

Annexure

Revamping and Upgradation with New system, servomotors and servo drives in CNC tube bending machine

PART B – TECHNICAL SPECIFICATION

Scope of Supply:

Sl. No.	Description	Vendor Response
1	Revamping and Up gradation with New system, new servomotors, new servo drives and with existing servo valves in Herber make CNC tube bending machine Machine: Herber make CNC tube bending machine Location: Bay-3 / Building-50"	
1.1	"The scope of work involves converting old XP based CNC system to Industrial PC based PLC with motion controller/CNC system with bending software. Retrofitting of existing XP Based Industrial PC and 4 axis servo system with supply and commissioning of following. New windows based CNC system with Bending program and interfacing of new 2 servo motor, drive and 2 servo valve for bending operation along with electrical control panel and operator panel with accessories. "	
1.2	"Machine background: CNC tube bending machine supplied by M/s. Herber, Sweden, is used for production of tube / coil formation for power boilers. The existing machine is operated with DOS based Industrial PC CNC system with Axis 1 : Carriage (to be replaced) Servo motor with brake (TYPE : MK D071 B – 061 – KP1 – KN MdN : 8.0 Nm n MAX : 6000 /MIN Brake 5.0 Nm, DC 24 V + 10% ,54A , KW : 7.2) and servo drive (DRIVE ECO REXROTH - DKC 11.3 – 040- 7 – FW) Axis 2 : Orientation (to be replaced) Servo motor with brake (TYPE : MK D071 B – 061 – KP1 – KN MdN : 8.0 Nm n MAX : 6000 /MIN Brake 5.0 Nm, DC 24 V + 10% ,54A , KW : 7.2) and servo drive (DRIVE ECO REXROTH - DKC 11.3 – 040- 7 – FW) Axis 3: Bending (Same shall be used) MOOG Two stage operated Servo Valve: Model no: 072-1703-5	

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	Type: S22FOFM5VBZN Axis 4: Booster (Same shall be used) Moog servo valve 4682-265-000 HYDRAULIC PUMP MOTOR: 2 Nos KW : 15.0 KW , VOLTS : 380-415V RPM : 975	
1.3	DESIGN AND PREPARATION Preparation of Bending program for CNC PC based System with for existing machine operation with supply of New servo motors with brake, servo drives, Servo valve amplifiers, New PC based system, Operator panel, Electrical control panel, Encoders, cables and suitable accessories including hydraulic motors controls .	
1.6	ELECTRICAL ASSEMBLY AND WIRING: "Assembly of PLC/CNC system, servo amplifiers, servo drives and servo motors matching transformer, control Transformers, relay module, plug/Sockets and connected electrical elements like contactors, MCBS, terminal blocks, push button and lamps as per the Specification required. - Electrical cabinet wiring to control all the CNC functions & also to incorporate control elements. - Preparing cable conduits to connect CNC control panel to the machine elements through flexible cable drag chain and flexible reinforced conduits with suitable end fittings.	
1.7	CNC INTERFACING AND PROVE OUT 1. Installation and Commissioning of CNC/PLC with motion control System. 2. Commissioning of Servo motors and Drives of Carriage axis & Orientation axis 3. Optimizing the servo drives and loading CNC machine parameters. 4. Preparation of bending software as per existing operational sequence 5. Checking all the inputs and outputs to the CNC system. 6. Develop & prove out of PLC software to incorporate all the Machine functions such as: * Axis Positioning. Interfacing between electro mechanical actuator/electric cylinder actuating servo motor encoder, bending angle position sensor. * Automatic lubrication cycle - Incorporate display of faults and messages in clear text for easy Operation and Maintenance. - Incorporate all the safety routines to check continuously while machine is operated.	

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	- Prove out of all the CNC functions for machine application such as, positioning, bending, Contouring cycles. - Graphic menu driven fixed cycles for the operation. - Custom Made Canned Cycle to make the user friendly program and to save the program time.	
1.9. ELECTRICAL		
1.9.1	"Supply of new CNC/PLC with motion control SYSTEM for New suitable AXIS motors and suitable servo amplifier for carriage axis & Orientation axis. Vendor to specify the model and make: (Latest model) Make: Fanuc, Mitsubishi, Siemens. Yaskawa .Rexroth only	
1.9.2	"SPECIFICATION OF THE CONTROL SYSTEM with following specification. 1. Control system will have all the standard features of multi axis continuous path 2. Machine control based on powerful 64 bit microprocessor supported by Graphic processor. 3. 18 inch Colour LCD display with the following features. 4. With keyboard and mouse.	
1.9.3	CNC / PLC shall be of make Fanuc / Siemens / Mitsubishi / Yaskawa / Rexroth only	
1.9.4	Supply of AC SERVO MOTORS with brake, Suitable for existing carriage motor and Orientation motor (not below the rating of existing motor) Power and Torque rating and speed to match the performance of the existing. Necessary fan for motor cooling and speed feedback device are also to be supplied along with motor. Mechanical items such as machined bracket, coupling to mount the new AC servo motor with the new gear box; required fasteners etc., for fixing the new motor shall include in part of the supply.	
1.9.5	Control Panel Within built Werner Finley / Rittal Air Conditioner - 1 No (control panel should be of machine mounted and dimension as per existing panel)	
1.9.6	Standalone Operator Panel with suitable AC -1 Nos	
1.9.7	Supply of cable drag chain for carriage movement – 1 No and carriage x axis movement – 1 No.	
1.9.8	Supply of new CONTROL PANEL with 4 axes CNC/PLC with motion control system, AC drives, LCD display unit, PLC system that includes required I/O modules and other subsystems to replace the existing relay and contactor based control logic without modifying present functionality of the working machine. The proposed new CONTROL PANEL shall be supplied as detailed below:	

Sl. No.	Description	Vendor Response
1.9.9	Control panel of a standard Rittal or Hoffman make shall accommodate the proposed new CNC, AC drives and their accessories.	
1.9.10	A new PLC based system to replace existing logical machine controls. (minimum of 128 Input and 128 output, digital / Analogue modules)	
1.9.11	All the control elements, switchgears, contactors, indicating elements, terminal blocks, and control and power wirings shall be accommodated in the new panel.	
1.9.12	Control panel shall include new contactors / new control elements for the existing motors for hydraulic motors	
1.9.13	The control panel should be of suitable size to accommodate all the above items and it should be suitable dimension to mount in the machine as existing in the machine.	
1.9.14	There should not be any component /elements mounted on the base, doors and side covering sheets of the control panel.	
1.9.15	Fluorescent tube light fittings or CFL fittings shall be provided inside the panels for sufficient illumination during maintenance.	
1.9.16	A 230volt, 5 amps, 3 pin, flush type switched wall socket shall be provided in the panel.	
1.9.17	MCCB of suitable rating for incoming supply, MCBs for control circuits and MPCBs at incoming supply for protection of all the motors other than spindle and axes.	
1.9.18	Suitable rating of Control transformer for 24V power supply.	
1.9.19	Suitable capacity PANEL AC UNIT that shall be mounted on the side of the control panel for cooling the power supply module, drive module, PLC and associated components.	
1.9.20	Supply of new OPERATING PANEL (free standing type) for all controls of the machine with suitable capacity Panel AC cooling system.	
1.9.21	Supply of remote pendant for emergency, cycle start and reset comment.	
1.9.22	Supply of OIL LEVEL, FILTER CLOG INDICATOR AND TEMPERATURE SENSORS for the existing hydraulic power packs. Necessary alarm indications and interlocks to be provided.	
1.9.23	Supply of appropriate INTERFACE CABLES for power, control, feedback and signals as required for the axis and servo valve controls. These cables are to be connected between motors and drives as well as between drives, operating pedestal panel and hand held remote control push button station. Most of these cables are standard ones with connectors at both the ends of each cable supplied by OEMs of CNC and drives.	

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1.9.24	Supply of NEW CABLES for all other motors in place of old cables. The ratings of these AC motors as listed below will be retained in the machine. Old cables for power, control, feedback and signal in the machine, as applicable for these motors, shall be replaced with new FRC (fire retardant) grade cables. PVC sheathed flexible metal hoses (Anagonda hose) of appropriate capacity and sizes are to be used.	
1.9.25	Supply and fixing of encoders with rack and pinion arrangement for Booster and bending for interfacing in the CNC system.	
1.9.26	Removing and replacing of power and control cables hydraulic motors and sensors	
1.9.27	Supply of all field elements such as limit switches, proximity switches, pressure switches, machine lamps, etc., in the machine. The above old components shall be replaced with new ones on the machine. New cables shall be laid for these elements.	
1.9.28	Supply of SOCKETS for hydraulic solenoid valves (rated for 24V DC). These sockets shall have indicating LEDs.	
1.9.29	Supply of DIGITAL ENERGY METER (three phase) at the incomer of the machine panel.	
1.9.30	Supply of a PROGRAMMING HARDWARE (a standard laptop PC) of latest version for trouble shooting, up loading, down loading and editing the CNC system parameters, machine parameters, axis parameters. The PC shall have standard features such as PCMCIA, USB, Ethernet ports, DVD(R/W), licensed Windows (LATEST Professional OS), etc. Licensed OEM software for editing and programming ladder logic is to be supplied with necessary hardware interface cables, connectors and carrying case.	
1.9.31	Supply of Cable drag chain of suitable size and length for housing cables to various carriage y axis and carriage x axis. Make: IGUS/ Kablescheelp/ Tsubaki only	
1.10 Mechanical		
1.10.1	Supply and install one new set of all hydraulic hoses in the Herber machine	
1.10.2	Supply and install one set of hydraulic valves except servo valves	
1.10.3	Servo motors should be fixed with new gear box as required matching with existing machine setup.	
1.11 General		
1.11.1	Supply of THREE sets of the following DOCUMENTS along with the system	
1.11.2	Commissioning and troubleshooting manuals including ladder diagram, parameter list and documents in English	
1.11.3	Interface wiring drawings, circuit diagrams for the new panels, bought out items including part number	

Sl. No.	Description	Vendor Response
1.11.4	Detailed drawings, Catalogues, Part dimension, Specification with part number of all mechanical items including like Electro mechanic actuators, machined brackets, gear boxes, coupling devices, connecting shafts, etc., which are supplied with the system.	
1.11.5	Supply of TWO sets of MANUALS in the form of hard copy for CNC and Drives (as supplied by OEMS) for description, maintenance, parameter, operation and interface of CNC system and description, parameter, maintenance manuals for spindle and servo motors shall be supplied.	
1.11.6	Supply of ONE set of SOFT COPY in CD(s) for all the above documents	
1.11.7	TRAINING for two persons on the maintenance and programming aspects of CNC, PLC and drives and two persons on the CNC Programming at OEM's Training Centre shall be arranged.	
1.12 GENERAL FEATURES AND CONDITIONS:		
1.12.1	Before submitting offer the vendor shall visit BHEL shop to study the existing working machine, its functions and the quantum of work required for retrofitting.	
1.12.2	The complete electrical shall be designed to suit 3 phase, 3 wire system (No neutral connection).	
1.12.3	The rating and type number of all the motors and other components selected shall be indicated in the offer and the technical leaflet showing the parameters and dimensional details shall be enclosed.	
1.12.4	All the existing INTERLOCK features to be retained	
1.12.5	The AC servo motors and drives shall be of SIEMENS / FANUC / Mitsubishi/Yaskawa /Rexroth make only rated for 3 phase 415V	
1.12.6	PLC, I/O modules and Power supply units shall be M/s. Siemens/ Fanuc / Allen Bradley / Mitsubishi/Yaskawa make only.	
1.12.7	The control panel shall be of Rittal or Hoffman make. Panel AC unit shall be of Rittal / Werner Finley	
1.12.8	Control panel, Operator pedestal and Push button control station shall conform to the IS / BS/ EN / Indian electricity Regulations from safety aspects. The panels shall be of indoor floor mounting type with IP 55 enclosure and made of 1.6mm/ 2mm sheet steel for the non-load bearing/ load bearing sheets with necessary MS angles/ sections includes the suitable size "EYE bolts for lifting. It shall undergo full degreasing, derusting, phosphating treatment process before painting with red oxide and two coats of Siemens / Apple green enamel paints outside and white enamel painting inside for better visibility.	

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1.12.9	All control elements like contactor, relay, push buttons, MCCB, MCB, MPCB, Proximity switches and limit switches shall be M/s. Siemens / L&T / Telemecanique / Technik / Omron / Mitsubishi / AB/ABB make only (with DIN rail mounting).	
1.12.10	All the control and power wires shall be M/s. Igus or Lapp makes only or BHEL approved make. Cable drag chain shall be of IGUS/Kablescheelp/Tsubaki only	
1.12.11	All the control and power wiring from control panel to field elements shall be protected with suitable sizes of PVC sheathed flexible metal hoses and ducts.	
1.12.12	The proposed electrical circuit diagram, component lay out, panel drawings with dimension, Bill of Materials, Mechanical drawings and other details for mechanical items such as Machined bracket, gear boxes, coupling arrangements, electric cylinder/electro mechanical actuator (including ball screws and ball nuts details) shall be submitted to BHEL officials for approval before starting manufacturing. Supplier shall submit these details for approval to BHEL engineers within 8 - 10 weeks from the date of PO/LOI.	
1.12.13	All the materials as per scope of supply shall be offered for Stage/Final inspection at supplier's works before dispatch. Recommended to call for pre-dispatch inspection on or before 18 weeks after PO/LOI placement.	
1.12.14	Before dismantling the existing wiring & drive, the vendor should check and record the performance of the m/c like i) operation of machine ii) output iii) Accuracy and Quality of job etc.	
1.12.15	The vendor shall give guarantee for trouble free operation for the period of one year after commissioning of the machine.	
1.12.16	The offer shall clearly indicate the list of material to be supplied under scope of supply and the list of activities to be carried out under scope of work with break up details	
1.12.17	Vendor is to submit the offer in TWO parts separately. Part-1: TECHNICAL BID having complete technical details, catalogues and point wise confirmation & deviations if any. Part-2: PRICE BID.	

Scope of Work:

Sl. No.	Description	Vendor Response
2.1	Electrical:	
2.1.1	Assembly of CNC system, servo amplifiers, drive matching transformer, control Transformers, and relay module, plug/Sockets and connected electrical elements like contactors, MCBS, terminal blocks, push button and lamps as per the Specification required. - Electrical cabinet wiring to control all the CNC functions & also to incorporate spindle control elements. - Preparing cable conduits to connect CNC control panel to the machine elements through flexible cable drag chain and flexible reinforced conduits with suitable end fittings.	
2.1.2	Establishing new AC servo system with drive and Servo system of hydraulic, by designing bending program as per existing system	
2.1.3	Introduction of oil low level, filter clog, pressure gauges (required where ever with minimess couplings) and temperature raise indication and other interlocks for hydraulic tanks in the power packs.	
2.1.4	Integration of all the subsystems with the machine	
2.1.5	Commissioning of the new control panels including programming of CNC, PLC and drives to suit the present job conditions	
2.1.6	Prove out of the machine performance - including verification of all functions of the machine, interlocks, testing the machine with no load and with full load (Including Servo motors for Carriage, Bender, to ensure smooth running and to record). The machine performance is to be better than or at least the same as the previous performance level before retrofitting in all respects.	
2.1.7	Training for Maintenance staff at OEM works of 2 Engineers	
2.1.8	Training the operators and maintenance staff at BHEL works after commissioning for minimum three days	
2.2	Mechanical:	
2.2.1	Dismantling and removal of old hydraulic hoses and installation of the new set	
2.2.2	Dismantling and renewal of all the hydraulic valve seating seals and O rings	
2.2.3	Arresting all the hydraulic oil leakages in the machine to make leak free	
2.2.4	Restoring the machine lubrication system for effecting lubrication of moving parts	

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2.2.5	Required cleaning materials like cotton waste, kerosene shall be issued by BHEL at free of cost.	
2.2.6	All the removed waste materials are to be moved to the respective bins as per instruction of Maintenance in-charge.	
2.2.7	Assembly of required hydraulic systems/components while retrofitting with mechanical arrangements.	
2.2.8	Shop Compressed air Pressure shall be 4 - 4.5 bar at 1" line	
2.2.9	Supplier shall indicate the any additional required components/systems which are required to make the system functional (if required) one.	
2.2.10	MAKE OF THE BOUGHT OUT ITEMS "Makes of all bought out items shall be as follows unless otherwise specified elsewhere 1. ALL COUPLINGS WITH GUARDS: SKF/FENNER/HYDAX 2. HYDRAULIC FITTINGS: PARKER/SWAGELOC/HYLOC" 3. CONTACTORS: SIEMENS/L&T/SCHENIEDER/TELEMECHANIC/MITSUBISHI / OMRON/ABB 4. PUSH BUTTONS AND SELECTOR SWITCHES: SIEMENS/TELEMECHANIC/ MITSUBISHI / OMRON/ABB 5. TEMPERATURE GAUGE: WIKA/WARRE/REXROTH/EATON VICKERS 6. SERVO MOTOR: Siemens/ MISTIBUSHI/Yaskawa/Rexroth/FANUC ANY OTHER MAKES RECOMMENDED BY THE SUPPLIER SHALL BE APPROVED BY BHEL ENGINEERS BEFORE MANUFACTURING	
3.1	PACKING: Sea worthy & rigid packing for all items of complete machine and all accessories and other supplied items to avoid any damage/loss in transit. When machine is dispatched in trailers, all small loose items shall be suitably packed in boxes.	
3.2	Delivery: Shall not exceed 20 weeks from date of Purchase order/LOI.	
3.3	GUARANTEE: 12 months from the date of acceptance of the machine at BHEL or 18 months from dispatch whichever is earlier	