Expression of Interest

For Reconditioning and CNC Retrofitting of CNC Lathe, Model – D1800 NYF1, Make – MFD; Plan No. – 2-394, Block-3

Bharat Heavy Electricals Limited (HEEP)
Haridwar, Uttarakhand

DISCLAIMER

The information contained in this Expression of Interest document (the "EOI") or subsequently provided to Applicant(s), whether verbally or in documentary or any other form, by or on behalf of BHEL or any of its employees or advisors, is provided to Applicant(s) on the terms and conditions set out in this EOI and such other terms and conditions subject to which such information is provided.

This EOI is not an agreement and is neither an offer nor invitation by BHEL to the prospective Applicants or any other person. The purpose of this EOI is to provide interested parties with information that may be useful to them in the formulation of their application for qualification pursuant to this EOI.

BHEL also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Applicant upon the statements contained in this EOI.

The issue of this EOI does not imply that BHEL is bound to select and shortlist Applicants for next stage or to enter into any agreement with shortlisted Applicants for the Project.

1.0 INTRODUCTION:

1.1 Background:

1.1.1 BHEL is a leading Government of India owned Public Sector Undertaking. BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing organizations in India catering to the infrastructure sectors of Indian economy viz. energy, transportation, industry and non-conventional energy. The energy sector covers generation, transmission and distribution equipment for hydro, fossil, and gas fuels. The transportation sector covers propulsion systems for Electric locomotives, Motors, alternators and transformers and electric locomotives up to 5500 HP. Nearly 63% of BHEL's equity is owned by the Government of India.

1.1.2 BHEL has been in this business for over 45 years and BHEL supplied equipments account for 64 % of the total thermal generating capacity in India. The company has 15 manufacturing units, 4 power sector regions, 8 service centres, 10 overseas offices and 15 regional offices, besides host of project sites spread all over India and abroad. BHEL's highly skilled and committed manpower of approximately 49390 employees, the best of manufacturing facilities and practices together with the latest technologies, has helped BHEL to deliver a consistent track record of performance. More details about the entire range of BHEL's products and operations can be obtained by visiting our web site **www.bhel.com.**

1.1.3 The Heavy Electricals Equipment Plant is one of the major manufacturing units of BHEL. The core business of HEEP includes design and manufacture of large size steam and gas turbines, turbo generators, heat exchangers, condensers and auxiliaries. Huge nos. of machines are used in the plant to manufacture variety of capital goods and products. With a view to restore the accuracies of ageing Machine tools / Equipments and upgrade them suitably with state of the art technologies wherever possible BHEL aims to extend the useful life of plant & Machinery and to upgrade Plant & Machinery technologically.

1.1.4 In line of above objectives BHEL is planning to Recondition and CNC Retrofit CNC Lathe, Plan No.- 2-394, BL-3, HEEP, Haridwar. For the same BHEL intends to get this work done by a qualified party/ vendor as per indicative scope of work given in Annexure.

1.1.5 BHEL shall receive Applications pursuant to this EOI in accordance with the terms set forth herein and all Applications shall be prepared and submitted in accordance with such terms on or before the date specified in this EOI for submission of Applications.

1.2 Brief Description of EOI Process:

1.2.1 The EOI process involves Pre-qualification of interested parties who make an application in accordance with the provisions of this EOI (the "Applicant"). In this process, BHEL expects to short-list suitable pre-qualified Applicants for further deliberations and negotiations to finalize the Final Scope Of Work.

1.2.2 Shortlisted vendors shall be considered and asked to submit firm technical bids and price bids in second stage of tendering through Open/Limited tender as may be decided by BHEL.

1.2.3 Vendors are strongly advised to visit the site and see machines and machine documents before submitting their bids.

1.2.4 The EOI can be submitted by hand or sent by Registered Post so as to reach before 01:45 PM. on Sep 05, 2014 at the following address. A signed copy of the EOI may be sent by e-mail also.

"TENDER ROOM, PPX,
4th FLOOR, MAIN ADMINISTRATIVE BUILDING,
HEEP, BHEL, HARIDWAR,
UTTARAKHAND-249403"
Email ID – harora@bhelhwr.co.in

1.2.5 Any request for further information or clarification on the EOI document may be submitted in writing to Sr. Engineer (MCR) at the above Email ID. BHEL may respond to the queries raised/clarifications sought to the best of its ability. However, no extension of the time or date of EOI submittal would be granted on the ground that BHEL has not responded to any query/clarification raised by any party. BHEL at its discretion may extend the due date for submission of EOI and the decision of BHEL in this respect would be final & binding on the respondents.

1.2.6 No oral modification or interpretation of any provisions of this EOI shall be valid. Written communication shall be issued by BHEL when changes,

clarifications or amendment to the EOI document is deemed necessary by BHEL at its sole discretion.

1.2.7 EOI submittals should be in English. Duly authorized representative shall sign on each page of the documents. Emphasis should be on (a) conformance to EOI instructions; (b) responsiveness to the EOI requirements; (c) completeness and clarity of content.

1.2.8 If at any time during the evaluation of EOI, BHEL requires any clarification on the documents submitted by the prospective parties, it reserves the right to request a clarification so as to complete the evaluation.

1.2.9 EOI which is found to be incomplete in content and/or attachments and/or authentication etc. is liable to be rejected.

1.2.10 No price bid is to be submitted against Expression of Interest.

2.0 Eligibility of Applicants (Pre-qualification Criteria):

Offers shall be considered only of those vendors/ manufacturers who meet the below mentioned criteria:

2.1 Experience of having successfully completed "similar work" during last 7 years ending on 30th July 2014.

Definition of "Similar Work":

Similar works means either of the following:

A. Reconditioning and CNC Retrofitting of a Lathe of minimum 60 Tons Headstock capacity and carriage longitudinal traverse of minimum 5000mm.

B. Reconditioning and CNC Retrofitting of a Vertical Borer of minimum 4000mm table diameter and minimum 3000mm of turning and facing height .

C. Reconditioning and CNC Retrofitting of a Horizontal Borer of minimum spindle diameter of 200mm and column longitudinal traverse of minimum 4000mm.

2.2 The machine builders who have designed, manufactured and commissioned any machine of the above specifications during last 7 years ending on 30th July 2014 may also submit their offers.

2.3 While carrying out Reconditioning and CNC Retrofitting of above referred machines the vendor should have done following works:

a) Assembly and installation of a new Ball Screw and nut in a CNC lathe/ CNC Vertical Borer/ CNC Horizontal Borer.

b) CNC Retrofitting with Siemens/ Fanuc system and Siemens/Fanuc servo drives and motors.

c) Reconditioning/ Replacement of spindle unit and installation of new bearings **(**main spindle bearing in case of CNC lathe/ table bearing in case of CNC Vertical Borer/ main spindle bearing in case of CNC Horizontal Borer**)**

2.4 Documentary evidence such as P.O. / W.O. Copies giving scope of supply and scope of work, final MOM and performance certificate shall be submitted as part of 'Expression of Interest' in support of Pre-Qualification Requirements.

2.5 The machine(s) whose documentary evidence has been submitted by the vendor as per Para 2.4 above should be running satisfactorily at his customer's premises on the date of publishing of notice inviting 'Expression of Interest'.

2.6 Vendor shall submit copies of audited balance sheets of the last 3 financial years ending 31st March or 31st December or as the case may be.

2.7 Customer's details such as Name, Address, Telephone No., FAX No., email ID shall be submitted by the vendor along with documentary evidences as per Para 2.4. 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 for such visits shall be borne by BHEL.

2.8 **The vendor shall do all the work of Reconditioning and CNC Retrofitting inside the territory of India**.

Indicative Scope of Work

A. Machine Specifications:

MAKE: HOESCH MFD, GERMANY

Year of Manufacture: 1972

MODEL: D1800 NYF1

Distance between Chuck and the tailstock quill	8000 mm
Diameter of job at support	1800 mm
Swing over bed	2400 mm
Max Wt. of the job	110 T

A.1. HEADSTOCK

Diameter of Faceplate:	2100 mm
No. of faceplate jaws:	4
Maximum clamping dia in the jaws:	1700 mm
Minimum clamping dia. in the jaws:	500 mm
Maximum load on Faceplate:	55000 kp
Cutting force (Max):	6250 kp
Maximum torque at Face plate:	5600 kpm
Koernerspitzenwinkel (nose angle):	75 deg
Height of faceplate center from bed top:	1450 mm
Spindle motor rating:	89 kW, 197 Amp
	210-670-2100 RPM
	170-495-495 V
Spindle DC motor make:	Siemens-Haschke

Faceplate RPMs:

Stage 1	0.5- 0.8-	12.5-	40	RPM
Stage 2	2.5	-40	-125	RPM
	Constant Torque	**Constant Power**		

A.2. MACHINE BED:

No. of Guide ways:

i. A pair of guideways for the tailstock and the steady rest.

ii. A pair of guideways for the tool saddle

Bed width across tool saddle guideways: 1810 mm approx.

Length of tool saddle guideways: 10,570 mm approx.

Type of guide ways: **Hydrostatic for X- and Z- axes**

A.3. FEED

With CNC	0.1-5500 mm/min
Conventional with CNC	2-200 mm/min
Conventional without CNC	2-200 mm/min

A.4. RAPID

CNC	5500 mm/min
Can be reduced to	550/55 mm/min

A.5. SWORD:

Max length of the sword (ram) when fully out

Left ram	630 mm (7 Positions including Home Position)
Middle ram	400 mm
Right ram	630 mm (7 Positions including Home Position)

A.6. STEADY

i)	Supports dia.	400 to 600 mm
	Load	40000 kp
ii)	Supports dia.	600 to 1000 mm
	Load	65000 kp

B. SCOPE OF WORK:

Sl.No	SCOPE OF WORK	Vendor's Offer as agreed/not agreed/ deviation
A.	**MECHANICAL:**	
1.	Following works shall be performed at BHEL, Haridwar by the Vendor with his personnel and measuring instruments: ❖ Measurement and recording the existing geometrical accuracies w.r.t. OEM / Dr Schlesinger's test charts ❖ Measurement /observation of vibration / noise ❖ Removing parts/ assemblies of the machine whose reconditioning shall be done at vendor's works ❖ Dismantling into transportable lots for further transportation to the vendor's works. Necessary personnel and tools are in vendor's scope. First Joint Inspection shall be carried out along with vendor's experts during and/or after the above mentioned activities to determine the additional work as per Paras **3, 4, 7(ii), 13, 17** mentioned hereinafter.	
2.	Unpacking the transported parts/assemblies at vendor's works, complete dismantling into individual items, de-greasing, chemically cleaning; pre-painting of structural /fabricated parts. Second Joint Inspection shall be carried out at Vendor's works to identify and finalize the detailed list of worn out/ damaged parts and work required to be done. Then, vendor shall submit a quotation for such identified parts and required work to BHEL. Prices for the extra work shall only be approved by BHEL subject to prices being reasonable following which placement of a separate order/amendment to the Work Order shall be issued by BHEL. BHEL may procure these identified parts from any other source as well and supply these items to the vendor who shall install these parts on the machine during reconditioning.	

3.	**Spindle Bearings:** Replacement of all bearings of spindle with SKF/FAG/TIMKIN/RHP-make only. Make of bearings used by OEM shall also be acceptable. T.C. and G. C. from original bearing manufacturer is required. The list of spindle bearings (as per available details) is enclosed in Annexure-I. Bearings other than those in the list are to be identified during Joint Inspection after complete stripping off of the machine.	
4.	**Headstock:** Examination, overhauling and complete restoration of the headstock, its gear train, shifters, clutches, telescoping brushes, etc and the overall lubrication and hydraulic systems of the headstock During Joint inspection, gears found worn out or damaged shall be replaced with new ones as per IS standards and specified quality materials complying with the original manufacturer's specified tolerances. Both the clutches for Low and High Gears of Headstock shall be replaced with new ones, preferably with those of original make. These clutches are EZL 630, EZL 250 of STROMAG-make. In case of difficulties in procurement of Stromag-make clutches, following makes may be accepted by BHEL: Vortex, Precision, Golden, Walpha. Lubrication shall be ensured for all parts of the headstock. Temperature supervision of main spindle bearings shall be ensured. It may need installation of new thermocouple.	
5.	With the change of spindle bearings and overhauling of the headstock, Vibration-free spindle rotation shall be ensured with accuracies and run-out achievable as per OEM test charts.	

6. i.	Reconditioning and overhauling of the existing hydrostatic worm and worm rack system of the Z-axis. This work shall also include the following: a) Re-laying of the diamant möglice coating of all the racks of Z-axis b) Reconditioning and overhauling of the hydrostatic worm c) Complete restoration of the hydrostatic system comprising of the pump(s), filters, Valves, flow and pressure switches, nozzles, tubes etc. to ensure the required hydrostatic lift. Any item which cannot be overhauled/restored to original performance, shall be replaced with new one. All hydrostatic pumps are of Vogel-make. New pumps should also be of the same make.	
ii.	As an alternative to requirements at 6.i. mentioned above, replacement of the existing hydrostatic worm and worm rack system of Z-axis with the following may also be considered: **A new similar system** OR **A new backlash-free double pinion gearbox and rack system** OR **A new drive system having new racks and a gearbox driven by two AC servomotors in Master-Slave configuration for backlash-free traverse in either direction.** However, Z-axis saddle shall continue to have hydrostatics with any of the above three options. Complete details and configuration of the Z-axis drive system shall be finalized on the basis of technical discussions between BHEL and the vendor during technical scrutiny phase. Detailed technical scheme(s) should be submitted by the vendor.	

7. i ii.	X-axis ball screw and ball nut shall be replaced with THK/Rexroth-Bosch/HMT -make only along with the bearing housings which shall be of SKF/FAG/TIMKIN/INA/IKO-make only. Ball screw -nut shall be double nut, backlash free with centralized lubrication (Note: Ball lead screw support bearings-Some of the bearings are not found in the latest catalogues of major bearing manufacturers. In such exceptional cases, other bearings may be allowed by BHEL). The offered ball screw type/make and accuracy grade shall be furnished along with the offer. X-axis drive gearbox shall be reconditioned. Replacement of keyless couplings, bearings, shafts and other parts shall be determined during Joint Inspection as also the need of a new Alpha-make gearbox providing identical/near-identical reduction.	
8. i.	Hydrostatic system of carriage saddle of the lathe shall be overhauled, reconditioned and restored. It will include replacement with new Vogel-make pumps with motors, pipings, nozzles etc. There are two Vogel-make hydrostatic pumps for X-axis and three such pumps for Z-axis.	
ii.	As an alternative to requirements at 8.i. mentioned above, vendor may also offer separately for an alternative modified hydrostatic system of the saddle. Complete details and configuration of the alternative system shall be finalized on the basis of technical discussions between BHEL and the vendor during technical scrutiny phase.	
9.	Local damages to slide ways of X-and Z-axes (scratches upto 2 mm deep) to be rectified by way of welding or otherwise to be decided during Joint Inspection. Slide ways have to be ground/scraped and blue-matched. Pasting of Teflon sheet/Turcite-B/Biplast/tin bronze anti-friction bearing material shall be done on all slides after removing the existing material.	
10.	Design, manufacture and installation of suitable brackets to mount and align Heidenhain/ Sony-make incremental linear scales for X-and Z-axes of the machine. (Preferably magnetic scale due to space constraint and oil splashing in Z-axis)	

11.	Main hydraulic/hydrostatic oil tank of the machine which is presently placed in a pit, shall be raised to the floor level. Existing transfer pump (gear type) on collection tank which is placed in the pit, shall be replaced with a new pump of self-priming type and shall be elevated above the collection tank level. It should be fitted with a suitable easy to clean suction filter and a twin delivery filter (fitted on main hydraulic tank) with clog indicator. The start and stop of transfer pump and hydrostatic pump should be monitored and controlled by float switches to avoid oil spill. Return oil collection tank will remain at the existing level. (Existing filtration system has two stages of filtration; first stage filter is of multiple disc type filter with manual cleaning system and second stage filtration is of cartridge type duplex filters with clog monitor, bypass valve and a switchover valve) This unit will be replaced by a new similar system with filters of standard makes of EPE/Hydac. Pumps/Solenoid valves etc. shall be of Parker/ Rexroth/ Vickers (Eaton)/ Hawe/ Hydac make. Float switches and Flow sensors shall be of Türck/IFM make. (Flow switches , Float switches & pressure switches should be digital type)	
12.	A new oil cooling unit (compressor-type) of minimum capacity of 15000kCal/hr for the main hydraulic oil system of the machine (as mentioned at Para 11. above) shall be installed and commissioned after removing the existing cooling unit. The Cooling Unit should be of Schimphaan/ Rital/ Eta/ Chilton make only.	
13.	**Headstock Lubrication System:** Existing lubrication oil system of the headstock/spindle gearbox oil/spindle bearings shall be overhauled. Two flow meters/gauges placed in two delivery lines of oil flow are defunct/non-operational. The same shall be replaced with new digital oil flow meters, preferably of Türck-make. Size of the display shall be big enough to enable the viewing of the flow rate by the operator from a distance of 5-6 meters. Flow meters should be interfaced with PLC to ensure proper monitoring and alarm system. A new oil cooling unit (compressor-type) of appropriate capacity for the lubrication system of headstock/spindle gearbox oil/spindle bearings shall be offered separately by the vendor. However, the decision to install the same shall be taken at the time of Joint Inspection.	

14.	Hydraulic oil leakages around the machine and headstock to be rectified and arrested with the replacement of all seals/O-rings/wipers/rubber packings.	
15.	New lubrication system for Z-axis (longitudinal traverse) gearbox/ worm and worm racks shall be provided. Lubrication shall be ensured in appropriate quantity and rate. Associated pressure switches, pipes and wipers shall be replaced. Pressure, flow and float switches shall be interfaced with PLC to ensure proper monitoring and alarm system.	
16.	New lubrication system for X-axis (cross traverse) gearbox and ball lead screw/ball nut lubrication shall be provided. Lubrication shall be ensured in appropriate quantity and rate. Associated pressure switches, pipes and wipers shall be replaced with new one. Pressure, flow and float switches shall be interfaced with PLC to ensure proper monitoring and alarm system.	
17.	**Swords/rams:** Overhauling of sword (I & III) clamping and motorized movement system which includes: -Replacement of hydraulic power pack of identical rating and capacity for tool - Sword (ram) comprising of new solenoids and pressure switches: Make: Hawe only - Replacement of all proximity switches with new ones for position feedback of Ram position -Replacement of pressure gauges. -Replacement of spring clamping cylinders. -Repair/renovation/replacement of swords movement drive motor, gear boxes, lead screw & nuts as decided during joint inspection.	
18.	**Tailstock:** Overhauling of tailstock clamping system , which includes - Replacement of Hydraulic power pack for tailstock clamping system with a new hydraulic system comprising of solenoids and pressure switches: Make: Hawe only - Replacement of pressure gauges - Replacement of spring clamping cylinders. - A new metallic drag chain carrying all the power and control cables of tailstock shall be provided and laid out along the side of tailstock beds.	

19.	**Tailstock quill:** New hydraulic pump for movement of quill of the tailstock along with required solenoids and pressure switches	
20.	**Tailstock lubrication:** New lubrication system for time-dependant lubrication of tailstock gears and guideways	
21. i. ii. iii. iv. v. vi.	**Steady Rest:** New hydraulic/hydrostatic system including pump-motor, solenoid valves and manifolds, pressure switches and limit switches for the steady rest of the lathe Replacement of Steady rest oil cooling and filtration unit with a new system Replacement of guide bushes and keys of central and side quills Replacement of all the seals. Integration of all the elements such as hydraulic/hydrostatic power pack and oil cooling unit onto the attached steady rest platform so that the entire system (power pack and cooling arrangement) along with the steady can be moved as a single unit. A new metallic drag chain carrying all the power and control cables of steady rest shall be provided and laid out along the side of steady rest/tailstock beds.	
22.	**Faceplate hydraulic jaw clamping system:** A new hydraulic power pack shall be provided. This includes replacement of all the oil seals, O-rings and other rubber parts inside the chuck and jaws, all the clamping spindle support bearings, reconditioning/replacement of hydraulic cylinder-pistons. All hose pipes and nozzles shall be replaced. New power pack shall include new solenoid valves, pressure switches, a pressure gauge and accumulator etc.	
23.	Information such as oiling points with periodicity and type of oil to be used shall be indicated on the machine at the required places (e.g. Lubrication tanks, Hydraulic tanks)	
24.	All hydraulic components shall be of Vickers/Rexroth-Bosch/Parker/Hydac/Hawe-make. All float switches, flow sensors should be of Türck/ IFM make (Digital Type)	
25.	Overhauling of Mist-air coolant system which includes – Replacement of valves, filters and mist air -coolant valve, flow controller,	

	metal jacketed hot metal chips resistant tubes etc.	
26.	Z-axis carriage movement cable drag chain travelling in the pit on the side of Z-axis guideways and which is carrying various electrical and hydraulic hoses shall be replaced with a new metallic cable drag chain (with Kabelschlepp-make). **Replacement of table top chain covers**: Electrical and hydraulic hoses of the carriage are lowered into the Z-axis carriage movement cable drag chain in the pit. A flat chain cover of about 140 mm width is placed along the length of the Z-axis guideways (ca.10570 mm) at the level of the shop floor. This chain cover shall be replaced with a new one.	
27.	Any modifications carried out shall not sacrifice original traverses, speed and feed ranges.	
28.	**Painting:** Machine outside body shall be painted with two coats of Apcolite (Asian paints) Premium enamel paint. Interior of the machine is to be painted with two coats of red enamel paint. Wherever oil comes in contact with interior of the body, oil resistant paint is to be used. Letters/numerals etc. will have to painted with a different colour as required/as indicated by BHEL at the time of final painting. For electrical panel boxes inside area is to be painted with two coats of white enamel paint. Painting shall be carried out according to the standard procedure for painting including cleaning and removing old paint, applying metal primer putty etc. good finish shall be ensured. **Overall machine aesthetic view shall be taken care of.**	
29.	Replacement of all existing 3Phase 500V AC Induction motors with 3 Phase 415V AC Induction motors of suitable rating.	
B.	**ELECTRICAL, ELECTRONICS AND CNC:**	
30.	Disconnecting and removal of existing CNC system Sinumerik 3T, DC spindle drive Simoreg 6RA26 and motor, DC feed drives and feed servomotors, electrical cabinets , all the interconnected cables and complete wiring of the machine, all AC motors, limit switches, proximity switches etc.	

31.	**Electrical Control Cabinets:** ❖ Installation of new electrical cabinets (with IP54 protection) for mounting the new spindle drive, feed drives, CNC System, PLC and electrical switchgear with proper cooling. ❖ Cabinets shall be stand-alone floor mounting type and accommodated in the space vacated by existing cabinets. ❖ All fuses and overload relays to be replaced with motor protection circuit breakers. ❖ Cabinets shall be equipped with new control transformers and new electrical switchgear of the machine of Siemens/ABB/Schneider-make and other necessary accessories ❖ Panel wiring shall be done properly and neatly. Engraved Labels shall be provided for identification of all the items in the electrical cabinet. ❖ Exhaust fans of ebm/ebm-nadi-make of capacity 1800 m^3 per hour (5 nos.) shall be installed in the cabinet(s). Air conditioner for proper cooling for drives, PLC, System shall be installed in the cabinet(s)	
32.	**Operator Pendant:** ❖ Operator Pendant hanging and swivelling type incorporating the CNC Operator Panel, MCP and selector switches. This shall be in line with the existing operator panel which can also be used after appropriate modifications with proper cooling. ❖ Electronic Hand wheel for X & Z axes. ❖ Operator Panel (OP) and the Machine Control Panel (MCP) shall have all the required features for operator-friendly and effective utilization of the machine ❖ Provision of Load meter on operator panel for display of current drawn by spindle motor.	
33.	Hand held control panel for Steady rest movement and fixed panels for Tail stock and quill consisting of all the existing control switches and indicators.	
34.	New CNC controller **Sinumerik 840D SI** with 15.0" inch or more TFT monitor, Full integrated Alphanumeric CNC key board and standard Machine Control Panel (MCP) for turning operations and to cater to all existing features(or more) and existing PLC Inputs and Outputs (160 Inputs/100 Outputs approx.). All outputs shall be configured through relay board. (**CNC features, operation features and programming features described in Annexure II**)	
35.	New Sinamics AC servo drives and AC servomotors for X-and Z-axes of suitable rating. (Details –Type and Model Nos. of new feed drives package shall be submitted by the vendor)	

	(Existing DC servo motors rating: 40 Nm, 5500 RPM). Installation and interfacing of above items.	
36.	Mechanism for locking X & Z axis shall be through electromagnetic brakes directly on the AC feed servomotors	
37.	New AC spindle drive and AC spindle motor of suitable rating. (Complete Details –Type and Model Nos. shall be submitted) Existing DC spindle motor rating : SIEMENS 1GF2264-0AE10-2,2100 RPM, 89 KW, Max RPM 2600 Installation of new spindle encoder for M19 and RPM display. Installation and interfacing of spindle drive and spindle motor. Spindle drive shall preferably be separate and isolated from feed drives of the machine.	
38.	Heidenhain/Sony-make linear scales as feed back system for X & Z axes shall be supplied, commissioned and interfaced with the CNC System. Z-axis 8250 ML approx. (Heidenhain or Sony make preferably magnetic scale type due to space constraint and being in the vicinity to oil splash) X-axis 940 ML approx. (Heidenhain or Sony make) (Details - Model Nos. shall be submitted)	
39.	An Ultra-Isolation transformer (250 KVA rating (Delta / Star Configuration) and power disconnector (400 Amp rating, and with rotary knob) to feed the CNC system, servo drives and PLC, preferably of Neel/Automatic Electric-make shall be supplied by the vendor	
40.	All feedback elements such as limit switches, pressure switches, flow and float switches shall be replaced with new ones.	
41.	New machine illumination Tube light(s) well guarded from chips and coolant. Portable machine lamp assembly with magnetic base operating at 24/220 V AC with three meter cable in protective conduit.	

42.	Total interface wiring between electrical cabinets, operator pendant, drives, motors, PLC, etc. New wiring connecting feedback elements such as limit switches pressure/ flow and float switches to PLC. Planning and laying of all necessary cables like interfacing cables between the drives and system, system and Machine Control Panel, power cables for motors, etc are in vendor's scope. **Make of cables/ wires: Lapp** All the used/unused PLC I/Os, field terminals of the auxiliary Motors, AC and DC supplies etc shall be terminated with proper identification on Terminal Blocks	
43.	Interfacing and commissioning of CNC System, PLC, Axes and Spindle drives, sword movements, lubrication, coolant, hydraulic system, chip conveyor motors, Heidenhain/Sony scales for control under part-programs.	
44.	Development of PLC logic and interface drawings	
C.	**PROVE OUT:**	
45.	Checking of Geometrical accuracies of complete machine as per OEM/ ISO Test chart. All accuracies should be within permissible tolerance limits.	
46.	Laser calibration and alignment of X & Z axes using laser interferometer and generation of compensation data for pitch error and backlash from a reputed agency.	
47.	Demonstration of the main functions (axes & spindle).	
48.	Demonstration of the auxiliary functions (tool carriers, tail stock and quill, steady rests, Coolant system, hydraulics, hydrostatics, lubrication system, chip conveyer etc.) Demonstration of Tool carrier (Sword) movement with M- codes as in existing system.	
49.	Demonstration of Manual Control of machine independent of MDI/ CNC Part Program: Presently, following operations can be performed manually 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 & Z	
50.	**Program conversion software** to convert the part programs and cycles (L94 to L97) of the existing Sinumerik 3T CNC system as per the offered CNC	

	system. The converted programs shall be able to run directly on the offered CNC system.	
51.	Diagnostic system installed on the CNC system with detailed cause and remedy indicating the probable elements responsible for the faults/Alarms. On screen display for faults/alarms related to mechanical/hydraulic and electrical/electronic maintenance. Help guide should be provided for user on the system.	
52.	Prove out and demonstration of all existing machine functions and programming features of new CNC System including manual control of the machine.	
53.	Successful machining of NAS/ ISO Test piece. Material of test piece (Cast iron / Aluminium) is to be arranged by the vendor	
54.	Successful machining of a work piece provided by BHEL by machining of different straight, taper, radius turning cuts, Grooving & Threading cuts.	
D.	**SPARES AND MACHINE MANUALS**	
55.	SPARES: i. Drive control card (one no. each type as used) ii. Drive power module (one no. each type as used) iii. Spindle Drive control card as used iv. Scale & scanning head for X-axis position feedback as used v. Scanning head for Z-axis position feedback as used vi. Spindle encoder as used for M19 and RPM display	
56.	Documents and manuals of machine: i. Mechanical Maintenance Manual (including manuals of BOI items) ii. Electrical Maintenance Manual (Including all circuit diagrams) iii. CNC Operation and Maintenance Manual iv. Siemens manuals v. Machine operation Manual	

ANNEXURE I:

List of Spindle bearings, CNC MFD Lathe, Model: **D1800 NYF1, Plan No. 2-394**

Sl.No.	Bearing No.	Type of bearing	Size	Qty
1	NNU 49/670 Bk / Sp / B900	Double row cylindrical roller bearing	600x900x230	01
2	NNU 4988 Bk /Sp/B900	Double row cylindrical roller bearing	440x600x160	01
3	81272M/P5	Thrust bearing	360x500x110	02
4	7322 BG	Ball bearing	110x240x50	02

ANNEXURE II:

CNC Features required in the proposed Sinumerik 840D Sl CNC System:

CNC controller should be offered with following features:

Sl.No.	**CNC FEATURES:**	Vendor's comments: agreed/not agreed
1.	2-axes continuous path control system for Turning operations	
2	Mode selection through mode selector switch	
3.	TFT/LCD monitor for display 15" or more	
4.	Graphic simulation	
5.	Display of NC & PLC Alarms	
6.	Full Alphanumeric key board for input of part programs (integrated with TFT)	
7.	RS 232 C and USB port for serial communication.	

8.	Minimum 3MB user memory along with flash card for program storage.	
9.	Facility to store up to 999 subroutines & 9999 part programmes.	
10.	Background editing of programs.	
11.	Part program renaming & copying facility.	
12.	Block search with calculations in automatic mode.	
13.	Facility to store 50 zero offsets & 2 additive zero-offsets.	
14.	It should be possible to store 128 tool offsets.	
15.	Resolution of 0.001 mm.	
16.	Backlash & pitch error compensation facility.	
17.	Software limits through machine parameters.	
18.	Automatic tool offset loading facility.	
	OPERATIONAL FEATURES: The swivel type pendent with the CNC operator panel should have the following operational features either on the MCP or provided additionally.	
1.	Axes selection joystick for X & Z in + and – direction selection	
2.	Directional keys + & - for axis movement in jog	
3.	Rapid traverse key	
4.	Emergency stop	
5.	Reset key	
6.	Single block switch	
7.	Dry run switch.(Dry run freely executable during program run in automatic)	
8.	Coolant ON / OFF switch/key	
9.	spindle continuous/inch selector switch/key	

10.	spindle Forward/Reverse selector switch/key	
11.	chip conveyer forward/reverse push button	
12.	Load indication for spindle in % of maximum current	
13.	Separate Hand wheels for X and Z axis	
14.	Axes over travel bypass switch	
15.	Safety and Emergency operation switches for tool carriers	
16.	Tool offset insert push button	
17.	Tool removal confirmation push button with indication	
Sl.No.	**PROGRAMMING FEATURES**:	
1.	ISO code (G&M mode type) programming	
2.	Absolute/incremental programming	
3.	Decimal point programming	
4.	Linear & circular interpolation on both axes	
5.	Programmable dwell	
6.	Scaling factor	
7.	Storage of user defined subroutine independent of the main program	
8.	Variable parametric programming with mathematical functions including trigonometric & logic functions	
9.	Programmable software limits	
10.	Arc-programming with radius & end-point	
11.	Conditional & unconditional jump	
12.	Programmable tool offset	
13.	Programmable zero offset	
14.	Two Programmable additive zero offset	

15.	Subroutine nesting up to 3 levels	
16.	Programmable skip	
17.	Facility of inclusion of message in the part programme	
18.	Corner rounding & chamfering	
19.	Diameter programming	
20.	Canned cycles for: • Axis parallel routing, with option of semi finishing cut parallel to contour. • Counter parallel roughing. • Diameter grooving. • Thread cutting • Face grooving.	
21.	Tool nose radius compensation G41,G42	
22.	Coolant on/off should be programmable	
23.	Programming of primary & auxiliary functions through M, S, T codes	
	Note: ***Complete breakup of all the constituent items with Siemens type number for CNC system and drive modules shall be provided.***	