ANNEXURE-1

SCOPE OF SUPPLY & WORK FOR RECONDITIONING & RETROFITTING OF CNC H. BORING MACHINE, SPINDLE DIA-130 MM, MAKE-SACEM, PLAN NO. 11/1-017

S. N.	Description	Compliance	Remarks
1.0	**Scope of Supply (Main Items)**		
1.1	New Ball Lead Screw and Double Nut of C3 class along with all the end bearings for Y-, Z-, W- and V-axes of **Shuton / Korta/Bosch-Rexroth/SKF/THK** make only. Existing Length, Dia and pitch are given in Para A & B of Annexure-2.		Vendor to provide details and Comply
1.2	New **screw type air compressor** of same or more capacity along with **drier** of **Chicago Pneumatic/ Elgi / Ingersoll Rand** make. All type of solenoid valves and flow & pressure switches of **HYDAC / REXROTH / VICKERS / IFM / NORGREN** make and pipes etc. of reputed make, for X-axis Aerostatic system as per existing scheme and requirement of the machine. Details of existing system are given in Para C-1 of Annexure-2.		
1.3	All types of **spindle bearings** (precision class), **Ram linear bearings** and **Thrust bearings of SKF/FAG/ INA / THK** make. Bearings shall be procured from either bearing manufacturers or their authorized dealers only. The list of bearings is given in Para-D of Annexure-2.		
1.4	All types of **Speed gearbox bearings** of **SKF/FAG/ INA /THK** -make. Bearings shall be procured from either bearing manufacturers or their authorized dealer only.		
1.5	New **hydraulic system** in place of existing hydraulic group as described in Para C-2 of annexure-2, complete with motor-Pump sets, filters, solenoid valves, logical elements, cartridge valves, pressure & flow/float switches, Manometer & Manometer selector switch etc. of **Vickers/Hawe /Rexroth-bosch/Hydac/Parker make**.		
1.6	All tubes, O-rings and seals (**preferably of Parker, Bosch Rexroth or Hydac make**) to replace the existing ones inside the ram housing. New RAM **Wipers** shall also be supplied.		
1.7	Hydraulic piston cylinders, disc springs, cup seals / U-seals, solenoid valves and pressure switches of **Parker/ Bosch Rexroth/ Hydac /Hawe make** for **clamping systems of X and Y- axes**.		
1.8	Solenoid valves, logical elements, cartridge valves, safety valves and U seal/cup seal of Hydraulic cylinders of **Vickers / Hawe / Rexroth** make for **Hydraulic Counterbalance system of Headstock.**		
1.9	New Motor-Pump and pressure switches of **Rexroth/Parker/Hydac** make for reconditioning and restoration of **Spindle speed gearbox lubrication system**.		
1.10	New lubrication units of **Willy vogel / Hydac/ Bosch Rexroth** make for **Double pinion of X-axis** and **Z & W- axes**.		

1.11	New **Chiller units** of same or more capacity of **Schimpke-Haan/Chilton/Rittal** make one each for main hydraulic system and speed gear box lubrication system shall be supplied with digital temperature controller (DTC). Chiller units shall have capacity to maintain oil temperature in the sump within temperature limits of 20°C to 30°C.		Vendor to provide details and comply
1.12	New Pumps, solenoid valves, safety valves, pressure switches, filters, O-seals, and pipelines of **Vickers / Parker / Hydac / Hawe / Bosch Rexroth** make for reconditioning and restoration of **Rotary Table Hydraulic Group.**		
1.13	Hydraulic piston cylinders, disk springs, cup seals / U-seals, solenoid valves and pressure switches of **Parker/ Bosch Rexroth/ Hydac /Hawe make** for clamping systems of **V and B- axes of Rotary Table**.		
1.14	New Motor-Pump and pressure switches of **Rexroth/Parker/Hydac** make for reconditioning and restoration of **double pinion lubrication system of Rotary Table**.		
1.15	New Lubrication unit of **Willy Vogel / Hydac / Bosch Rexroth**- make for **V-axis of Rotary Table**.		
1.16	All type of hose pipes for hydraulic, lubrication, air and coolant system of **GATS/PARKER** make only.		
1.17	New Heavy duty metal **cable drag chains** of **Sur-Hennig / KabelSchlepp / Igus** make for **X & V-axes**.		
1.18	**Hennig / Sur-Hennig / KabelSchlepp** make **Telescopic Covers** of walk on type, coolant leak proof and having polyurethane wipers to protect guide ways of **Column (X-axis), Headstock (Y-axis) and Table (V-axis).**		
1.19	Recirculating type **Flood coolant System** for filtration and delivery of coolant with Multistage Centrifugal pump of **Brinkmann / Grundfos Make** & Easy to clean drum type suction filter having large filtration area shall be supplied. Coolant collection and recirculation system shall be leak proof & perfect to avoid any spillage on shop floor, trenches cables & foundation pit of the machine etc. All attachments shall have the provision so that coolant is available directly at the tool-cutting tip. It is to be ensured that the coolant shall not mix with Hydraulic/ Lubricating oil at any point. The new coolant system shall have coolant flow capacity not less 30 LPM.		
2.0	**Scope of Work (All the items to be replaced shall be in vendor's scope)**		
2.1	Measurement and recording of the **geometrical accuracies** as per manufacturer's test charts shall be carried out jointly before dismantling of the machine at BHEL Haridwar.		Vendor to comply
2.2	Removing assemblies of the machine at site at BHEL, dismantling into transportable lots for further transportation of the parts / assemblies for reconditioning of the machine at vendor's works. Necessary personnel and tools shall be in vendor's scope. Vendor shall depute its team for these activities within 15 days of such intimation by BHEL to the vendor.		
2.3	Unpacking of the transported parts/assemblies of the machine at vendor's works, complete dismantling into individual items, de-greasing, chemically cleaning and pre-painting of structural parts. Joint inspection shall be done as per clause 14.1.		
2.4	Removing the existing plastic material from the **saddles of X-, Y-, V- & B - axes** and pasting of Biplast or equivalent of existing plastic material on all saddle surfaces.		
2.5	Scraping and matching of **saddles of X-, Y- and V- & B-axes** with their Guide ways.		

2.6	Existing **air nozzles of X-axis Aerostatic system** shall be removed and replaced with new nozzles. One set of spare nozzles shall also be supplied.		
2.7	**Leveling and alignment of machine and table beds**, ensuring the squareness of the machine column with respect to the rotary table.		Vendor to comply
2.8	Mounting and Installation of new **Ball Lead Screws and Nuts of Y-, Z-, W- and V-axes** as per clause 1.1 of scope of supply.		
2.9	Restoration of **X-axis aerostatic system** by replacing existing air compressor, drier, solenoid valves, manometer, cylinder, flow & pressure switches and pipes etc. with new items as per clause 1.2 of scope of supply. Aerostatic system should be capable of providing dry air to ensure required lifting of column saddle as per OEM manual and machine requirement for smooth jerk free movement.		
2.10	Replacement of all **spindle bearings** with new bearings as per clause 1.3 of scope of supply.		
2.11	Replacement of all **Spindle Speed gear box bearings** with new items as per clause 1.4 of scope of supply.		
2.12	**Spindle Taper** grinding as per **BT50-MAS403** shall be done to restore its accuracy.		
2.13	Revamping of **main machine hydraulic system** by replacing Pumps, Accumulator, Manometer & Manometer selector, solenoid valves, safety valves, pressure & flow switches, micro-filters and O-seals with new items as per clause 1.5 of scope of supply. New Hydraulic System should be capable of leakage-free operation.		
2.14	Reconditioning of **Headstock** by replacing all tubes which are inside the ram housing, O-rings, seals and wipers with new items as per clause 1.6 of scope of supply. It shall be ensured that there is no oil leakage from ram assembly after overhauling.		
2.15	Overhauling of **Spindle speed gearbox** including replacement of all bearings, repair/replacement of worn-out gears, gear-shifters and shafts. Replacement of gearbox lubrication system with new system as per clause 1.9 of scope of supply.		
2.16	Overhauling of **clamping systems of X- and Y- axes** by replacing solenoid valves and hydraulic cylinders as per clause 1.7 of scope of supply. It shall be ensured that there is no oil leakage from clamping system of X- and Y- axes.		
2.17	Overhauling of **Hydraulic counterbalance system** of Headstock by replacing pumps, solenoid valves, safety valves and U seal/cup seal of hydraulic cylinders. There shall not be any leakages from Hydraulic counter balance system.		
2.18	Overhauling of **Ram compensation system** by replacing pump-motor, servo/proportional valve, seals and other accessories.		
2.19	Overhauling of **tool clamping system** by installing new tool clamping collets, oil seals, piston rings, springs and other components.		
2.20	Overhauling of **hydraulic coupling system of the head attachments** to ensure proper clamping/unclamping of both attachments heads. Details of existing system are given in Para C-4 of Annexure-2.		
2.21	Reconditioning and Overhauling of both the **attachment heads** (Indexing head and Universal head) by replacing bearings and other components as per requirement. The clamping system for tools in these heads and taper of tool clamping surface shall be restored.		

2.22	Overhauling of **lubrication system of Double pinion of X-axis and Z- & W- axes** by replacing pressure switches, solenoid valves etc.		
2.23	Reconditioning and Overhauling of **oil-air mist lubrication system of spindle bearings and Ball nuts of Z and W-axes** by replacing pressure switches, solenoid valves etc.		
2.24	Reconditioning and overhauling of Double pinion compensation and lubrication system of rotary table by replacing solenoid valves, safety valves, pressure switches, filters, O-seals and pipelines. There should be no oil leakages from hydraulic circuit.		
2.25	Overhauling of **clamping systems of V- and B- axes** by replacing solenoid valves hydraulic cylinders, disc springs, solenoid valves and pressure switches as per clause 1.13. There should be no oil leakages from clamping system of V and B- axes.		
2.26	Proper lubrication is to be ensured at all parts of machine wherever required for smooth operation of the machine.		
2.27	The **Automatic Tool Changer (ATC) system** along with tool magazine shall be dismantled and removed.		
2.28	List of all parts repaired or replaced shall be furnished to BHEL. Old parts, which would be replaced by new ones, after proper tagging shall be returned back to BHEL Hardwar.		
2.29	Dismantling of the machine into transportable lots, after PDI clearance as per clause 14.4 of scope of supply, for shifting of the complete machine from vendor's works to BHEL Haridwar.		
2.30	Erection, Installation & commissioning of the complete machine & Rotary Table along with all supplied items; geometry test; 48 hour test; laser calibration, NAS test piece machining and Job Prove-out shall be done by the vendor at BHEL, Haridwar as per clause 15.0 of scope of supply.		
3.0	**Scope of Supply for CNC Controller - 1Set**		
3.1	**The CNC controller Sinumerik 840D sl / Fanuc 31i** with Windows 7 operating system (latest version should be supplied). The System should have operator panel with TFT colour display (15 inch or more), Full Qwerty keyboard & Mouse / Trackball housed in a sliding tray, RS232, USB, Ethernet interface. Network ready with LAN and preinstalled system software (licenced) & other required software's (licenced) for operation of Horizontal Boring Machine. All standard features should be listed in technical offer. Also all available optional features of Sinumerik 840 D sl / Fanuc 31i CNC system as mentioned below should be offered and included in the offer for 1 Spindle and 6 Axes (five linear + one rotary), having all necessary features for Milling, Drilling, Thread Milling, Grooving & Tapping operations.		Vendor to provide details and comply

3.2	Other Features of the CNC system in addition to its standard feature: - Front panel USB interface for loading & unloading of programs. - Circle geometry test, co-ordinate system transformation & rotation and 3D Interpolation. - Helical/Spline & Cylindrical Interpolation. Scaling, Mirroring, Solid Tapping & work offset transformation. - Part Program Renaming & Copying Facility. At least 20 Programmable work zero offset. - Programmable Tool Management. Automatic tool offset storage, Tool Life Monitoring and 128 tool offsets. - Facility to store up to 999 subroutines & 9999 part programs. Resolution of 0.001 mm - Facility of inclusion of message in the part program. Tool nose radius compensation G41, G42. - Axis replacement with GEOAX command. Absolute/ Incremental programming. - Integration of Cycle800/equivalent with the machine to carry out all the machining(drilling, milling, boring, tapping & threading with cutter compensation) with already available universal milling head and right angle milling head. - A cycle/program for determining work offset at any rotation of table angle with respect to a defined work offset on the job for machining of angular details on the job. - Block search with and without calculation in automatic mode. - Conditional & unconditional jump of program. Foreground / Background editing and Graphic Simulation. - Access locks on operator panel and Look Ahead of Minimum 70 Blocks. PP/User Memory 5MB Minimum. - All standard milling cycles for Drilling, Boring, Taping (both solid & flexible), Pocket milling (rectangular & circular), Thread whirling and Thread milling Operations. - Oriented / Fixed Spindle Stop. Corner rounding & chamfering. (e.g. RND, CHF and ANG). - Measuring system & Bidirectional lead screw compensation. - Programmable and Manual Coolant ON/OFF (irrespective of mode of operation). - Manual control of the machine with selection of axis, direction of movement, feed ON/OFF, spindle ON/OFF etc. with Push Buttons and Selector Switches. - The CNC system shall have the option of running any Axis with Motor encoder in case of any problem / fault in 2nd measuring system. - Machine control panel for Mode selection, Feed override, Spindle override, Feed ON/ OFF, Spindle OFF/ON, Cycle ON/ OFF, Axes Jogging option, Reset , Incremental Keys (1,10,100,1000 &10000 micron) and user definable keys. - Chip Conveyor FWD/REV selector switch. 3 Tier Lamp for showing the machine status. - Dry run switch on the MCP. (Dry run freely executable during program runs in automatic).		Vendor to comply

	▪ Spindle continuous/inch selector switch and Electronic Hand Held Unit Interface. ▪ Display of PLC program on Operator Panel with PLC program loaded on hard disk. (Required software should be loaded on hard disk). On-line fault diagnostic system including Input address related to the Alarms/Messages. ▪ On screen graphic simulation.(offline graphic simulation-fast simulation of tool movements without requirement of locking machine axes/independent of machine movements) ▪ Any special function/cycle required for smooth functioning of attachments like CNC boring head. Universal milling head or right angle milling head.		
3.3	PLC system (Input Card, Output Card & Interface Card) shall be supplied for distributed I/O's (Min 3 Stations) with approx. 152 Inputs & 104 Outputs are to be programmed maintaining the existing logic. In case the vendor perceives that more Inputs/ Outputs are required for completion for the work as per their designed and conceived electrical scheme, the same should be included in the scope of supply. Relays of sufficient rating of **Phoenix / Omron make** shall be used for connection of PLC outputs to solenoid valves, contactors & other field elements.		Vendor to provide details and comply
3.4	Handheld Operator Panel (HHT/HHU) having all the existing features with 10m spiral cable.		
3.5	DC Regulated power supplies, 24VDC/20A of **Siemens/Phoenix/Schneider make** (separate units for CNC control, Drives and PLC I/Os) – 3Nos.		
3.6	DC-UPS Module 24VDC/15A with LEAD GEL Battery Module 24 V / 20 A / 7 AH, for Power back-up of the CNC control for Automatic unattended shutdown in the case of power failure or power OFF.		
3.7	All communication cables & license software for data back-up & restoration from machine to laptop to be supplied.		
3.8	USB Flash Drive 16GB minimum.		
4.0	**Drives, Motors, and Cables: 1 set**		
4.1	**AC Servo motors of Siemens 1FT7 / Fanuc αi** series with suitable rating for the following axes shall be supplied. The AC Servo motor should have rating equal to or higher than the motor installed on machine. Torque and speed to match with the parameters of the existing system mentioned above and suitable to be interfaced with the offered CNC control. Any mechanical fittings, intermediate flanges, pulleys, belts, brackets etc. required to match the new motors with the existing mechanical drive system should be included in the offer. The type number / model of the motor selected should be indicated in the offer and the technical leaflet should be enclosed. a) X Axis Motor, 45Nm, 2000rpm, with key, without brake – **1no.** b) Y Axis Motor, 45Nm, 2000rpm, with key, with brake – **1 no.** c) Z & W Axes Motors, 39Nm, 2000rpm, with key, with brake, for Z & W Axes – **2 nos.**		Vendor to provide details and comply

	d) V Axis Motor, 28Nm, 3000rpm, with key, without brake – **1 no.** e) B Axis Motor, 47Nm, 1200rpm, with key, without brake – **1 no.**		
4.2	**AC Servo drives of SINAMICS S120/FANUC αi series** for X, Y, Z, W, V and B axes shall be provided. The rating of the drive modules selected should support the selected servo motors. All the motor drive modules shall be single motor modules. The type no. / model of the drive module selected should be indicated in the offer and the technical leaflet should be enclosed.		Vendor to provide details and comply
4.3	**AC Servo drives of SINAMICS S120/FANUC αi series** for spindle motor shall be provided. The rating of the drive modules selected should support the existing 1PH6206-4NE46-Z=G97 Spindle motor. The type number / model of the drive module selected should be indicated in the offer and the technical leaflet should be enclosed.		
4.4	Suitably rated Line filter with Choke /Control unit/Active Interface module/Active Line module/Power supply module/Sensor modules etc. required to interface the servo motors/servo drives etc. to supplied CNC system (SINUMERIK 840D sl / FANUC 31i). Shield terminal plates and earthing schematic for all the modules.		
4.5	Power and signal cables of suitable length (approximately 30M) for all the motors including existing spindle motor.		
4.6	Connecting cables, connectors, and Interface card etc. for interfacing the drive modules with supplied CNC system.		
5.0	**Measuring Systems: 1set**		
5.1	HEIDENHAIN make LB382C Linear incremental measuring system complete with scanning head AE LB382C (1Vss) with distance coded reference, Accuracy ± 5 µm, Resolution 0.5 µm for the following axes: a) X-Axis, Measuring Length- 4240mm Minimum. b) Y-Axis, Measuring Length- 2840mm minimum. c) W-Axis, Measuring Length- 1240mm minimum. d) V-Axis, Measuring Length- 2240 mm minimum.		Vendor to provide details and comply
5.2	HEIDENHAIN make Rotary Incremental Encoders (1Vss) for the following axes: a) Z-Axis, ROD486, 2500 PPR. b) B- Axis, ROD880C, 36000 PPR, with distance coded reference. c) Spindle rotation, ROD486, 1024 PPR.		Vendor to provide details and comply
5.3	Mounting Clamps, Couplings for all the measuring systems.		
5.4	Preassembled cables of suitable length (approximately 30M) along with signal converter / EXE/ Sensor modules required for interfacing of all the measuring systems with the offered CNC controller. All the measuring systems should be suitable for resolutions of 1µm (0.001mm) for CNC system.		

6.0	**Electrical Cabinet, Operator Panel, Cables and Other Accessories: 1set**		
6.1	Electrical Cabinet of **RITTAL / SCHNEIDER** make and appropriate size with IP55 protection. The panel shall be stand-alone floor mounted type. It shall be a single unit with multiple doors. The components shall be mounted on the front side only. Rear part of the panel shall not have doors/covers. Cable entry shall be from bottom. The cabinet shall accommodate CNC System, PLC modules, Servo Drives, SMPS, Relays, Contactors, Control Transformers and other elements required for retrofitting. The mains disconnect switch should be mounted on the side wall of right most panel.		Vendor to provide details and comply
6.2	Operator Pendant of **RITTAL / SCHNEIDER** make with IP55 protection, suitable for CNC Controller, MCP and selector switches & other operator control elements. Cable / wire length required between OP & Electrical Panel minimum 30 meters. The operator panel should be swivel type for rotation of the panel in case of working with Hand Held Unit. Handles must be provided on left & right side of the panel for rotating the panel by hand. The rear side of the panel should be mounted on hinge with lock not on screw mounted. Three tier lamp for indication of machine status shall be mounted on the top of operator panel.		
6.3	Each Panel of the electrical cabinet should be fitted with suitable illumination with switch for ON/OFF & 220 VAC/5A socket. One socket of 220VAC/15A near operator panel with separate MCB for heaters to be used in winters.		
6.4	Portable LED machine lamp with magnetic base, 24V DC, 20 Watts or more with 5 meter cable with conduit -2nos.		
6.5	2 nos. Side mounted air conditioners of Rittal/Chilton/Advance make of sufficient rating (minimum 1500W) for electrical cabinets & 1 no. air conditioner for operator panel. Operating temperature shall be 25°C to 30°C.		
6.6	All the control functions available on existing operator panel should be available on the new operator panel.		
6.7	All the electrical switch gear such as Main Disconnect Switch, Fuses, Contactors, Relays, MPCB, MCB, and other accessories of suitable rating and reputed make (SIEMENS/ABB/SCHNEIDER/TELEMECANIQUE) as required for retrofitting the machine. All the switchgears should be 25% over-rated to actual requirement.		
6.8	Suitably rated Control transformers of reputed make for new CNC control and Servo Drives if required.		
6.9	Rexroth / Vickers make proportional valve with controller & cable for RAM compensation.		
6.10	Panel Meters for display of Voltage & Current of main supply. Display meter for spindle power on operator panel.		
6.11	Suitably rated VFD Drive of Siemens/Fanuc/ABB make for Coolant pump and motor, for controlled coolant flow.		
6.12	New Multiple & Single block Limit Switches with IP67 protection of Teknic-Euchner/Siemens/Balluff/ Honeywell make to replace existing Limit Switches of X, Y, Z, W and V & B Axes.		
6.13	New Enclosed type Limit Switches, SPDT, Top Plunger, 1NC+1NO, with IP68 protection of Teknic-Euchner/Siemens/Balluff/ Honeywell make to replace existing Limit Switches of Spindle Speed Gear Box.		
6.14	New Inductive Proximity Sensors M8X1 & M12X1, flush mount with LED, PNP, NO, 10-30VDC with IP67 protection in metal housing of TEKNIC/PEPERL/IFM/BALLUFF make to replace existing Proximity Sensors.		

6.15	All the Cables (LAPP/FINOLEX/SAB/SIEMENS/HEIDENHAIN make) with conduits, Mating Connectors, Cable Terminations (Phoenix/ Elmax) and cable accessories required to interface the new CNC system, Auxiliary Pendants, Feed/Spindle Drives and Control magnetics.		
6.16	Cable lugs/thimbles, ferrules and other control elements required for rewiring of electrical cabinets, operator Panel and field devices. Identification Tags / nos. should be clearly mentioned for all the items in the Cabinet as per electrical schematic.		
6.17	Any other electrical/electronic item required for successful retrofitting and commissioning of the machine.		
7.0	**Scope of work for CNC Retrofitting : 1set**		
7.1	Removal of existing electrical cabinet and operator panel along with existing CNC System, PLC, drives, measuring systems, motors, cables, wires, cable terminations and other accessories.		Vendor to comply
7.2	Mounting & installation of the new CNC Control System, Keyboard, Machine Control Panel and other operator controls at the operator panel located on the machine headstock.		
7.3	Mounting & installation of Spindle drive, Feed drives & accessories in new electrical cabinet and interfacing with CNC System.		
7.4	Mounting, Installation and interfacing of measuring system in all the axes of the machine.		
7.5	Modification / re-engineering and manufacturing of Motor couplings and flanges for Motor mounting as per requirement.		
7.6	Installation of new Motors, laying of new cables and interfacing with the Drives in the electrical cabinet.		
7.7	Mounting, installation, cabling, connection and interfacing of new magnetics & switchgears with the machine elements. Refurbishment and rewiring of connectors & Junction Boxes shall be done as per requirement.		
7.18	Mounting, installation, cabling, connection of Limit / Proximity Switches.		
7.19	Interfacing of coolant motor, hydraulic motor, lubrication motors, RAM compensation, aerostatics and oil cooling units with the new control & switchgears. Checking & adjustment of RAM compensation shall be done as per requirement.		
7.10	Start-up and commissioning of CNC Control System, Spindle & Feed Drives, Servo Motors, Measuring systems & Other auxiliaries viz. Hydraulics, coolant RAM compensation etc.		
7.11	Development of PLC program, generation of operator messages, alarms and help on alarms & messages with cause, remedy & component locations with pictures for the new control.		
7.12	To provide suitable provision for switch-over of measuring system to run the machine with built-in encoders of the axes Servomotors. This facility is intended to be used in the event of failure of the second measuring system.		
7.13	Complete control of machine as available on existing control panel with required PBs, switches & keys, shall be provided on new operator panel for selection of Axis, Axis dir. & Feed ON/OFF, display of axis position values etc.		
7.14	Demonstration of different features of the control viz. Turning, Drilling, Thread Milling & Tapping functions.		
7.15	Proving of the PLC program, Part Program, Parameters, Ghost Backup, & Other data's uploading & downloading.		

7.16	Demonstration of the network LAN functions (Part program & parameter transfer).		Vendor to comply
7.17	Manual Control of Machine independent of MDI/ CNC Part Program: Same status is to be maintained after retrofitting also: a. Start (CW/CCW) & Stop of spindle rotation b. Inching (CW&CCW) of spindle rotation c. Regulation & Indication of spindle speed d. Start, Stop, Regulation & Indication of feed, fast traverse, inching in X ,Y ,W ,B & Z.		
7.18	Demonstration of all existing machine functions and programming features of new CNC System including manual control of the machine.		
8.0	**Spares:** Prices of spares shall be quoted item-wise separately.		
8.1	Mechanical Spares consisting of the following items: 1 set a. X-axis aerostatic nozzles – 1set b. Pressure switch - 5 nos. c. Oil Filter elements - 10 nos. d. Manometer Gauge - 2 nos. e. Pressure regulator valve - 2 nos. f. Slide Lubrication unit-1 no. g. Hydraulic Hoses -1 no. of each type. h. Motor Couplings - 2 nos.		Vendor to comply
8.2	CNC/Electrical Spares: consisting of the following items: 1 set a. Relay Boards having 8 relays - 2nos. b. Push Buttons with LED Lamps -10 nos. c. PLC I/O modules - 2nos. d. Power Supply 24VDC/20A - 1No. e. X-axes motor module/servo amplifier - 1 no. f. Z-axes motor module/servo amplifier - 1 no. g. Preassembled Motor Encoder cable (30 M length) - 1No. h. Motor Power cable with connector (30 M length) - 1No. i. Scanning Head AE LB382C- 1No. j. Transducer/encoder preassembled cables, (30 Mtrs. length) - 2 Nos. k. Sensor Modules - 2nos.		Vendor to comply

9.0	**Manuals / Documents: 3 sets**		
9.1	a. Operating & Programming Manuals of CNC control and Maintenance manual of other supplied systems. b. Maintenance, Interface & commissioning manuals, PLC programming manual for CNC control, Interface & commissioning manuals for spindle drive, feed drives and auxiliary drives. c. Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable. d. Complete list of parts/items (Bill of materials) used in the machine in English language. e. Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English. f. Additional set of all the above documentation on Pen Drive, wherever possible including complete backup of all cycles/subroutines (provided by both vendor and supplier of CNC System) and any other special programs pertaining to different applications/machining processes/accessories/measuring systems etc. and CNC programs for prove out machining. Complete back up of CNC control, PLC and Drives on Pen Drive g. Drawings of supplied assemblies/sub-assemblies/parts including Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list marked on it in English. h. List of Inputs, Outputs, Alarms/Messages showing detailed cause and remedy. i. PLC program print-out including cross reference & comments in English.		Vendor to comply
10.0	**Part Program Converting Software** (Price to be quoted separately): Vendor should provide program conversion software for automatic conversion of existing part programs of the machine ensuring conversion of all basic codes (G,M,F,S,T,H codes etc.), coordinate values, text instructions, subprograms having R-parameters & other mathematical/logical functions, canned cycles, block structure and tool nos. of NC program. In case, conversion of any special function/feature/cycle/offset nos. is not possible with supplied software, necessary manual correction of existing programs (253 part programs, 663 sub programs) shall be carried out by vendor for acceptance by BHEL. The software shall be installed on BHEL PC (Windows 7 onwards). Testing of software shall be done by converting 5 existing programs with their subprograms using supplied software and checking of converted programs for their correctness & suitability to new system. Backup of conversion software shall be provided on CD/pen drive.		Vendor to provide details and comply
11.0	**Painting Of The Machine After Reconditioning:**		
11.1	Putty shall be applied on machine parts to prepare the surface painting before painting.		Vendor to comply
11.2	Moving units/parts of the machine shall be painted in Satin Blue (RAL 5012) Shade.		
11.3	Non-moving units shall be painted in Phirozi Blue (RAL 5017) shade after reconditioning.		
12.0	**Packing:** Supplier shall arrange for adequate protection and packing of the consignment so as to avoid loss and damage during transit and also take appropriate measures to prevent metal parts from rusting and corrosion during transit. Handling instructions shall be clearly printed /painted on the packages. Each package should carry a detailed packing slip with item names.		Vendor to comply

	Supplier shall be responsible for any loss/damage during transit due to defective/inadequate packing. Any item which is damaged must be replaced with new one, repairing shall not be acceptable.		
13.0	**Training:**		
13.1	The vendor shall arrange the training of BHEL personnel, prior to commissioning of the Machine, at Vendor's / CNC system manufacturer's training centre, in the area of: a. Programming of CNC Control with all CNC Features for one Engineer for one week. b. Maintenance of CNC Control, PLC and Drives for two Engineers for one week. c. Maintenance of Hydraulic and Pneumatic systems for one engineer at manufacturer's works/ Vendor's works for one week. d. Operation of the machine with the new CNC Control for three operators for three days.		Vendor to comply
13.2	Expenses for travelling, boarding & lodging of the trainees during training shall be borne by BHEL.		
14.0	**Joint Inspection & Pre-Dispatch Inspection (PDI):**		
14.1	After the machine is completely dismantled, parts cleaned and arranged assembly-wise, a Joint Inspection shall be carried out at Vendor's works to determine the parts for repair/ replacement and to finalize the detailed list of items and work required for reconditioning of the machine. Vendor shall submit to BHEL the Bill of Material (BOM) and activity chart for approval.		Vendor to comply
14.2	The parts and work which are not included in the scope but required for successful completion of reconditioning and trouble-free performance of the machine shall be identified. The Vendor shall submit a quotation for such identified parts and required work to BHEL. Prices shall be approved by BHEL subject to price reasonability following which separate order/amendment to the Work Order shall be done by BHEL. BHEL may also procure these parts from any other source as well and supply these items to the vendor who shall install these parts on the machine during reconditioning.		
14.3	In addition to this BHEL reserves the right to visit the Vendor's works any time before Pre-dispatch Inspection to review progress of reconditioning and retrofitting work.		
14.4	Pre-dispatch Inspection of the machine, after reconditioning and retrofitting of the machine as per Scope of Supply & work, shall be carried out by BHEL at vendor's works. Geometrical Accuracies and functionality of the machine shall be checked during PDI. Only after the clearance given by BHEL, all parts & assemblies of the machine and other material shall be dispatched to BHEL, Haridwar.		
14.5	Travelling, Boarding & lodging of BHEL engineers during PDI shall be on BHEL's account.		
15.0	**Commissioning, Job Prove out and Acceptance:**		
15.1	Erection and commissioning of the reconditioned Machine & Rotary Table along with all supplied items shall be done by the vendor at BHEL Haridwar. Vendor shall depute its personnel (along with all required tools) within 15 days of intimation to this effect by BHEL.		Vendor to comply

15.2	After completion of erection and commissioning of the machine, all its functions shall be checked. Geometrical tests shall be carried out and their conformance with OEM test charts shall be demonstrated by the vendor. LASER calibration of all axes shall be done by the vendor. 48 hours continuous running and machining on NAS test piece shall also be done before final prove-out as per clause 15.3.		
15.3	The Prove out component for the machine shall be a component named **'Carriage'.** Job setting plan, Machining process plan & cutting tools etc. for machining of prove out components shall be provided by BHEL. (Final prove out component drawing number may change, however, the machining features of the changed components shall be in line with the original component drawing). Complete machining of prove out components shall be done by BHEL in presence of vendor's representatives, using CNC programs converted by supplied conversion software. The details of operations to be carried out on the component along with the normal standard time required to complete that operation is enclosed in Annexure-6. If required vendor may personally visit to see the component and detailed drawings of component.		
15.4	In case of non-availability of a regular job at the time of job prove out, machining accuracy shall be demonstrated on a technological test piece and its successful machining will be deemed to be completion of Job prove out.		
15.5	After settlement of all pending issues related to work and supply, a certificate for Completion of works in all respect shall be released by BHEL which will be the referred document for final acceptance and final payment to the vendor.		
16.0	**Warranty:**		
16.1	The vendor shall stand warranty for the material supplied and work done for a period 12 months from the date of commissioning and acceptance of the machine. Any material (supplied by the party) found defective within warranty period shall be replaced free of cost by the party.		Vendor to comply
17.0	**Delivery and Completion Period:**		
17.1	Delivery Period: Max. 8 months from the date of receipt of all parts & assemblies of the machine at vendors' works. Early delivery shall be acceptable.		Vendor to comply
17.2	Installation, Commissioning and Job Proving as per clause 15.0 : Max 4 months from the date of receipt of machine at BHEL, Haridwar.		
18.0	**Payment Terms :**		
18.1	No advance payment shall be made to the vendor. Part payment will be made after completion of following milestones:		Vendor to comply
18.2	First payment of **30%** of total work order value will be made after doing Joint Inspection at Vendor's works as per clause 14.1, subject to submission of Bank Guarantee of equal amount valid up to final acceptance of Machine at BHEL Haridwar.		
18.3	Second payment of **30%** of total work order value will be made after PDI and dispatch clearance at Vendor's works as per clause 14.4, subject to submission of Bank Guarantee of equal amount.		
18.4	Final Payment of **40%** of total work order value shall be made after successful erection, commissioning and acceptance as per clause 15.0, subject to submission of Performance Bank Guarantee (PBG). All the Security Deposits & Bank Guarantees shall be returned back at the time of final payment.		

18.5	All the payments shall be made through e-payment after submission of following documents along with first bill: i. E-payment form duly filled (form will be provided by BHEL). ii. Income tax exemption letter (if applicable).		
19.0	**Late Delivery Penalty:**		
19.1	LD @ 0.5% per week (limited to a maximum 10%) of the total work order value shall be applicable for delay in deliveries. Vendor should intimate BHEL regarding Joint Inspection and Pre Dispatch Inspection at least two weeks in advance. The time period from date of invitation from vendor to the date of arrival of BHEL team for PDI at vendor's works in excess of two weeks due to any reason attributed to BHEL will be excluded from delay period for calculating Liquidated Damages.		Vendor to comply
19.2	LD @ 0.5% per week (limited to a maximum 10%) of the Erection and Commissioning Charges shall be applicable for delay beyond scheduled commissioning date for reasons attributed to the party.		
20.0	**BHEL's Obligation/ Facilities**		
20.1	Crane facility along with lifting tackles, trolleys etc. will be made available free of charge while working in BHEL premises only. Any civil work required for the erection of panel shall be done by BHEL.		Vendor to note
20.2	Facilities of minor welding, brazing, minor machining limited to fitting work /rework etc. will be made available free of cost inside BHEL premises if available.		
20.3	Consumables like lubricants, kerosene oil, cotton waste etc. will be supplied free of cost by BHEL during execution of works inside BHEL premises. Vendor should make his own arrangements for all types of hand tools including pneumatic/electrical drill machines, grinders, scraping tools along with the general purpose measuring instruments, straight edges etc.		
21.0	**Commercial Terms:**		
21.1	Prices shall be quoted on "Firm Price" basis only. The prices should be on F.O.R BHEL, Haridwar basis inclusive of Packing & Forwarding, transit insurance & Transportation charges etc. Applicable % of Excise Duty, CST/VAT & Service Tax should be clearly indicated in attached Price bid format as per **"Annexure-3".**		Vendor to comply
21.2	Validity of offer shall be for a minimum period of 120 days from the date of Tender Opening.		
21.3	Freight & transit insurance from BHEL Haridwar to vendor's works shall be in BHEL's scope.		
21.4	Freight & transit insurance charges from vendor's works to BHEL, Haridwar shall be borne by the vendor.		
21.5	Test certificates of the bought out items such as ball screws, bearings, pumps etc., from the Original Manufacturer are required to be submitted by the vendor at the time of PDI.		
21.6	The material will be dispatched to Central Plant Stores, HEEP, BHEL, Haridwar with instruction to forward the same to Sr. Engr. (WEX-MCR).		

22.0	**Earnest Money Deposit (EMD):**		
22.1	Vendors have to deposit Rs. 2 Lakh as the EMD. EMD may be deposited in cash, through pay order in favor of BHEL, Hardwar or through demand draft only.		Vendor to note and comply
22.2	EMD shall be converted to security deposit if the work is awarded.		
22.3	EMD of unsuccessful bidders shall be refunded back normally within fifteen days of acceptance of award of work by the successful bidder.		
22.4	EMD shall not carry any interest.		
22.5	The units registered under Single Point Registration Scheme of NSIC are eligible to get the benefits under "Public Procurement Policy for Micro & Small Enterprises (MSEs) Order 2012" as notified by the Government of India, Ministry of Micro, small and Medium Enterprises, New Delhi vide Gazette Notification dated 23.03.2012. • Issue of the Tender Sets free of cost; • Exemption from payment of Earnest Money Deposit (EMD). • MSE suppliers can avail the intended benefits only if they submit along with their offer, attested copies of EM-II certificate having deemed validity (five years from date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM-II certificate along with attested copy of a CA certificate (Format enclosed **Annexure -5** attached where deemed validity of EM – II certificate of five years has expired) applicable for the relevant financial year (latest audited). Date to be reckoned for determining deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiencies in above required documents are not submitted before price bid opening. If tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. **All These Documents should be notarized or attested by Gazetted officer.**		
23.0	**Security Deposit (SD):** Successful vendor shall deposit security.		
23.1	The rate of security deposit will be as below: For work Up to Rs.10 Lakhs: 10% Above Rs.10 Lakhs upto Rs. 50 Lakhs: Rs. 1 Lakh + 7.5% amount exceeding Rs.10 Lakhs Above Rs. 50 Lakhs: Rs. 4 Lakhs + 5% amount exceeding Rs. 50 Lakhs		Vendor to comply
23.2	The security deposit should be submitted before the start of work in the following forms: i) Cash (As permissible under the Income Tax Act) ii) Pay Order, Demand Draft in favour of BHEL, Hardwar iii) Local cheques of Scheduled Banks, subject to realization. iv) Bank Guarantee from Scheduled Banks/Public Financial Institution as defined in the companies Act. The Bank guarantee format should have the approval of BHEL.		

23.3	Security Deposit shall not carry any interest.		
23.4	EMD of successful tenderer can be converted and adjusted against the Security Deposit.		
23.5	100% of the Security Deposit amount shall be refunded to the vendor after post commissioning successful running of the machine for one month after submission of PBG.		
24.0	**Bank Guarantee:**		
24.1	For shifting of machine outside the premises of BHEL, Hardwar for reconditioning and retrofitting, a bank guarantee of **Rs. 20 Lacs** against **salvage value** of the machine shall be submitted by the vendor on the Performa provided in Annexure -4.		Vendor to comply
25.0	**Performance Bank Guarantee**		
25.1	Vendor shall submit a Performance Bank Guarantee equal to 10% of the Work Order value in BHEL prescribed format (Annexure 4) valid for the period of one year from date of successful commissioning of the machine. The Performance bank guarantee shall be returned after completion of this period.		Vendor to comply
25.2	Vendor shall attend the breakdowns free of cost, immediately after such intimation from BHEL, during the warranty period.		
25.3	Vendor shall replace/repair any defective part/item free of cost during the warranty period.		
26.0	**Risk Purchase Clause:**		
26.1	In case of delays in supplies / defective supplies or non-fulfilment of any other terms & conditions given in the work order, BHEL may cancel the work order in full or part thereof and may also make the purchase of the material / service from elsewhere / alternative source at the risk and cost of the supplier. If vendor does not agree to above clause, their offer is liable to be rejected. In case any vendor accepts risk purchase clause initially and subsequently declines to honour the term in the eventuality of RISK PURCHASE, they may be banned for business with BHEL.		Vendor to comply
27.0	**PQR:** Offer of the vendors meeting the following criteria shall only be considered:		
27.1	Average annual turnover during the **last 3 financial years ending 31st March 2015**, should be at least **Rs. 80 lakhs**. Copies of **audited balance sheets** should be submitted.		
27.2	Having successfully completed Reconditioning &/or Retrofitting work on H. Boring / V. Boring / Plano-milling / Gantry Milling / Lathe machine during last **7 years** ending on 30th November 2015, meeting one of the following three conditions: a. One work costing not less than Rs. 192 Lakh **OR** b. Two works costing not less than Rs. 120 Lakh each **OR** c. Three works costing not less than Rs. 96 Lakh each.		Vendor to provide details

27.3	Having successfully completed the following works during last **7 years** ending on 30th November 2015. a. Reconditioning of a CNC Horizontal boring machine having spindle dia of 130mm or more. **AND** b. Retrofitting of a Horizontal boring machine with CNC control and servo drives.		
27.4	Vendors may submit the reference of other works for experience against clause 27.3 (a) & (b) above, if not covered in the references given against clause 27.2.		
27.5	The above reconditioned/retrofitted machines as per clause 27.2 & 27.3 should be running satisfactorily for a period of minimum six months after commissioning prior to 30th November 2015. Documentary evidence such as copy of PO / WO along with scope of supply and work, final MOM/ commissioning certificate and **performance certificate from the customer** shall be submitted as part of Tender technical bid.		Vendor to provide details
27.6	Customer's details such as Name, Address, Telephone No., email ID shall be submitted by the vendor along with documentary evidences as per clause 27.5. BHEL reserves the right to verify the information provided by the vendor with the vendor's customers directly. Vendor shall also agree to facilitate the visit of BHEL engineer(s) to his customer's premises, if considered necessary by BHEL. Travel, boarding and lodging expenditure of BHEL personnel for such visits shall be borne by BHEL.		
28.0	**Offer:**		
28.1	The offer shall be submitted in two parts in the following manner. ❖ Techno-commercial bid. ❖ Price bid.		Vendor to comply
28.2	Techno-commercial & Price bids should be submitted in separate envelopes marked accordingly. The Price bid will be opened after scrutiny of Techno-commercial bids.		
28.3	The first envelop shall contain the **Techno-commercial Bid (ANNEXURE-1)** with technical details and commercial terms & conditions along with copies of all relevant documents such as ESI, PF code, PAN No., Service Tax Regn. No., TIN No., CST No., Audited Balance Sheets, P.O./W.O., Commissioning & Performance certificates (against Pre-qualifying conditions), EMD etc.		
28.4	Point-wise compliance of this scope of supply and work **(ANNEXURE-1)** is to be given by vendors along with their Techno-commercial offer in the format provided by BHEL. Each page of the compliance list should have signature and seal of the vendor.		
28.5	The vendor must note that no prices are to be quoted/ mentioned in the techno-commercial offer.		
28.6	The second envelope shall contain only the price bid with separate price for material, spares (item-wise price), work, FOR Haridwar basis including P&F, Freight, Insurance and applicable taxes & duties on **Price Bid Format only as per ANNEXURE-3**.		
28.7	Price bid of only techno commercially accepted bidders shall be opened.		

28.8	The award of works will be made on the basis of the total of Material cost, Spare Parts cost and work / Commissioning charges etc. including P&F, Freight, insurance and all taxes, duties as applicable (Total Cost to BHEL).		
28.9	The Vendor should submit their best price at this stage itself and they will not be allowed to revise the price. Any revision / discount given by the vendor subsequently will be ignored.		
28.10	Both the above two envelopes shall be kept in another sealed cover. The cover shall be super-scribed with "Quotation for (name of work), NIT No. & opening due date and Bidder's address. The tender shall be submitted in **Tender Box** kept in the **Tender room** of Purchase department at the **4th floor, Main Administrative Building of BHEL, HEEP, Haridwar-249403.**		
29.0	**General Terms & Conditions**		
29.1	Vendors are strongly advised to visit BHEL Hardwar before submitting their offer, on any working day between 8am to 5 pm, to see the machine and related documents for having further details about the machine and its accessories.		Vendor to comply
29.2	The offers of the bidders who are on the banned list and also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.		
29.3	In the event of award of any contract, vendor will have to comply and abide by all the laws/enactment of state and central government. Documents regarding registration with Sales Tax and Excise authorities may also be forwarded along with income tax clearance.		
29.4	BHEL reserves the right to reject the lowest or any tender or accept any tender in full or in part without assigning any reasons whatsoever.		
29.5	If any information/documents submitted by the vender are found false/fake at any stage, the tender submitted by the vender will be cancelled and earnest money deposited shall be forfeited, debarring the vendor from participation in future tenders.		
29.6	BHEL Reserves right to go for reverse auction (RA). In case of RA, terms & conditions for covering RA shall be intimated to the techno-commercially accepted bidders without opening of price bid.		
29.7	If during technical scrutiny phase, any major works/materials are found essential for successful commissioning and performance of the machine which are otherwise not envisaged in the scope of supply & work, the vendor shall be asked to offer the same and submit the price impact in a sealed envelope through tender room. Such envelope (s) shall be opened with the original price bid and prices of that work/ material shall also be included while computing L1 (lowest) bidder.		