

| RETROFITTING & RECONDITIONING OF KWS M/C. |                                                                                                                                                                                                                                                                |
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| ANNEXURE III                              |                                                                                                                                                                                                                                                                |
| SCOPE OF WORK                             |                                                                                                                                                                                                                                                                |
| S.No                                      | Description                                                                                                                                                                                                                                                    |
| 1                                         | Preparation of new circuit diagram for complete electrical systems with the new CNC/ Drives/ Motor. Designing and preparation of brackets for X/Z and spindle motors as required.                                                                              |
| 2                                         | Dismantling and removal of old Electrical cabinets, CNC control panel, operator panel switch gear ,CNC,PLC, feed motors, spindle motor, Drives , linear scales, encoders, ball screw rods, motors, pumps and field devices along with old cabling and wirings. |
| 3                                         | Assembly of new servo motors for X, Z and spindle with suitable mounting brackets.                                                                                                                                                                             |
| 4                                         | Installation and prove out of X and Z axis ballscrews and end support bearings.                                                                                                                                                                                |
| 5                                         | Installation/Commissioning of coolant (immersible) pump and proper line connection.                                                                                                                                                                            |
| 6                                         | Installation of new guideway wipers for axes.                                                                                                                                                                                                                  |
| 7                                         | Assembly and prove out of supplied high speed hydraulic cylinder for chuck clamping/unclamping                                                                                                                                                                 |
| 8                                         | Assembly of all high pressure hydraulic hoses along with suitable end fittings.                                                                                                                                                                                |
| 9                                         | Installation of all supplied valves on the machine.                                                                                                                                                                                                            |
| 10                                        | Complete dismantling and servicing of turret housing with the required spares.                                                                                                                                                                                 |
| 11                                        | Assembly/installation and prove out of centralized lubrication pump and systems with piston distributor and required copper/nylon tubings.                                                                                                                     |
| 12                                        | Assembly/installation of hydraulic power pack and prove out of proper hydraulic actuation of machines.                                                                                                                                                         |
| 13                                        | Assembly of supplied hydraulic fittings and to ensure leak free operation of machine.                                                                                                                                                                          |
| 14                                        | Installation of new Electrical Panel and Interfacing the machine control elements like limit switches, pressure switches, level switches, pushbuttons etc, with necessary wiring materials.                                                                    |
| 15                                        | Erection of the operating pendent and mounting the CNC system on it.                                                                                                                                                                                           |
| 16                                        | Assembly of AC Drives and other switchgears in the new Electrical Panel.                                                                                                                                                                                       |
| 17                                        | Mounting of external encoders for axes, spindle.                                                                                                                                                                                                               |
| 18                                        | Replacing the limit switches, proximity switches and other sensors in the machine.                                                                                                                                                                             |
| 19                                        | Complete rewiring of the machine to establish all the existing machine functions.                                                                                                                                                                              |
| 20                                        | Installation of all other supplied materials.                                                                                                                                                                                                                  |
| 21                                        | Interfacing the CNC system, drives, motors, lubrication system, hydraulic power pack, control valves and other accessories to establish the complete and smooth functioning of the machine.                                                                    |
| 22                                        | Optimizing the parameters for X, Z and spindle                                                                                                                                                                                                                 |
| 23                                        | Development of PLC program as per the new CNC controller and implementation on machine.                                                                                                                                                                        |

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| 24   | Laser calibration of X & Z axes (before and after the work) and generation of compensation data for pitch error and backlash.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 25   | Prove-out of all the functions of the machine. Demonstration of all programming features of new CNC System .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 26   | The complete system will be integrated and proved out for performance With a standard test piece and also two regular production components.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 26   | <b>BACK UP:</b> The back up of machine, softcopy of documentations to be given in CD, USB as well as in flash card compatible with the CNC system.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 27   | <b>TRAINING:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 27.1 | Training shall be given for 2 Maintenance personels on CNC/ Drives maintenance & for 2 Production personels on Operation and Programming of the CNC at the OEM's works for 5 days.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 27.2 | Training to be imparted to BHEL personels on operation, programming and maintenance of the CNC machine at BHEL for 2 days.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 28   | <b>DOCUMENTATION:</b> 3 sets of the following documents shall be supplied<br><input type="checkbox"/> Electrical circuit diagram<br><input type="checkbox"/> PLC printout in ladder form with symbols & comments in English<br><input type="checkbox"/> O&M manuals (hard copy) for CNC, PLC, Drives & Measuring systems.<br><input type="checkbox"/> Programming manual (hard copy) for CNC system<br><input type="checkbox"/> Machine data (NC, PLC, Setting & Alarm texts), Drives data & PLC program<br><input type="checkbox"/> Details of all mechanical modifications & fittings with drawings. |
| 29   | <b>WARRANTY:</b> The vendor shall stand warranty for the material supplied and work done for a period 12 months from the date of acceptance of the machine after successful job trials and completion of all work as per scope. Any material (supplied by the party) found defective within warranty period shall be replaced free of cost by the party.                                                                                                                                                                                                                                               |
| 30   | <b>GENERAL CONDITIONS:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 30.1 | The equipments should be suitable for 415V, 3ph, 50Hz, a.c. supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 30.2 | <b>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 vendors shall be considered for technical evaluation.</b>                                                                                                                                                                                                                                                                                                                                                               |
| 30.3 | 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.                                                                                                                                                                                                                                                                                                                                                                                 |
| 30.4 | Materials used shall be of reputed make or as per IS standards.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 30.5 | Party shall bring all tools and testing equipment with them during erection and commissioning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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