



BHARAT HEAVY ELECTRICALS LIMITED

UNIT'S ADDRESS:

UNIT'S PHONE NO.:

CONTACT PERSON'S NAME/DESGN./PHONE NO./E-MAIL

Annexure-I

Enquiry No. : _____

Due Date : _____

Supplier Qtn. No.: _____

Date : _____

SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR
3-AXIS CNC VERTICAL MILLING MACHINE
TECHNICAL SPECIFICATION: FTM/EOI/CNC-V.MILLING/2023/01

NOTE:-

1. Vendor must submit complete information against clause no. 22 (Qualifying conditions) . The offer meeting this clause would only be processed.
2. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.
3. The offer and all documents enclosed with offer should be in English language only.

ADDRESS OF THE SUPPLIER :		ADDRESS OF THE OEM :			
TELEPHONE NOS.:		TELEPHONE NOS.:			
FAX NOS.:		FAX NOS.:			
E-MAIL ADDRESS :		E-MAIL ADDRESS :			
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF 3-AXIS CNC VERTICAL MILLING MACHINE AS SPECIFIED BELOW.					
S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
1.0	PURPOSE & WORKPIECE MATERIAL				
1.1	Purpose : The machine is mainly intended for machining of Clamp plates, Inspection Pads, Turret mounting Pads, Locking Pads of Transformer Tank Fabricated assemblies. The various machining operations to be carried out on machine are facing, grooving, chamfering, milling, drilling, boring, tapping etc.	Vendor to Confirm			
1.2	Work Piece Material: Generally is made of Stainless Steel, J4, 690 QL, MS Gr Ultimate Tensile Strength (UTS) upto 755 N/mm2 Maximum Hardness upto 350 BHN .	Vendor to Confirm			
1.3	Material Removal capacity : While roughing the machine should be able to take a depth of cut of 10 mm at a feed rate of 0.1 mm/tooth with a Bull nose cutter of diameter 80 mm having latest generation of coated carbide round insert at a cutting speed of 150 m/min on stainless steel AISI 304 . Material removal capacity test will be done with above cutting parameters on S.S. AISI 304 block.	Vendor to Confirm			
1.4	Surface finish : In finishing operation, the achievable surface quality on finished surface should be Ra 1.6 μm (microns) or better for Stainless steel AISI 304 block.	Vendor to Confirm			
	SCOPE OF SUPPLY				
2.0	MACHINE SPECIFICATION (Minimum requirements)				
2.1	MACHINE CONFIGURATION: 3-axis CNC Vertical Milling Machine	Vendor to Confirm			
2.1.1	Spindle Orientation: Vertical	Vendor to Confirm			
2.1.2	Table longitudinal traverse: X Axis	Vendor to Confirm			

2.1.3	Spindle Head lateral traverse: Y Axis	Vendor to Confirm			
2.1.4	Spindle vertical traverse: Z Axis	Vendor to Confirm			
2.1.5	Time taken to complete machining of job along with groove machining as per details & drawing no. 44641600047 R00, with SS material.	Vendor to Confirm			
2.2	TABLE :				
2.2.1	Size of Clamping Surface of Table : 1500 mm (Longitudinal axis) x 1500 mm (Transverse axis)	Vendor to Confirm			
2.2.2	Max Job Envelope : 1500 (L) x 1500 (W) x 500 (H) mm	Vendor to Confirm			
2.2.3	Max. Weight of Work-piece : 300 kg	Vendor to Confirm			
2.2.4	Details of T-Slots: No / Size / Pitch	Vendor to Specify			
2.2.5	Central Slot tolerance	Vendor to Specify			
2.2.6	Lateral Slot size and tolerance	Vendor to Specify			
2.2.7	Table top and central slot should be accurately machined and it shall be used as reference surfaces.	Vendor to Confirm			
2.3	SPINDLE:				
2.3.1	Spindle Bearing Bore Diameter : ≥ 100 mm	Vendor to Confirm			
2.3.2	Spindle Motor Power at 100% Duty Cycle (AC Continuous Duty S1) : 18 KW or more (Details to be provided)	Vendor to Confirm			
2.3.3	Spindle Motor & Drive Make : FANUC αi / βi series or SIEMENS 1PH series spindle motor with matching spindle drive. (Details to be given)	Vendor to Confirm			
2.3.4	Spindle Encoder : FANUC/SIEMENS/HEIDENHAIN rotary encoders for direct reading of actual spindle rpm. (Details to be given)	Vendor to Confirm			
2.3.5	Spindle Bearings (Radial/ Axial/ Angular) : Type / class / accuracy	Vendor to Specify			
2.3.6	Taper in Spindle : ISO 50 DIN 69871 / BT 50	Vendor to Confirm			
2.3.7	Spindle speed (Infinitely variable) rpm : From ≤ 20 RPM to ≥ 6000 RPM	Vendor to Confirm			
2.3.8	Detail of speed ranges (Selectable through program)	Vendor to Specify			
2.3.9	Max Spindle Torque at 100 % duty cycle.	Vendor to Specify			
2.3.10	Torque/Power/Speed diagram of spindle motor is to be submitted with the offer.	Vendor to Confirm			
2.3.11	Lowest and Highest Position of Spindle Face from Table Top				
2.3.11.1	Lowest position of Spindle Face from Table Top : ≥ 200 mm	Vendor to Confirm			
2.3.11.2	Total travel of Spindle face should be 1000 mm from its lowest position. (refer clause 2.3.11.1)	Vendor to Confirm			
2.4	TRAVERSES:				
2.4.1	Table Longitudinal Traverse (X-Axis): 1500 mm	Vendor to Confirm			
2.4.2	Spindle Head lateral traverse (Y-Axis): 1500 mm	Vendor to Confirm			
2.4.3	Spindle Vertical Traverse (Z Axis) : 500 mm	Vendor to Confirm			
2.5	FEEDS AND DRIVE SYSTEM:				
2.5.1	Feed range in X, Y & Z axes (Infinitely variable): 0 to 10000 mm/min	Vendor to Confirm			
2.5.2	Rapid traverse in X, Y & Z axes (Infinitely variable): 0 to 10000 mm/min	Vendor to Confirm			
2.5.3	Feed motors & drive : FANUC αi / βi or SIEMENS 1FT/1FK series AC servo motors with matching AC servo drives. (Details to be submitted)	Vendor to Confirm			
2.5.4	Feedback system for X, Y & Z axes. Heidenhain / Fagor / Renishaw sealed linear scales. (Details to be submitted)	Vendor to Confirm			
2.5.5	Mechanism for locking X,Y & Z axis : Servo Lock + Motor Brake	Vendor to Confirm			
2.5.6	X, Y & Z Axis Resolution: 0.001mm	Vendor to Confirm			
2.6	CONSTRUCTION:				
2.6.1	Backlash free re-circulating ground ball screw with Pre-loaded double nut of THK/NSK/Korta/Hiwin/Shuton make for all axes. (Details to be submitted)	Vendor to Confirm			

2.6.2	The main and sub-assemblies of the machine like Column, Cross rail, Bed, table etc. should be of cast iron / Fabricated.	Vendor to Confirm			
2.6.3	Vendor to furnish material, hardness of guideways & constructional details, including explanatory drawings, of various components/assemblies like Gear Box, Guideways/slides, Telescopic covers, Accessories, Table, hydraulic/pneumatic and lubrication system etc. of the machine.	Vendor to Specify			
2.6.4	X, Y & Z axis shall be provided with LM / Machined guide-ways (integrated hardened & ground) & other sub assemblies of machine should be rust free while in contact with coolant /atmospheric moisture. LM guideways shall be preferably of THK/Schneeberger/Rexroth/Hiwin/NSK make or equivalent Internationally reputed make and same to be specified in technical bid.	Vendor to Confirm			
2.6.5	X axis shall be provided with Steel Telescopic covers, Y & Z axis shall be provided with Steel Telescopic covers / Bellow covers of rust resistant material with wipers. Joints of telescopic / bellow covers should be so sealed to avoid mixing of coolant and other lubricating oil.	Vendor to Confirm			
2.7	OPERATION AND CONTROL SYSTEM:				
2.7.1	OPERATOR'S PANEL:				
2.7.1.1	Swivelling type air conditioned Operator's Pendant/Desktop of Rittal/Schneider make (preferable) or equivalent Internationally reputed make , incorporating the CNC Operator Panel (OP) and Machine Control Panel (MCP) of required configuration shall be provided. All switches on the Operator's Pendant/Desktop should be within reach of operator of average height of 170 cm for convenient, efficient & safe operation. All displays/indications should also be conveniently placed accordingly. Layout showing complete details of the panel with Photographs should be submitted.	Vendor to Confirm			
2.7.2	CNC SYSTEM & FEATURES :				
2.7.2.1	Make: Fanuc or Siemens	Vendor to Confirm			
2.7.2.2	Model: Suitable for the application. (Details to be submitted) Note: Latest version of hardware and firmware, as available at the time of ordering/delivery, should be supplied.	Vendor to Specify			
2.7.2.3	Details of Standard features	Vendor to Specify			
2.7.2.4	Details of optional features, recommended by vendor. (Including features required for Prove-Out Components)	Vendor to Specify			
2.7.2.5	Details of other optional features:				
2.7.2.5.1	Axes Interpolation: Linear, Circular, Cylindrical, Helical.	Vendor to Confirm			
2.7.2.5.2	Part Program Storage: Minimum 2 MB	Vendor to Confirm			
2.7.2.5.3	Technology Cycles: Geometry Calculation, Drilling, Tapping, Milling cycles.	Vendor to Confirm			
2.7.2.5.4	Pitch Error compensation	Vendor to Confirm			
2.7.2.5.5	Backlash error compensation	Vendor to Confirm			
2.7.2.5.6	Graphics simulation of Part Program.	Vendor to Confirm			
2.7.2.5.7	Co-ordinate Transformation : Datum shift, rotation, mirror image, scaling factor.	Vendor to Confirm			
2.7.2.5.8	Feed override switch 0-120% for all axis	Vendor to Confirm			
2.7.2.5.9	Spindle speed override switch 50-120%	Vendor to Confirm			
2.7.2.5.10	Zero Offset for all axes	Vendor to Confirm			
2.7.2.6	The system should have full alphanumeric keyboard, TFT colour display (≥10.4"), Machine Control Panel (MCP), 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.	Vendor to Confirm			
2.7.2.7	Provision for automatic safe shut down of CNC Control in case of PC based System.	Vendor to Confirm			
2.7.2.8	The Controller should have feature to accept USB Pen-Drives / PCMCIA/Flash Card for Part Program and Machine data transfer both ways.	Vendor to Confirm			

2.7.2.9	Machine should be OPCUA / FOCAS Compliance with necessary license if required.	Vendor to Confirm			
2.7.3	MANUAL CONTROL:				
2.7.3.1	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 detail of all switches/keys should be submitted.	Vendor to Confirm			
2.7.4	HAND HELD UNIT:				
2.7.4.1	Hand Held unit, along with sufficient length of interfacing cable is to be offered for handwheel (MPG) operation of individual axis in jog & increment mode & provision for spindle inch in c.w. & c.c.w. directions.	Vendor to Confirm			
2.7.5	UPS FOR CNC SYSTEM: (Only in case of PC based CNC system)				
2.7.5.1	UPS of 10 minutes backup for CNC system with proper cooling arrangement and charge status display is to be supplied only in case of PC based CNC system with HDD. Preferable Make: Hitachi /APC/Emerson (Liebert)/Siemens/Omron or equivalent Internationally reputed make.	Vendor to Confirm			
2.8	MACHINE LIGHTS:				
2.8.1	Machine Lights for sufficient illumination of complete working area on both sides of machine should be provided for clear visibility.	Vendor to Confirm			
2.8.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to Confirm			
2.8.3	Any light required in the foundation/pit area (if any) shall also be foreseen and supplied by the vendor.	Vendor to Confirm			
2.8.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to Confirm			
2.8.5	Flashing / rotary type End of Cutting and Program Stop Light should be provided.	Vendor to Confirm			
2.9	AIR CONDITIONERS:				
2.9.1	Air conditioners are to be provided for all Electrical Panels/Cabinets including operator's panel considering continuous operation at ambient temperature of 45 degree C. The blow of cool air from the air conditioners shall not fall directly on the electronic circuits/modules. Detailed specifications of the same are to be submitted. Temperature required inside the panel should not be greater than 25 degree centigrade. The air conditioner should be of Advance/Werner Finley/Rittal/Bluestar/Voltas make or other reputed international make having spares & service support in India.	Vendor to Confirm			
2.10	HYDRAULIC SYSTEM : Details should be submitted by the vendor.				
2.10.1	System should be centralised. Hydraulic Tank shall preferably be located at floor level	Vendor to Confirm			
2.10.2	Make: Rexroth/Vickers Sperry/Hydac/Yuken or equivalent from a reputed manufacturer of international repute. (Details to be submitted)	Vendor to Confirm			
2.10.3	Filtration System (Details should be submitted)	Vendor to Specify			
2.10.4	Failure indication	Vendor to Confirm			
2.10.5	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 25-27 deg C irrespective of the ambient conditions. Complete details should be submitted. Make : Advance/Werner Finely/Rittal/Bluestar/Voltas make or other reputed international make having spares & service support in India.	Vendor to Confirm			

2.10.6	Hydraulic pump capacity (flow / pressure)	Vendor to Specify			
2.10.7	Each pump should have an independent motor. Tandem pumps should not be used	Vendor to Confirm			
2.10.8	First filling of all required oil & grease etc. should be supplied by vendor. Indigenous (Indian) source, or Indian Equivalent, and specifications of oils/ greases also should be provided by the vendor.	Vendor to Confirm			
2.11	COOLANT SYSTEM :				
2.11.1	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 Confirm			
2.11.1.1	Recirculating Type Flood Coolant System through adjustable trajectory multiple nozzles around the spindle.	Vendor to Confirm			
2.11.1.2	High Pressure Coolant through Spindle	Vendor to Confirm			
2.11.1.3	Air coolant system	Vendor to Confirm			
2.11.2	It shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to Confirm			
2.11.3	Coolant collection and recirculation system should be leak-proof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc.	Vendor to Confirm			
2.11.4	Coolant Filtration System: Recirculating type coolant system with centrifugal Hydrocyclone System/ Vacuum Rotary drum type System/ Cartridge Type Filtration System / Paper Type filtration system and magnetic separator.	Vendor to Confirm			
2.11.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc.to be submitted with the offer.	Vendor to Confirm			
2.11.6	Pressure & rate of flow of coolant for different variants should be furnished in the offer. The Pressure should be sufficient for the coolant to reach the tool tip at full pressure.	Vendor to Confirm			
2.11.7	Coolant Tank Capacity	Vendor to Specify			
2.11.8	For finer control of Pressure and Coolant Flow Rate, after its activation through program or switches, Rotary/ potentiometer switches shall be provided on the Operator's Panel.	Vendor to Confirm			
2.11.9	Coolant pump and motor details for all variants	Vendor to Specify			
2.11.10	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to Confirm			
2.11.11	Coolant should not get mixed with lubricating oil. Coolant falling on job / table should not get mixed with machine table / bed lubricating oil. Necessary provision to be made.	Vendor to Confirm			
2.12	ELECTRICAL:				
2.12.1	415V +/- 10%, 50HZ +/-3 %, 3 Phase AC (3 wire system without neutral) Power Supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets, shall be the responsibility of vendor. Requirement of grounding/earthing with required material details should be informed by vendor well in advance so that same could be incorporated during construction of foundation.	Vendor to Confirm			
2.12.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized	Vendor to Confirm			
2.12.3	Electrical cabinets should be of Rittal/Schneider make or any other equivalent from reputed International make, properly air conditioned and sealed from ingress from all liquids & encroachments of rodents. All electrical & electronic control cabinets & panels should be dust and rodent proof	Vendor to Confirm			
2.12.4	All electrical components should be mounted on DIN Rail	Vendor to Confirm			
2.12.5	All electrical and electronic panels should be provided with fluorescent lamps for sufficient illumination and power receptacles of 230 Volts, 5 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	Vendor to Confirm			
2.12.6	Motors shall conform to IEC or Indian Standards	Vendor to Confirm			

2.12.7	All cables outside the electrical cabinets and operator pendant must be routed through flexible conduits capable of withstanding stress, chip hazard and ingress of oil /coolant. All cable through trenches to run on cable trays. Additionally, all cables moving with transverse axis should be of trailing type and installed in cable drag chain with minimum specifications as follows : Heavy engineering polymer ,design type :interlock(tongue & groove) ,Links should be interchangeable ,stray to cover drag chain from top & bottom.	Vendor to Confirm			
2.12.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to Confirm			
2.12.9	In-cycle hour counter with reset facility.	Vendor to Confirm			
2.13	SAFETY ARRANGEMENTS:				
2.13.1	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 and messages (with device identification) on CNC display and panels should be available	Vendor to Confirm			
2.13.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to Confirm			
2.13.3	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			
2.13.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to Confirm			
2.13.5	Emergency Switches at suitable locations as per International Norms should be provided. Atleast one emergency switch should be provided on machine enclosure from front side.	Vendor to Confirm			
2.13.6	Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to Confirm			
2.14	ENVIRONMENTAL PERFORMANCE OF THE MACHINE :				
2.14.1	Maximum noise level shall be 85 dB(A) at normal load condition, 1 M away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16 . Supplier to demonstrate compliance to noise level, if so required.	Vendor to Confirm			
2.14.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to Confirm			
2.14.3	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			
2.14.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to Confirm			
2.14.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to Confirm			
2.14.6	Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to Confirm			
3.0	CHIP CONVEYOR:				
3.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on the floor, should be provided at the side of the machine. Two chip bins of appropriate size, with wheels and handle for movement, should also be supplied.	Vendor to Confirm			
3.2	Type of chip conveyor	Vendor to Specify			
3.3	Width of conveyor	Vendor to Specify			
3.4	Elevation of chip conveyor for chip bin	Vendor to Specify			
3.5	Material of chip conveyor should be rust resistant.	Vendor to Confirm			
3.6	Provision for smooth flow of chips to the conveyor.	Vendor to Confirm			
3.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to Confirm			

3.8	Layout showing location of chip conveyor should be submitted.	Vendor to Confirm			
4.0	ULTRA ISOLATION TRANSFORMER				
4.1	Indian make Ultra Isolation Transformer (TTN configuration) suitable for complete machine shall be provided.	Vendor to Confirm			
4.2	Make: NEEL / AEI / SAIGON or any other equivalent make of International repute.	Vendor to Confirm			
4.3	Model & Rating	Vendor to Specify			
4.4	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to Confirm			
5.0	PNEUMATIC SYSTEM:				
5.1	AIR COMPRESSOR:				
5.1.1	Independent Air Compressor (Make: ELGI / ATLAS COPCO / INGERSOLL RAND or any other equivalent make of International repute.) 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 6 bar, could be used as and when required. The compressor unit should be suitable for continuous duty. Indications for over/under pressure should be provided.	Vendor to Confirm			
5.1.2	Make & Model of Air Compressor	Vendor to Specify			
5.1.3	Make & Model of Refrigerated Air Dryer	Vendor to Specify			
5.1.4	Capacity (Flow, Pressure & KW)	Vendor to Specify			
5.2	COMPRESSED AIR POINTS:				
5.2.1	Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning along with air gun.	Vendor to Confirm			
6.0	TOOLINGS:				
6.1	All supplied tool holders, Cutting Tools, adapters etc. shall have built in system for the coolant so that coolant is available directly on the cutting tip during all possible operations.	Vendor to Confirm			
6.2	Tooling from SANDVIK, SECO, ISCAR, KENNAMETAL & WIDIA or any reputed international make operating in India. Following Tools are to be supplied along with the machine:	Vendor to Confirm			
6.2.1	Indexable Square End mills: Dia.25 & Dia.40 mm - Qty 02 no. each	Vendor to Confirm			
6.2.2	Indexable Ball Nose Endmills: Dia.25 & Dia.32 mm - Qty 02 no. each	Vendor to Confirm			
6.2.3	Face Mill Cutter : Dia. 63, Dia 100 & Dia 125 mm - Qty 02 no. each	Vendor to Confirm			
6.2.4	Bull Nose cutter nom. Dia 63 & Dia 80 mm - Qty 02 no. each	Vendor to Confirm			
6.2.5	Indexable Drill : Dia. 28, Dia 32 & Dia 36 mm - Qty 02 no. each	Vendor to Confirm			
6.2.6	Micro boring bar : Range dia. 29 -50 mm - Qty 02 no.	Vendor to Confirm			
6.2.7	Tool Holders : One no. each type for tools mentioned above.	Vendor to Confirm			
6.2.8	Inserts (suitable for machining of stainless steel material) : 100 No. each type for tools mentioned above.	Vendor to Confirm			
6.2.9	Screws for insert : 50 No. each type for tools mentioned above.	Vendor to Confirm			
6.2.10	Standard spare for each tool (For all the above tools) - Qty 02 set	Vendor to Confirm			
6.2.11	Mandrel for centering - Qty 01 no	Vendor to Confirm			
6.2.12	All cutting tools, adaptors, sleeves & tool holders recommended for machining of prove out components shall be supplied by vendor (which are not included in the above list - Qty 1 set	Vendor to Confirm			
6.2.13	Job Fasteners 1 Set	Vendor to Confirm			
	Note : Cylindrical shank tools should of Weldon type, Tools should be supplied with proper adaptors				

7.0	LEVELING & ANCHORING SYSTEM				
7.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, levelling shoes etc should be supplied.	Vendor to Confirm			
8.0	TOOLS FOR ERECTION, OPERATION & MAINTENANCE :				
8.1	Special tools and equipment required for erection and necessary tools like Torque Wrench, Spanners, Keys, grease guns etc.for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer.	Vendor to Confirm			
8.2	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to Confirm			
9.0	ACCESSORIES:				
9.1	Tool Cabinet to be provided (Details to be submitted)	Vendor to Confirm			
9.2	Enclosure for Machine from all sides (top side not mandatory) with provision of visibility of cutting area.	Vendor to Confirm			
10.0	SPARES:				
10.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares used on the machine (as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis) should be offered by vendor. The spares shall be ordered as per requirement.	Vendor to Specify			
10.1.1	Mechanical & Hydraulic Spares: All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc.	Vendor to Specify			
10.1.2	Electrical /Electronic / CNC Spares: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Scanning Heads for Linear Scales, CNC controller, Operator's panel with Display Unit, I/O Cards for PLC, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives etc.	Vendor to Specify			
10.2	All types of spares for total machine and accessories should be available for at least ten years after supply of the machine. If machine, software 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 them in advance, if required.	Vendor to Confirm			
10.3	List of recommended set of spares for all assemblies & sub assemblies of machine are to be offered with details.	Vendor to Confirm			
10.4	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			
11.0	DOCUMENTATION :				
	Four sets of following documents (Hard copies) in English language should be supplied along with the machine	Vendor to Confirm			
11.1	Operating manuals of Machine & CNC system	Vendor to Confirm			
11.2	Programming Manuals of Machine & CNC system	Vendor to Confirm			
11.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also.	Vendor to Confirm			
11.4	Hard copy (Print out) as well as soft copy (in PDF Format) of Electrical Schematics of the machine with comments in English.	Vendor to Confirm			
11.5	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives and position feed back system.	Vendor to Confirm			
11.6	Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable.	Vendor to Confirm			
11.7	Detailed specification of all rubber items and hydraulic/lube fittings.	Vendor to Confirm			

11.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied Voltage Stabilizer, Isolation Transformer, Air-Compressor and all supplied Accessories.	Vendor to Confirm			
11.9	Hard copy (Print out) of PLC program with comments in English.	Vendor to Confirm			
11.10	Soft copy of PLC program and complete machine data.	Vendor to Confirm			
11.11	Complete back-up of hard disk on GHOST CD (only in case of PC based CNC system)	Vendor to Confirm			
11.12	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor to Confirm			
11.13	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to Confirm			
12.0.	TRAINING				
12.1	BHEL Persons should be trained at supplier's Works for 5 working days in the area of (a) CNC Part Programming for the machine & supplied equipment's, - 1 persons (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipment's - 1 persons (c) Mechanical maintenance of the machine & other supplied equipment's - 1 person (d) Operation of the machine with the supplied equipment's/accessories - 1 person.	Vendor to Confirm			
12.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to note			
12.3	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to Confirm			
12.4	Vendor to quote for training on per man per day basis.	Vendor to Confirm			
12.5	Vendor shall organize for specialised system training for one Maintenance Engineers and one Programmers at the CNC System Manufacturer's (Fanuc/Siemens) Training Centre in INDIA for 5 working days.	Vendor to Confirm			
13.0	FOUNDATION :				
13.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) / P.O. whichever is earlier. Soil condition data will be furnished by BHEL along with the approval. Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete machine including space requirement for 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 equipment's 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 Confirm			
14.0	ERECTION & COMMISSIONING				
14.1	Supplier to take full responsibility for carrying out erection, start up, testing of the machine and all types of supplied equipment's, machining of test pieces etc. The machine is to be erected at the site by the supplier with their own manpower, tools & tackles etc. Other erection equipment's like mobile crane, measuring instruments & devices for testing & commissioning of machines should be brought by the supplier on returnable basis. However, EOT Crane will be provided by BHEL depends on the availability. Service requirement like air, water, electricity will be provided by BHEL at one point to be indicated by the supplier in advance. Complete commissioning & demonstration of all the features of machine/ equipment's to the entire satisfaction of BHEL is the sole responsibility of vendor at BHEL Bhopal works. Complete commissioning, testing including all the test is in the scope of supplier.	Vendor to Confirm			
14.2	Erection & Commissioning of Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to Confirm			

14.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at clause 18 (Machine Acceptance) shall form part of the commissioning activity.	Vendor to Confirm			
14.4	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to Confirm			
14.5	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to Confirm			
14.6	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to Specify			
15.0	ACCURACY TESTS:				
15.1	GEOMETRICAL ACCURACIES :				
15.1.1	Submit test chart for all accuracies as per ISO8636 / ISO 10791 standard or equivalent applicable standard.	Vendor to Confirm			
15.1.2	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at supplier's works and during erection & commissioning at BHEL works.	Vendor to Confirm			
15.2	MACHINE POSITIONING ACCURACIES & REPEATABILITY: Should be measured as per VDI/DGQ 3441/ ISO 230-2 (Latest Revision) using LASER INTERFEROMETER.	Vendor to Confirm			
15.2.1	Positioning accuracy in X / Y axis (P) per 1000 mm : 0.015 mm or better	Vendor to Confirm			
15.2.2	Positioning accuracy in Z axis (P) per 1000 mm : 0.015 mm or better	Vendor to Confirm			
15.2.3	Repeatability in X / Y axis (Ps) : 0.012 mm or better	Vendor to Confirm			
15.2.4	Repeatability in Z axis (Ps) : 0.012 mm or better	Vendor to Confirm			
15.2.5	Positioning accuracy over entire traverse in X / Y axis (P): 0.025 mm or better	Vendor to Confirm			
15.2.6	Positioning accuracy over entire traverse in Z axis (P) : 0.025 mm or better	Vendor to Confirm			
15.2.7	All the above accuracies should be demonstrated to BHEL engineers during pre acceptance at suppliers works and during Erection & Commissioning at BHELWorks.	Vendor to Confirm			
	Note : 1. LC of scale should be better than values mentioned above.	Vendor to Confirm			
16.0	OPERATING CONDITIONS :				
16.1	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: Voltage: 415 V, ± 10% Frequency: 50 Hz ± 3% No. of phases = 3 Ambient Conditions: Temperature = 5 to 45 degree Celsius Relative Humidity = 95% max. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor)	Vendor to Confirm			
16.2	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 Centigrade in 24 hours. Vendor to ensure that machine is suitable for above mentioned temperature variation, specified Ambient Conditions, accuracy requirements of BHEL components and trouble free operation of the machine.	Vendor to Confirm			
16.3	The machine including attachments and accessories should be suitable for 24 hours continuous operation to its full capacity for 24 hour a day and 7 days a week throughout. Vendor to ensure & confirm the same.	Vendor to Confirm			

17.0	PROVEOUT OF BHEL COMPONENTS :				
17.1	<p>Vendor to carry out complete machining (using 3 axis simultaneous interpolation facility) of TWO prove out components as per enclosed drawing (Drawing no. VMC/DRG/001 Rev.00 and VMC/DRG/002 Rev. 00). Vendor to submit preliminary process, time study & tool list recommended by them. Change in process/tools may be mutually discussed and agreed. Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools, fixture and CNC programs provided by the vendor to prove the machine after complete erection, testing & test piece machining etc. Material for the prove out components shall be provided by BHEL. Vendor should submit the CNC programs, setting schemes, process sheets, tooling layouts, time studies etc. for the prove out components. Vendor to provide cutting tools (along with adaptor, holders, sleeves etc) and required fixture to hold the prove out components for successful machining.</p> <p>Vendor shall be fully responsible for machining of prove out 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 prove out components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.</p> <p>Note 1: In case of unavailability of same components, similar type of other components along with drawing & model (if applicable) will be provided for proving of components.</p> <p>Note 2 : The machining of blade profile (using 3 axis simultaneous interpolation facility) shall be done as per drawing & model. Solid model of the component shall be provided by BHEL after placement of order.</p>	Vendor to Confirm			
17.2	Accuracies for prove out components				
17.2.1	<p>Accuracies of prove out components (Drawing no. VMC/DRG/001 Rev.00 and VMC/DRG/002 Rev. 00) shall be achieved as per the drawing.</p> <p>Note 1: In case of unavailability of same components, similar type of other components along with drawing will be provided for proving of components.</p>	Vendor to Confirm			
17.3	Vendor shall be responsible for any deviation/rejection in prove out component due to wrong machining or malfunctioning of the machine during prove out machining and also for the delay in machining due to improper recommended tooling etc. The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.	Vendor to Confirm			
18.0	MACHINE ACCEPTANCE: (Tests/Activities should be Performed by Vendor)	Vendor to Confirm			
18.1	Tests/Activities should be carried out at supplier's works on the machine before dispatch :	Vendor to Confirm			
18.1.1	Geometrical accuracies in accordance with Clause 15.1	Vendor to Confirm			
18.1.2	Positioning accuracies in accordance with Clause 15.2	Vendor to Confirm			
18.1.3	The machine should be tested for continuous running of 12 hrs. If any break down occurs during this test, the test should be repeated for 12 hrs from that time.	Vendor to Confirm			
18.1.4	Material Removal capacity : While roughing the machine should be able to take a depth of cut of 5 mm at a feed rate of 0.1 mm/tooth with a Bull nose cutter of diameter 80 mm having latest generation of coated carbide round insert at a cutting speed of 150 m/min on stainless steel AISI 304. Trial for Material removal capacity will be done with above parameters on S.S. AISI 304 block. Material & Tooling's for trial shall be arranged by supplier.	Vendor to Confirm			

18.1.5	Surface finish : As per clause 1.4 , material & tooling's for trial shall be arranged by supplier.	Vendor to Confirm			
18.1.6	Demonstration of all features of the machine, control system & accessories	Vendor to Confirm			
18.1.7	Machining of test piece as per NAS/ISO . Vendor to supply test piece and tooling for it's machining. Vendor to arrange the instruments required for measurement of the machined test piece.	Vendor to Confirm			
18.2	Tests/Activities should be carried out at BHEL works while commissioning the machine :	Vendor to Confirm			
18.2.1	Geometrical accuracies in accordance with clause 15.1	Vendor to Confirm			
18.2.2	Positioning accuracies in accordance with clause 15.2	Vendor to Confirm			
18.2.3	Full load test : To demonstrate the maximum power & cutting capacity of the machine trial will be done as per clause 1.3 . Material for trial shall be arranged by BHEL. Tooling's shall be arranged by vendor.	Vendor to Confirm			
18.2.4	Surface finish : As per clause 1.4 . Material for trial shall be arranged by BHEL. Tooling's shall be arranged by vendor.	Vendor to Confirm			
18.2.5	Machining test piece as per NAS/ISO. BHEL shall arrange material for test piece & instruments for its measurements. Tooling's shall be arranged by vendor.	Vendor to Confirm			
18.2.6	Job prove out machining as per clause 17.0	Vendor to Confirm			
18.2.7	The machine should be tested for continuous running of 24 hrs. If any break down occurs during this test, the test should be repeated for 24 hrs from that time.	Vendor to Confirm			
18.2.8	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 Confirm			
18.2.9	Two weeks supervision of independent operation of machine by BHEL after job prove out.	Vendor to Confirm			
18.2.10	5 working days 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 Confirm			
18.2.11	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to Confirm			
19.0	PACKING:				
19.1	Sea worthy & rigid packing for all items of complete machine, CNC System, all Accessories and other supplied items to avoid any damage/loss in transit. When machine is despatched in containers, all small loose items shall be suitably packed in boxes	Vendor to Confirm			
20.0	GUARANTEE :				
20.1	24 months from the date of commissioning & acceptance of the machine at BHEL Bhopal.	Vendor to Confirm			
21.0	GENERAL :				
21.1	Machine Model	Vendor to Specify			
21.2	Total connected load (KVA):	Vendor to Specify			
21.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to Specify			
21.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to Specify			
21.5	Total weight of the machine	Vendor to Specify			
21.6	Weight of heaviest part of machine	Vendor to Specify			
21.7	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to Specify			
21.8	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to Specify			
21.9	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, Axes Travel, Max Feed, Max Spindle speed, Spindle power, Load Capacity, Max job Envelope, CNC System etc	Vendor to Specify			
21.10	Detailed catalogues, sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to Confirm			
21.11	Hydraulic, Pneumatic & oil piping's should be preferably metallic except places where flexible piping's are essential. All the pipes required for the same shall be included in the standard scope of the machine including first filling of oil.	Vendor to Confirm			

22.0	QUALIFYING CONDITIONS :				
22.1	<p>a) Only those vendors (OEMs) should quote who have commissioned in the past Ten years (on the date of opening of Tender) at least One 3-Axis CNC Vertical Milling Machine of same or higher sizes (Spindle Power : 18 KW, Table load capacity : 0.5 Tons , Axes travel : X Axis travel - 1500 mm, Y Axis travel - 1500 mm, Z Axis travel - 500 mm) and capable of achieving machining accuracies as required in prove out components mentioned at clause no. 17.2 (Accuracies for Proveout components) either(i) in at least one country other than the country from where the machine tool will be supplied to establish vendor's (OEM's) global business activity or (ii) in India; and referred machine is presently working satisfactorily for more than one year after commissioning (on the date of opening of Tender) . Vendor should submit proof of the same.</p> <p>b) However, such Indian machine tool vendors (OEMs), who do not meet specified qualifying conditions [clause 22.1(a)] , can quote if they have running Collaboration/ Joint Venture/ Joint Working Arrangement for manufacture of 3-Axis CNC Vertical Milling Machine of same or higher sizes (Spindle Power : 18 KW, Table load capacity :0.5 Tons , Axes travel : X Axis travel - 1500 mm, Y Axis travel - 1500 mm, Z Axis travel - 500 mm)) with foreign machine tool manufacturer, who meets qualifying conditions as specified in clause 22.1(a). Vendor should submit proof of the same .</p> <p>Such Indian machine tool vendors (OEMs) shall have to submit from their foreign partner a back to back guarantee for satisfactory performance of the offered machine in compliance to all specified tender requirements.</p> <p>NOTE :</p> <p>1. BHEL reserves the right to accept or reject the OEMs based on the assessment of their technical and financial capability.</p> <p>2. In respect of Indian vendors (OEMs) against (b) above, BHEL reserves the right to accept or reject both the Indian vendors (OEMs) & their Foreign Partners based on the assessment of their technical and financial capability.</p>	Vendor to Confirm			
22.2	Copy of Purchase Order (PO) in the name of OEM for machine or its authorised agent as per clause 22.1 is to be submitted along with the offer. The type, make and model number of the machine should be clearly mentioned in the PO copy.	Vendor to Submit			
22.3	The following Information should be submitted by the vendor about the companies where referred machine (clause 22.1) have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to Confirm			
22.3.1	Name of the customer/company where referred machine is installed	Vendor to Inform			
22.3.2	Complete postal address of the customer.	Vendor to Inform			
22.3.3	Month & Year of commissioning	Vendor to Inform			
22.3.4	Parameters of machine(s) (Spindle Power, Table load capacity, Axes travel : X Axis, Y Axis, Z Axis) and application for which the machine(s) is supplied	Vendor to Inform			
22.3.5	Name and designation of the contact person of the customer.	Vendor to Inform			
22.3.6	Phone, FAX no, and email address of the contact person of the customer	Vendor to Inform			
22.3.7	Performance certificate from the customers regarding satisfactory performance of machine supplied to them vide Purchase Order as per clause 22.1 & 22.2 (Original Certificate or through Email directly from the customer).	Vendor to Submit			

22.3.8	<p><u>FINANCIAL PQC:</u> Vendor should have minimum average annual turnover of Rs.122.2 lakhs for the last three consecutive financial years. Vendor to submit audited Profit & Loss Account Statement and balance sheet of last three consecutive years as documentary evidence for the same.</p> <p>For Micro & Small Enterprises (MSE) & Start-Up Vendors, in line with GOI circular 1(2)(1)/2016-MA dated 10/03/2016 and Ministry of Finance circular No.F.20/2/2014-PPD(Pt.) dated 20/09/2016, relaxation permitted for prior turnover criteria only. However, prior experience is mandatorily required and no relaxation in this regard shall be given.</p>	Vendor to Confirm & Submit			
22.3.9	<p>BHEL reserves the right to verify the information provided by the Vendor for the referred machine at their referred customer's works including machining accuracies. It shall be the responsibility of the vendor to facilitate the visit of BHEL's team at their referred customer works .The Travel and Boarding expenses for BHEL Personnel shall be borne by BHEL. In case the information provided by vendor is found to be false/incorrect the offer shall be rejected.</p>	Vendor to accept & confirm			
23.0	<u>NETWORKING:</u>				
23.1	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 for Industry 4.0 application. The networking should have following capabilities.	Vendor to Confirm			
23.1.1	The machine shall appear as a node in the Entire Network. (Network Neighbourhood).	Vendor to Confirm			
23.1.2	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			