required. Set of instructions /Help guide for re-installation should also be provided.	Vendor to offer			
2.23.2.6	Sinumerik Operator's Guide (HMI Advanced)	Vendor to offer			
2.23.2.7	Sinumerik Diagnostics Guide	Vendor to offer			
2.23.2.8	Sinumerik Programming Guide (Fundamentals)	Vendor to offer			
2.23.2.9	Sinumerik Programming Guide (Advanced)	Vendor to offer			
2.23.2.10	Sinumerik Programming Guide (Cycles)	Vendor to offer			
2.23.2.11	User and Manufacturer Documentation on external hard disk (mentioned at clause no.2.22.3.3), with help tool	Vendor to offer			
2.23.2.12	Functional Block Diagram for S7-300 & S7-400 (if applicable) programming	Vendor to offer			
2.23.2.13	Manual NCU Planning SINUMERIK 840 D SL	Vendor to offer			
2.23.2.14	Manual Operator Components SINUMERIK FM-NC / 810 D / 840D SL	Vendor to offer			
2.23.2.15	Description of Functions SINUMERIK FM-NC / 810D / 840D SL Basic Machine	Vendor to offer			
2.23.2.16	Installation & Start up guide SINUMERIK 840D SL & SINAMICS	Vendor to offer			
2.23.2.17	Installation Guide Lists	Vendor to offer			
2.23.2.18	Statement List for S7-300 & S7-400 (if applicable) programming	Vendor to offer			
2.23.2.19	SIMATIC configuring Hardware and Communication Connections Step 7 V 5.2	Vendor to offer			
2.23.3	One complete set of documents in best available condition shall be supplied one month prior to start of training date for study by BHEL engineers.	Vendor to offer			
2.23.4	One additional set of all the above documentation / machine drawings / machine manuals (from clause no.2.23.1.1 to 2.23.2.19) on portable hard disk (2 TB or more) mentioned at clause no.2.22.3.3 wherever possible.	Vendor to offer			
2.23.5	Software license fee wherever applicable.	Vendor to offer			

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2.24	PART FIXTURING				
2.24.1	Part fixturing arrangement with interchangeability of clamping jaws and stops to accommodate various types of blades shall be offered. Jobs i.e. blades shall have completely finished roots with rhomboid shape as in blade drawings. These blades will be clamped in work pice holder with clamping jaws and there should be a reference butting surface in the holder/ fixture. All grinding reference shall be taken from datum plane at root as per blade drawings provided. Part fixturing shall include holding elements at root end and supporting the blade with a tailstock pin. There should not be any damage/ scratch due to clamping of blade root.	Vendor to accept & provide details			
2.24.2	Fixture/ holding system should be capable of holding blade roots with different rhomboid angles such as 17 degree to 39 degree, Rhomboid size from 20 mm to 100 mm and blade length from 75 mm to 500 mm. The fixture should be universal type and capable of holding Left hand side blade and Right hand side blades of all types by changing the clamping jaws in the fixture keeping the reference planes at same position.	Vendor to accept & provide details			
2.24.3	The fixture should have a reference zero position for repeatability in clamping and grinding of blades for complete stage of blades. Detailed manufacturing drawings of part fixturing to be supplied in the event of order. However, with the offer a scheme of holding arrangement with dimensional indication of clamping portion to be submitted and subsequent discussions will be done with BHEL during technical discussion. The arrangement for clamping blades shall be finalised during technical discussion.	Vendor to accept & provide details			
2.25	TOOLING PACKAGE				
2.25.1	The tooling package shall consist of all toolings including consumables, belts, contact wheels & rollers for grinding for following blades on machine. The tooling package should be sufficient to grind the quantity of blades mentioned against each type of blade on machine. Item wise price and minimum ordering quantity, if any shall be clearly indicated in the price bid. Detailed drawing /catalogue of all the toolings are to be supplied in the event of order.	Vendor to offer			
2.25.1.1	DRAWING NUMBER: SKETCH 1, MATERIAL: NIMONIC 80A, BLADE HEIGHT: 144 MM, BLADE QTY: 20	Vendor to offer			
2.25.1.2	DRAWING NUMBER: SKETCH 2, MATERIAL: NIMONIC 80A, BLADE HEIGHT: 167 MM, BLADE QTY: 20	Vendor to offer			
2.25.1.3	DRAWING NUMBER: SKETCH 3, MATERIAL: INCONEL 617M, BLADE HEIGHT: 205 MM, QTY: 500	Vendor to offer			
2.25.1.4	DRAWING NUMBER: SKETCH 4, MATERIAL: INCONEL 617M, BLADE HEIGHT: 218 MM, QTY: 500	Vendor to offer			
2.25.1.5	DRAWING NUMBER: SKETCH 5, MATERIAL: X20Cr13, BLADE HEIGHT: 317 MM, QTY: 20	Vendor to offer			
2.25.1.6	DRAWING NUMBER: SKETCH 6, MATERIAL: X20Cr13, BLADE HEIGHT: 458 MM, QTY: 20	Vendor to offer			
2.25.1.7	DRAWING NUMBER: SKETCH 7, MATERIAL: X20Cr13, BLADE HEIGHT: 85 MM, QTY: 20	Vendor to offer			

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2.26	TIME CYCLE				
2.26.1	Vendor to indicate cycle time for grinding the blade profiles mentioned at 2.25.1.1 to 2.25.1.7 Offered cycle times shall be discussed during technical discussions and will be subjected to acceptance of BHEL.	Vendor to submit			
2.27	TROPICALISATION				
2.27.1	All electrical / electronic equipment shall be tropicalized.	Vendor to confirm			
2.27.2	All electrical & electronic control cabinets & panels should be dust and vermin & rodent proof.	Vendor to confirm			
2.27.3	All electrical components in the cabinets should be mounted on DIN Rail.	Vendor to confirm			
2.27.4	All electrical / electronic panels to be provided with adequate door locks. All electrical & electronic panels including operator's panel should have sufficient illumination and power receptacles/plug points of 220Volts, 5/15 Amp AC with on/off switch. All electrical adapters/receptacles, fittings, consumables etc. should be compatible with Indian equivalents.	Vendor to confirm			
2.27.5	All motors shall conform to IEC or Indian Standards	Vendor to confirm			
2.27.6	All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays/chains etc. required for laying of cables should be included in the offer.	Vendor to confirm			
2.27.7	Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest available location of the production shop.	Vendor to confirm			
2.28	OPERATING CONDITIONS				
2.28.1	Total machine including all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply (AC): Voltage = 415 V +10% / -15% Frequency = 50 Hz +3% / -3% No. of phases = 3 (3 wire system without neutral) Ambient Conditions: Temperature up to 45 degree Celsius Relative Humidity About 70%	Vendor to confirm			
2.29	SAFETY ARRANGEMENTS				
	Following safety features in addition to other standard safety features should be provided on the machine:				
2.29.1	Machine should have automatic belt or roller breakage detection system. The machine should automatically stop into a safe position without damaging the job during such incidents.	Vendor to confirm			

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2.29.2	In case of sudden power trip Machine should have suitable provision to automatically stop into a safe position without damaging the job during such incidents.	Vendor to confirm			
2.29.3	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			
2.29.4	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to confirm			
2.29.5	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			
2.29.6	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.	Vendor to confirm			
2.29.7	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to confirm			
2.29.8	Oil & water pipe lines should not run with electrical cable in the same trench.	Vendor to confirm			
2.30	ENVIRONMENTAL PERFORMANCE OF THE MACHINE				
	The Machine should conform to following factors related to environment :				
2.30.1	Maximum noise level shall be 85 dB (A) at 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 during commissioning.	Vendor to confirm			
2.30.2	There shall not be any emissions from the machine. All fumes etc. during grinding shall be arrested by Fume / Mist extraction system.	Vendor to confirm			
2.30.3	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			
2.30.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
2.30.5	Machine should be built in line with international safety and environmental protection standard. A copy of confirm and detailisation certificate shall be given during pre-dispatch inspection.	Vendor to confirm			
2.30.6	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
2.30.7	Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant.	Vendor to confirm			
2.31	GEOMETRICAL ACCURACIES				
2.31.1	Geometrical Accuracy Tests shall be in accordance with relevant & prevailing international standards viz. ISO 1701 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 and submit.			

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2.31.2	All the Geometrical accuracies including test pieces grinding etc. should be demonstrated to BHEL engineers during pre-acceptance at Supplier's works. In case due to some unforeseen reasons it becomes imperative to repeat test of the geometrical accuracies at BHEL Hardwar, the same shall have to be arranged by the vendor. Test pieces are to be supplied by vendor. Drawings of test pieces to be submitted with the offer.	Vendor to confirm and submit.			
2.32	POSITIONING & REPEATABILITY ACCURACIES				
	Positioning & repeatability accuracies shall be measured as per VDI/DGQ 3441 or relevant International standards.				
2.32.1	Positioning uncertainty over entire X axis (P)	Vendor to intimate			
2.32.2	Positioning uncertainty over entire Y axis (P)	Vendor to intimate			
2.32.3	Positioning uncertainty over entire Z axis (P)	Vendor to intimate			
2.32.4	Positioning uncertainty over entire Aaxis (P)	Vendor to intimate			
2.32.5	Positioning uncertainty over entire B axis (P)	Vendor to intimate			
2.32.6	Positioning uncertainty over entire C axis (P)	Vendor to intimate			
2.32.7	Positioning Scatter over entire traverse in Xaxis (Ps)	Vendor to intimate			
2.32.8	Positioning Scatter over entire traverse in Y axis (Ps)	Vendor to intimate			
2.32.9	Positioning Scatter over entire traverse in Zaxis (Ps)	Vendor to intimate			
2.32.10	Positioning Scatter over entire traverse in A axis (Ps)	Vendor to intimate			
2.32.11	Positioning Scatter over entire traverse in B axis (Ps)	Vendor to intimate			
2.32.12	Positioning Scatter over entire traverse in C axis (Ps)	Vendor to intimate			
2.32.13	All the Positioning and Repeatability accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and again during Erection & Commissioning at BHEL Works.	vendor to confirm			
2.33	LEVELING & ANCHORING SYSTEM				
2.33.1	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment and fixing of the machine on the floor should be supplied. Details to be submitted.	Vendor to confirm, offer and submit details			
2.34	TOOLS FOR ERECTION, OPERATION & MAINTENANCE				
2.34.1	Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench (02 Sets), Spanners (02 Sets), Allen Keys (02 Sets), Torx Keys (02 Sets), Electrical screw driver set (02 Sets), grease guns, Fluke make hand held digital multimeter (For Current & Voltage Measurements) and other special tools as required for operation and maintenance of the machine should also be supplied by the vendor. List of such tools should be submitted with offer.	Vendor to offer			
2.34.2	Set of Test Mandrels/Special Gauge for checking grinding head unit run-out & alignment of holding system / tailstock etc. should be brought and provided by the vendor.	Vendor to confirm and submit details			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.35	FOUNDATION				
2.35.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) or Purchase Order, whichever is earlier. 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 for Preliminary layout Drgs. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air dryer, Chip Bin & all other accessories/offered items. 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 accept & offer.			
2.35.2	Soil condition at BHEL, Haridwar is mentioned below : (a) Soil strata : Silty sand up to 2.5 meter depth (b) Average density of soil = 1.8 T/m^3 (c) Angle of internal friction = 35° (up to 3.0 m depth) (d) Coefficient of elastic uniform compression "Cu" = 3.0 Kg/cm^3 (at 7m depth for 10m^2 base area and 1.0 Kg/cm^2 confining pressure) (e) Bearing capacity at 1.5 meter depth = 10T/m^2 (f) Water table = 25 meter below ground level	For vendor's information.			
2.36	TRAINING				
2.36.1	BHEL Persons should be trained at vendor's works for mutually agreed period in the area of (a) CAM Software, CNC Part Programming, Use of all CNC Features, Programming for Measuring Systems & supplied accessories, grinding Technology of the Proveout Component 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 equipment. Vendor should provide training of Electronics Engineer and Programmer at the CNC System Manufacturer's works for advanced features and specialized training. Vendor shall offer training schedule and mention per day and per person basis price.	Vendor (to offer)			
2.36.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	For vendor's information.			
2.36.3	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to accept & confirm			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.37	MACHINE PRE-ACCEPTANCE AT VENDOR'S WORKS				
2.37.1	BHEL persons deputed for training will be doing pre-acceptance at vendor's works and give dispatch clearance after satisfaction from all angles. During pre-acceptance all accuracy tests mentioned at point number 2.31 & 2.32 shall be witnessed by the team. Also during pre-acceptance, vendor shall grind & polish profile of two types of blades (3 numbers each) from the list of drawings mentioned at 2.25 in the presence of BHEL representatives. Vendor shall also demonstrate achievement of time quoted for grinding the two types of blades and submit 3D Co-ordinate Measuring Machine reports for polished blade profile w.r.t. root & shroud.	Vendor to accept & confirm			
2.37.2	Toolings required for pre-acceptance at vendor's works shall be provided by the vendor and shall not be consumed from the tooling package offered against clause number 2.25.	Vendor to accept & confirm			
2.37.3	The blades for pre-acceptance tests will be supplied by BHEL, however the vendor will have to arrange the transportation for these blades from BHEL and back after the pre-acceptance tests. The vendor will also have to provide suitable Bank guarantee for these blades.	Vendor to accept & confirm			
2.37.4	Training of BHEL personnels as per clause no.2.36.	Vendor to accept & confirm			
2.37.5	The two types of blades for pre-acceptance purpose will be intimated by BHEL before pre-acceptance of machine.				
2.38	ERECTION & COMMISSIONING				
2.38.1	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment/accessories, grinding 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 helping personnel shall also be provided by BHEL. Details of these requirements should be informed/discussed by vendor and agreed with BHEL in advance. In case crane is required, representative of vendor to hire mobile crane from local sources (at their own cost). Compressed air pressure available in the shop is 5.0 Kg/Cm ² . If the required compressed air pressure for operating of the machine is more than the stated pressure, the vendor to provide suitable compressor (of Indian make preferable).	Vendor to confirm & offer			
2.38.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer, Air Dryer and other accessories with all electrical & mechanical connections shall also be responsibility of the vendor.	Vendor to offer			
2.38.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at Sl. No.2.31 and 2.32 and testing/demonstration of tele-diagnostic service shall also be part of the commissioning activity.	Vendor to confirm			
2.38.4	Tools, Tackels, Test Mandrels, instruments and other necessary equipment (including Laser equipment, if required) required to carry out all erection & commissioning activities should be arranged and brought by the supplier.	Vendor to confirm			
2.38.5	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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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.38.6	Broad Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit			
2.38.7	Charges, duration, terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer.	Vendor to offer			
2.38.8	Portion, if any, of the machine, accessories and other supplied items where paint got rubbed or peeled off during transit or erection should be repainted and matched with the original adjoining paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours/shades of paints used. The vendor shall ensure performing touching after commissioning but before final acceptance.	Vendor to confirm			
2.38.9	Any spare required during commissioning period (before final acceptance of the machine) shall have to be arranged by the vendor free of cost and duty levied have to be borne by the vendor.	Vendor to confirm			
2.39	PROVE OUT OF BHEL COMPONENTS				
2.39.1	Complete and successful grinding & polishing of proveout component, to the specified design accuracy and surface finish shall be done by the vendor after erection & startup of the machine at BHEL works using tools equipment and CNC programs etc. supplied by the vendor. Representative of vendor shall have to grind 10 nos. blades for each drawing numbers as mentioned at point number 2.25.1.1 to 2.25.1.7 and time study submitted at point number 2.26 shall have to be adhered. Blades will be checked in 3D Co-ordinate Measuring Machine available at BHEL and the reports of blades will be used for acceptance of achieved dimensions as per drawing. Blades for prove out purpose shall be given by BHEL.	Vendor to confirm & offer			
2.39.2	Vendor shall be fully responsible for grinding & polishing of proveout components as per drawing accuracies 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 got cleared by vendor during initial technical discussions.	Vendor to accept & confirm.			
2.39.3	Vendor shall be responsible for any deviation/rejection in proveout component due to wrong grinding or malfunctioning of the machine during proveout and also for the delay in grinding due to improper recommended tooling etc. Any change in tooling during proveout shall be at the responsibility and cost of the vendor. The vendor shall supply the toolings changed at proveout stage for the quantity of blades mentioned under the heading of 'Tooling Package'. Tooling required for prove out of BHEL components shall be separate from tooling package and shall not be consumed from the tooling package offered against clause number 2.25.	Vendor to accept & confirm.			
2.39.4	Prove out of blades at BHEL mentioned at point number 2.25.1.1 to 2.25.1.7 may get changed at the time of prove out at BHEL but size and shape of blades will be similar and within the size given in clause 1.1.				
2.40	FINAL MACHINE ACCEPTANCE				
2.40.1	Final acceptance shall be made by BHEL Hardwar after completion of following activities:				
2.40.1.1	Demonstration of specified/offered Geometrical accuracies as per test chart/standard after machine commissioning	Vendor to accept & confirm.			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
2.40.1.2	Demonstration of specified/offered Positioning accuracies and specified values after machine commissioning	Vendor to accept & confirm.			
2.40.1.3	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.			
2.40.1.4	Training of BHEL machine operators in operation of complete machine, software & accessories etc by the supplier's experts / engineers during their stay at BHEL works.	Vendor to accept & confirm.			
2.40.1.5	Prove out of BHEL components as per contract agreement.	Vendor to accept & confirm.			
2.40.1.6	Demonstration and establishment of System of automatic access, generation, storage & retrieval of NC program to the satisfaction of BHEL for efficient and smooth usage	Vendor to accept & confirm.			
2.41	PACKING				
2.41.1	Sea worthy & rigid packing for machine, control and other supplied items to avoid any damage/loss in transit.	Vendor to offer			
2.42	GUARANTEE				
2.42.1	Guarantee for complete machine,CNC Control, softwares and all supplied accessories/equipments for 24 months from the date of final acceptance of the machine. Any spare required during commissioning period (before final acceptance of the machine) shall have to be arranged by the vendor free of cost and duty levied have to be borne by the vendor.	Vendor to confirm & offer			
2.43	COLOUR OF THE MACHINE				
2.43.1	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to offer			
3.0	ADDITIONAL INFORMATION				
3.1	Following information shall be supplied with the offer:				
3.1.1	Machine Model No.	Vendor to inform			
3.1.2	Total connected load (KVA)	Vendor to inform			
3.1.3	Space required (Length, Width, Height) for complete machine & accessories. Height of machine should not be more than 5 m.	Vendor to accept & inform			
3.1.4	Catalogue of the machine	Vendor to submit			
3.1.5	Total weight of the machine	Vendor to inform			
3.1.6	Weight of heaviest part of machine	Vendor to inform			
3.1.7	Weight of the heaviest assembly of the Machine	Vendor to inform			
3.1.8	Dimensions of largest part of the machine	Vendor to inform			

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SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
4.0	GENERAL INFORMATION				
4.1	All the information and drawings attached with tender document are exclusive property of BHEL Hardwar. Drawings and other documents will be provided to the vendor only after the vendor has signed a non disclosure agreement with BHEL. Under no circumstances these should be passed to any third party without prior permission of BHEL and must not be used directly or indirectly detrimental to the interest of the company.	Vendor to accept & confirm.			
4.2	During technical scrutiny of the offer, vendor may be called for detailed technical discussion across the table for better understanding of the offer at BHEL, Hardwar.	Vendor to accept			
4.3	Vendor to submit the soft copy of video showing working of machine, axes movement, loading / unloading of jobs, Belt / Contact Wheel / Roller changing etc in CD/Pen drives etc. at the time of submission of their offer.	Vendor to accept & submit			
5.0	QUALIFYING CONDITIONS				
5.1	Only those vendors (OEMs) should quote who have supplied and commissioned at least one CNC 6 Axis Grinding & Polishing Machine of similar (X, Y & Z axes as per clause no. 2.1) or higher configuration for grinding and polishing of twisted and intricate type aerofoil of blade having integral root and shroud, in the past ten years (On the date of opening of Tender) and referred machine is presently working satisfactorily for more than one year after commissioning (on the date of opening of Tender). The following information should be submitted by the vendor about the companies where referred machine(s) have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to confirm			
5.2	Name & complete address of the customer / company, where referred machine(s) is(are) installed.	Vendor to submit			
5.3	Year of Commissioning of the referred machine.	Vendor to submit			
5.4	Broad specifications of the referred machine i.e. Model, Blade profile length, accessories supplied, features of Software supplied etc.	Vendor to submit			
5.5	Application for which the referred machine has been supplied.	Vendor to submit			
5.6	Name and designation of the contact person of the customer.	Vendor to submit			
5.7	Phone, FAX no. and email address of the contact person of the customer.	Vendor to submit			
5.8	Performance certificate (with specific mention of model of the machine) from the customer(s) regarding satisfactory performance of the machine supplied to them (original certificate or through e-mail directly from the customer). The performance certificate can be returned after verification by BHEL, if required.	Vendor to submit			
5.9	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 submit			

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