

Retrofitting and reconditioning works in STC-25 CNC machine (Loc.no: 4474-2833), Bay 2, Bldg 5		
ANNEXURE - II		
Specification and Scope of Supply / Work		
S.No	Description	
1	DETAILS OF THE EXISTING MACHINE AND ITS SYSTEMS	
1.1	CNC SYSTEM: SIEMENS Make HINUMERIK 2000 CNC controlling 2 axes and 1 spindle	
1.2	X AXIS SERVO MOTOR : Type: 3ø~ permaenent magnetic motor Make: Siemens 1FT5072-0AC71-1-Z ; Brake EBD2MOU 24v 24.5W Mo: 10/12 Nm, Idn: 6.3 / 7.5 A ; Ur 372V, Mn : 11 Nm ; S1= 2000 /min ; Max speed = 3200 X AXIS DRIVE: IP 6SN1130-1AA11-0AA0	
1.3	Z AXIS SERVO MOTOR : Type: 3ø~ permaenent magnetic motor Siemens 1FT5074-0AC71-1 ; MO 14-18 Nm ; MN 16 Nm S1 - 2000/m ; Nmax 3200/min Mdn: 16Nm, Idn: 8.8/11.5 A ; 3~1FU1050-6MC 20.0 mv / min Z AXIS DRIVE: 6SN1130-1AA11-0EA0	
1.4	External encoder for X & Z axes : HEIDENHAIN : 2500 PPR	
1.5	Spindle motor : 3~ spindle motor 1PH6135 4NG40Z ; FN92 4781 01001 ; S1 - 20KW, 53A ; S6 - 40% , 30KW , 71A ; Nmin-2000 to Nmax-8000 1/min ; Encoder - Ron 350 2048 sig/R ; pulse inverter code Nr 116S ; ZK10K64	
1.6	External encoder for spindle : SPINDLE ENCODER : 1024 PPR	
1.7	Stabilizer Details: Input - 340V - 480V ; output - 415 V ; I-56A ; Rating - 40 KVA ; Make - Neel	
1.8	Centralized lubrication system for the guide ways - 3ø~ Induction motor 70W	
1.9	HYDRAULIC MOTOR : 3ø~ Induction motor 3.7 Kw , 5HP ; 415 V Δ ; I-7.2 A ; N-1440 rpm	
1.1	COOLANT MOTOR : 3ø~ Induction motor 415V, 50 Hz, 1.3 kW, I-3.4 A, N-1400 rpm, Duty- S1	
1.11	CHIP CONVEYOR MOTOR : 3ø~ Induction motor 415V , 0.5 HP (0.37kW), Speed- 1370 rpm	
1.12	AIR BLAST OIL COOLER MOTOR : 3ø~ Induction motor 415V , 0.75 HP	
2	SCOPE OF SUPPLY - ELECTRICAL ITEMS	Vendor to Confirm
2.1	Supply of CNC Controller, able to perform all the machine functions. CNC PACKAGE: Latest version of CNC system with min 10.4" Colour display package only. CNC Makes acceptable: SIEMENS/FANUC/FAGOR The CNC system offered shall have the following features. 1. Full Alphanumeric Keyboard and Colour Display (TFT/LCD monitor) of size 10.4" or more. 2. MCP and other Operator controls having necessary Push Buttons with Indicating Lamps and Selector / Toggle Switches. 3. PLC configuration having at least 96 Inputs and 64 Outputs with necessary I/O cards. 4. Graphic Machining Simulation of tool paths in part programs and Real time simulation option. 5. Minimum 3MB user memory along with MIN 1 GB flash card facility for program storage. 6. Manual measurement and automatic storage of tool offsets in tool offset memory. 7. All turning operations and shall cater all existing machine features. 8. CNC data can be transferred quickly and easily using USB / Compact Flash (CF) card / Ethernet interfaces Note: 1. The CNC system being offered shall be available in the market for next 10 years and spares/service support shall be available for the next 15 years. 2. All features available in the old CNC system of the machine shall be made available in the new CNC being offered. 3. Service support shall be available in India. Details of the service centre facility available in India to be provided.	

2.2	Supply of AC servo motors of suitable capacity for X and Z axes with Built-in Brake (for both motors). Torque, speed and other motor parameters to match with the parameters of the existing A.C. servo motor as mentioned above and suitable to be interfaced with the CNC system offered. Mechanical interfacing arrangement required to match the new motor 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. Makes acceptable: SIEMENS/FANUC/FAGOR	
2.3	Supply of external encoders for X and Z axes Make: Heidenhain/Fanuc/Siemens/Fagor, PPR: 2500	
2.4	Supply of AC digital servo amplifier modules for X and Z axes. The rating of the drive modules selected should support the selected servo motors. The type number / model of the drive module selected should be indicated in the offer and the technical leaflet should be enclosed.	
2.5	Supply of new AC spindle servo motor of suitable capacity to replace the old spindle motor. The parameters of the offered motor to match with the existing motor and suitable to be interfaced with the CNC system offered. The type number / model of the motor selected should be indicated in the offer.	
2.6	Supply of external encoder with sufficient cable length for spindle. Make: Heidenhain/Fanuc/Siemens/Fagor, PPR: 1024	
2.7	Supply of latest digital servo amplifier module for spindle with regenerative braking. The rating of the drive module selected should support the selected servo motor. The type number / model of the drive module selected should be indicated in the offer and the technical leaflet should be enclosed.	
2.8	Necessary line filter and reactor unit for the drive modules	
2.9	Supply of motor power cable, signal cable, external encoder feedback cables of sufficient length with end connectors for axes and spindle.	
2.10	Supply of necessary 24V SMPS units of Siemens/ Fanuc or other reputed make.	
2.11	Supply of new operating pendant for mounting the new CNC system and keyboard.	
2.12	Supply of new Electrical panel for mounting the drives, power supply units and other switchgears. The panel should have the following features. 1. The panel shall be metal enclosed, indoor, floor mounting and free-standing type of Rital make (or any other make acceptable to BHEL). The panel shall be free from flaws, dents and undulations. 2. All mating surfaces shall be provided with neoprene gaskets. Panel shall be provided with three point locking arrangement. Hardware used shall be chrome/ nickel - plated. The anti-vibration pad shall be of hard rubber. 3. Degree of protection of panel enclosure: IP 55 4. Removable cable entry shall be provided. 5. The bottom surface of the control panel should be free and no components should be mounted on it.	
2.13	Supply of air conditioning unit for the Electrical panel and operating panel of sufficient rating. Air conditioner shall be of following makes. i. M/s Advance Cooling System pvt Ltd ii. M/s Werner Finley pvt Ltd iii. M/s Rittal or any other reputed make acceptable to BHEL.	
2.14	Supply of Hand Held Unit along with 5 metres cable and adapter as required.	
2.15	Supply of suitable ratings of MCB, MPCB, contactors, relays, fuses and other control elements for all the auxiliary motors / equipments in the machine.	
2.16	Supply of new limit switches, pressure switches, proximity switches for the replacement of old sensors in the machine.	
2.17	Supply of oil flow switch of rating 2 LPM. Qty required: 2 nos	
2.18	Supply of Voltage Stabilizer of rating 40 KVA. Stabilizer shall be of following makes: NEEL, AEI, POWER AID, DELTA, Servo max (or any other make acceptable to BHEL)	
2.19	Supply of necessary cables, single/multi core wires, glands, sleeves, ferrules etc for complete rewiring of the m/c.	

2.20	Supply of new induction motors to replace the old ones in the machine	
2.21	M/C spindle area spot light , top side working area covered lighting , Panel area lighting, handlamp to be provided.	
2.22	Supply of new turret encoder of reputed make to replace the existing turret encoder of the machine.	
2.23	Supply of tools for maintenance of the machine. 1. Clamp meter - 1 no 2. Electrical maintenance socket set - 1 Set 3. Heat gun : Working temperature 300 - 500 °C - 1 Set 4. Multimeter (AC/DC 0-800V) - 1 nos 5. Hydraulic cable crimping tool (95 sqmm to 185 sqmm) - 1 set 6. Allen key set (Inches) - 2 sets 7. Spanner set (inches) - 2 sets 8. Mechanical Bearing Puller (TWO LEG) – 2" & 3"- 1 set each 9. Mechanical Bearing Puller (THREE LEG) - 4" & 6"- 1 set each	
3	<u>SCOPE OF SUPPLY - MECHANICAL ITEMS</u>	
3.1	Supply of suitable brackets for mounting the new AC servo motors for axes and spindle.	
3.2	Supply of new Centralized lubrication system ALU-03 (CENLUB) or equivalent with piston distributors and copper tubing for the guide ways.	
3.3	Supply of necessary timing belts, V belts and pulleys	
3.4	Supply of X axis ball screw rod with C1 accuracy. Vendor to dismatle the ballscrew rod from the machine to take dimensions before manufacturing for one to one matching.	
3.5	Supply of Z axis ball screw rod with C1 accuracy. Vendor to dismatle the ballscrew rod from the machine to take dimensions before manufacturing for one to one matching.	
3.6	Supply of high pressure hydraulic hoses along with suitable end fittings.	
3.7	Supply of coolant circulation hoses along with suitable end fittings	
3.8	Supply of X and Z axis ballscrew support bearings -1 SET	
3.9	Supply of chip conveyor gear box ratio 200:1 along with motor.	
3.10	Supply of immersible coolant pump model no RV100/220 Make: Rajamane or its equivalent in any standard make.	
3.11	Supply of high speed hydraulic cylinder model no: OSP/OSPA 150 Make: HMT or equivalent in other standard makes	
3.12	Supply of guideway wipers for X and Z axis-THREE SET	
3.13	Supply of taper lock coupling for X and Z axis drives.	
3.14	Supply of highspeed spindle grease ISOFLEX NBU 15 Make:Kluber (OR) equivalent in other standard make- TWO kg	
3.15	Supply of curvie coupling and seal kit for turret clamping. Vendor to take drawing by dismantling of turret assembly at BHEL works.	
3.16	Supply of all hydraulic valves, Pressure reducing valve and flow control valve, Pump, pressure gauge, pressure switch and filters . Vendor to take the list of valves at BHEL works.	
3.17	Supply of spindle bearing-1 set	
3.18	Supply of Maintenance Tools as mentioned below. a) Spanner set, allen key set, circlip plier - internal & external, screw driver set in suitable tool box - 2 SET b) Ratchet type circlip plier (internal)for bore size 85 to 150 mm - 5 Nos c) Ratchet type circlip plier (external)for shaft size 85 to 150 mm - 5 Nos d) Metric feeler gauge set with minimum blade size 0.001mm – 2 Nos. e) Circlip Plier straight with leaf spring (3 sizes, shaft size 25,50,75mm)-3 SET f) Circlip Plier bend with leaf spring (3 sizes, shaft size 25,50,75mm)-3 SET g) Hook spanners set model no: HN4, HN5-6, HN 7. HN8-9, HN10-11(Make: SKF or Equivalent) - 3 SET h) Axial lock nut sockets model no:TMFS 3 to 10 Make: SKF or Equivalent - 3 SET	
3.19	Supply of bearing set and seal kit for tailstock. Vendor to take the seal/bearing model no from the machine at the BHEL works.	

3.20	Supply of Hydraulic oil chiller unit for the machine. CAPACITY: 3000 Kcal/Hour Refrigerant : R134a/R407c Chiller shall be preferably of the following makes. i. M/s Advanced cooling System pvt ltd ii. M/s Werner Finley pvt ltd iii. Emmpe Associates, Coimbatore iv. Sunbeam v. Rittal	
3.21	Important point to be noted by the vendor: 1. Any material not specified in the scope of supply but required for successful commissioning of the supplied electrical and mechanical materials in the scope of the contractor. 2. Vendors (except OEM of the machine) MUST visit HPBP BHEL, Tiruchirappalli, study the existing machine and assess the work content before submission of quotation. Only such offers shall be considered for technical evaluation.	
4	<u>SCOPE OF WORK FOR RETROFITTING OF CNC SYSTEM, DRIVES AND MOTORS</u>	
4.1	DESIGN & PREPARATION:	
4.1.1	Preparation of new circuit diagram for complete electrical systems with the new CNC/ Drives/ Motor.	
4.1.2	Designing and preparation of brackets for X/Z and spindle motors.	
4.1.3	Preparation of machine dependent PLC software flow Diagram/Ladder diagram for all the machine functions.	
4.2	DISMANTLING: Disconnect existing CNC system/drives/motors/electrical, mechanical elements and other accessories.	
4.3	ASSEMBLY:	
4.3.1	Assembly of servo motors for X, Z and spindle with suitable mounting brackets.	
4.3.2	Erection and commissioning of the new Electrical Panel and Interfacing the machine control elements like limit switches, pressure switches, level switches, pushbuttons etc, with necessary wiring materials.	
4.3.3	Erection of the operating pendent and mounting the CNC system on it.	
4.3.4	Assembly of AC Drives and other switchgears in the new Electrical Panel.	
4.3.5	Mounting of X-Axis Rotary encoder, Z-Axis Rotary encoder and spindle Encoder.	
4.3.6	Complete electrical rewiring of the machine with new wiring materials.	
4.3.7	New supplied ball screw rod for X, Z axis and bearings set shall be assembled suitably.	
4.3.8	Supplied high pressure hydraulic hoses and coolant hoses shall be assembled with suitable end fittings.	
4.3.9	Installation of new lubrication system and necessary copper tubings with suitable end fittings for all axes lubrication.	
4.3.10	Dismantling and servicing of turret clamping cylinder, and assemble with new curvic coupling.	
4.3.11	Installation of supplied hydraulic valves and accessories in the machine and prove out of its proper functioning.	
4.3.12	Installation and commissioning of coolant pump circulation system.	
4.3.13	Dismantling, servicing of and assembling of tailstock with supplied seal and bearings.	
4.3.14	Installation and trouble free prove out of all supplied eletrical and mechanical items.	
4.4	CNC INTERFACING AND PROVE OUT:	
4.4.1	Interfacing the CNC system, drives, motors, lubrication system and other accessories to establish the complete functioning of the machine.	
4.4.2	X-Axis Rotary encoder, Z-Axis Rotary encoder and spindle Encoder to be replaced and interfaced with the new CNC system with necessary cables and connectors.	
4.4.3	Developing and prove out of PLC software to incorporate all the existing machine functions.	
4.4.4	Calibration of X and Z axis for positioning accuracy and repeatability Using Laser interferometer before and after work.	

4.4.5	The complete system will be integrated and proved out for performance With a standard test piece and also two regular production components.	
4.4.6	All the existng machine functions to be proved out.	
4.7	DOCUMENTATION: Three sets of the following documents to be supplied along with the retrofitting packages. 1) Original CNC system manual, drives manual, motor catalogues and also for the other bought out items. 2) Original programming manual for the CNC system 3) Original CNC Interfacing/ Installation/ Diagnostics Manuals. 4) Drives commissioning/ Trouble Shooting manuals for spindle and feeds. 5) Complete Electrical and Electronics wiring diagram as per retrofitting / modification. 6) Hardcopy of CNC parameter list, PLC programs / machine Data / Alarm Text messages. 7) All the mechanical assembly part drawings taken by the vendor. Supply of a) Three sets of manuals for the CNC system, servo motors, spindle motor, drives and manuals of bought-out components. b) Three sets of Electrical drawings for entire machine. c) Three sets of and PLC program	
4.8	BACK UP: The back up of PLC program and parameters to be given in CD as well as in flash card compatible with the CNC system.	
4.9	TRAINING:	
4.9.1	Training shall be given for 2 Maintenance personels on CNC Maintenance & for 2 Production personels on CNC Operation / Programming at the OEM's works for 5 days.	
4.9.2	Training to be imparted to BHEL personels on operation, programming and maintenance of the CNC machine at BHEL for 2 days.	
4.10	GENERAL:	
4.10.1	The equipments should be suitable for 415V, 3ph, 50Hz, a.c. supply	
4.10.2	Parties are advised in their own interest to visit BHEL, Trichy on any working day to inspect and study the machine before submitting their offer.	
4.10.3	Any other work (electrical, mechanical and electronics) not mentioned in this scope of work to keep the machine in working condition with all features as before starting the work are in the scope of the contractor.	
4.10.4	Materials used shall be of reputed make or as per IS standards.	
4.10.5	Party shall bring all tools and testing equipment with them during erection and commissioning.	
4.10.6	The vendors (except OEM of the machine) must visit BHEL, to study the existing machine & assess the work content before submitting the offer. Otherwise the offer shall not be considered for technical evaluation.	