

RECONDITIONING & ELECTRICAL/ELECTRONICS
UPGRADATION OF INTERNAL CIRCULAR GRINDING MACHINE

- MAKE: Werkzeugmaschinenfabrik Glauchau GmbH, (East)Germany
- MODEL: S18/1S-NCx500
- MACHINE No: 34003.0168
- YEAR OF PRODUCTION: 1992
- ITEM No: 5/A/2109

A. INTRODUCTION:

Internal circular grinding machine as detailed above is used for machining of traction motor components. The machine is configured with 2 (two) CNC controlled axes - X (table cross feed) and W (face grinding feed). Additionally, there are 3 (three) PLC controlled movements - U axis (driven by a 3Φ induction motor) with position display for shifting the work spindle headstock (parallel to X axis), Table longitudinal feed (hydraulically driven) and Swivelling axis (hydraulically driven) for positioning the face grinding attachment. Presently, this machine is running on custom made CNC controller provided by the OEM with Siemens make PLC 135U catering to about 128 inputs (24VDC), 32 outputs (24VDC, 0.5Amax) and 64 outputs (24V, 2Amax). Axes X & W are equipped with AC servo motors (Siemens 1FT5 series) while Axis U is driven by a 3Φ induction motor and is provided with Heidenhain linear scale for position display.

B. SCOPE OF SUPPLY:

ITEM	QTY
1. CNC Controller of FANUC/SIEMENS make , capable of controlling 4 axes with the following basic features & programming features as per Annexure 3A <ul style="list-style-type: none"> ❖ 3 Axes interpolation ❖ 10.4 inch colour TFT LCD monitor, Machine control panel with feed override switch, mode selector switch/keys, handheld unit (with MPG, feed override & alphanumeric key pad). ❖ Network Ready for two-way transfer of data/program ❖ Graphic Simulation ❖ Program Memory 128 KB or more ❖ Fixed Cycles for grinding: Plunge cut, Traverse, Face, Wheel dressing, warm-up cycle. ❖ Programming of Cycles ❖ Zero Offsets (G54 to G57), External zero offsets, 99 tool offsets ❖ Repositioning ❖ Automatic Calculation and Storing of Tool Offsets/Zero Offsets 	1 No
2. AC servo motors of FANUC/SIEMENS make with matching AC feed drives of appropriate rating for 4 axes (X, Z, U & W). Ratings of the feed motors presently fitted on the machine are detailed in the Annexure-3A. Rating of the feed motor for table longitudinal feed shall be calculated by the bidder in line with the mechanical modifications.	4 No

3. Ball-screw, ball-nut and associated fittings for conversion of the hydraulically driven table longitudinal feed to an electrically driven servo controlled CNC axis (Z axis).	1 set
4. Ball-screw, ball-nut and associated fittings for reconditioning of Axis X. Specifications of the existing ball-screw for Axis X is detailed in annexure- 3A.	1 set
5. Ball Screw and ball nut assembly for U axes	1 set
6. Bearings for internal grinding spindle and associated items.	1 set
7. Lubrication Unit. Existing lubrication units are to be replaced with equivalents having appropriate alarms, signals and interlocks.	2 No
8. Coolant System. Complete coolant system with magnetic dust collector/filter is to be replaced with appropriate equivalent.	1 set
9. Operator Pendant with suitable cooling, incorporating the Display unit of the replacement CNC controller with the machine control panel. Key switches for machine functions as detailed in the appendix must be provided.	1 No
10. Position feedback devices: For X, W, U, Z to be provided new.	1 set
11. Cables & Conduits. Complete wiring of the Machine including all power, control, signal and interface cables should be changed and shall be routed through conduits.	1 set
12. Miscellaneous Items. Based on requirement, miscellaneous items like shaft & flange adapters for replacement motors, additional switchgear for electrical cabinet, hardware for integrating the position feedback system with the new controller, electro-valves, pressure switches, limit switches, proximity switches, cabling & cable termination items (like glands, channels, terminal blocks, lugs, ferrules, sleeves, ties etc.), fittings for pendant & cabinet should be supplied.	1 set
13. Valves: All valves on the power pack are to be replaced by equivalents of Yuken/Vickers/Rexroth make.	1 set
14. Documents. The following documents should be supplied: ❖ Operation, maintenance & programming manual for the CNC controller & drives. ❖ Modified electrical schematics with cable schedules ❖ PLC program in ladder form with symbols and comments (Hardcopy) ❖ Backup of all Machine Data and PLC in CDs (Softcopy) ❖ Detailed drawings of all mechanical modifications carried out	3 sets

NOTE: The following are to be retained:

- a) Hydraulic tank with pump and chiller unit.
- b) Electrical cabinet.

C. SCOPE OF WORK:

- Complete reconditioning of the Machine.
- Removal of the entire hydraulic system for the table longitudinal movement.
- Removal of all redundant motors, devices and cables.
- Removal of the ball-screws of Axis X & U.
- Removal of the operator pendant with the existing CNC controller and accessories.
- Conversion the hydraulically driven table longitudinal feed to an electrically driven servo controlled CNC axis through incorporation of suitable ball-screw and ball-nut and driven by a servo motor with appropriate position feedback.
- Mechanical refurbishment of axis X & U
- Mechanical refurbishment of axis W as per requirement.

- Installation of new ball-screw and ball-nut for X, Z and U Axes.
- Installation of new feed motors.
- Installation of new operator pendant, incorporating the new CNC system with accessories.
- Installation of new feed drives with accessories.
- Replacement of Electro-valves, pressure switches, limit switches, and proximity switches as per requirement.
- Overhauling and realignment of safety guards
- Painting of the complete machine.
- Laying and termination of new cables for CNC system, feed motors and drives.
- Cabling of the inputs and outputs for the PLC.
- Interfacing the CNC controller with the PLC, Feed drives & position feedback devices.
- Development of PLC program, in LADDER form with symbols and comments, incorporating all the OEM features.
- Provision for implementing the existing M, S, T codes and all OEM functions.
- Development of grinding programs, cycles, menu screens and all the programming features as detailed in Annexure-3A
- Development of Machine Data for the CNC controller.
- Start-up and commissioning of CNC controller.
- Optimisation of parameters of the CNC controller for the spindle and feed drives.
- Final commissioning of the machine.
- Prove out of the spindle, axes and all other auxiliary machine functions.
- Prove out of Geometrical accuracy of the Machine as per manufacturers test chart.
- Prove out of positioning accuracy as per VDI /DGQ 3441.
- Prove out of all the programming features, menu screens and modes as detailed in Annexure-3A
- Final trial in automatic mode with part programs on test pieces and thereafter on actual jobs (Job prove-out).

D. COMPLETION:

Upon completion of the scope of supply and scope of work, **successful machining of BHEL components** shall constitute the FINAL HAND-OVER of the machine and completion of the job.

E. PERIOD OF RETROFITTING

Six (6) months maximum, including transportation time, erection, commissioning and final hand-over.

F. TRAINING:

Training shall be arranged by the vendor for eight man-weeks in the fields of

- Operation & maintenance of the machine at vendor's works.
- Operation, Programming & Maintenance of the CNC system and drives at training centre of the OEM.

G. WARRANTY:

Vendor shall stand guarantee for smooth functioning of the machine, including all the items and parts employed in retrofitting, for a period of **one year** from the date of FINAL HAND-OVER of the machine.

H. QUALIFYING CRITERIA:

The parties meeting any of the following criteria would only be considered:

1. Any party who is presently manufacturing (OEM) similar CNC Grinding Machines.
2. Any party who have reconditioned, retrofitted or previously manufactured CNC Internal circular grinding Machine of similar size (Swing more than 800 mm). The party must submit “Performance Certificate(s)” of the machine(s) from the end user along with the offer and arrange for visit of BHEL team for verification at the end user’s works.

NOTE:

Bidders are strongly advised to study the machine and its documents before submitting the bids

SPECIFICATIONS

A. Axes:

The axes configurations are as follows:

1. AXIS X (Table Cross Feed):

- ❖ Motor: Make: SIEMENS; Type: 1FT5 064-0AC71; Torque: 4.5Nm; RPM: 2000
- ❖ Position Feedback: Ball Screw mounted rotary encoder for TTL output.
- ❖ Ball-screw: Dia:31.5mm; Pitch: 5mm; Total length: 481.7 mm; Threaded length: 250mm

2. AXIS U (Work Spindle Headstock Feed):

- ❖ Motor: 3Φ induction motor, KW: 0.37 RPM: 920
- ❖ Position Feedback: Heidenhain Linear Scale with EXE for TTL output.

3. AXIS W (Face Grinding Feed):

- ❖ Motor: Make: SIEMENS; Type: 1FT5 064-0AC71; Torque: 4.5Nm; RPM: 2000
- ❖ Position Feedback: Ball Screw mounted rotary encoder for TTL output.

B. Operator Pendant:

The following key switches/programmable keys for machine functions are to be provided:

- ❖ Hydraulic ON/OFF
- ❖ Work spindle inching
- ❖ Coolant ON
- ❖ Open grinding wheel guard
- ❖ Close grinding wheel guard
- ❖ Work guard hood Open
- ❖ Work guard hood Close
- ❖ Internal grinding motor inching
- ❖ Dresser left
- ❖ Dresser right
- ❖ Face grinding motor ON/OFF
- ❖ Swivel In
- ❖ Swivel Out

C. Programming Features:

1. Programs: The following grinding programs should be available.

- ❖ Grinding with oscillation
- ❖ Infeed Grinding
- ❖ Infeed Grinding for close seat spacing
- ❖ Face Grinding

2. Additional Technological functions and programs to be made available:

- ❖ Constant Grinding
- ❖ Delta Dressing
- ❖ Circular Grinding Control

- ❖ Adaptive control of output.
- ❖ Reciprocal Dressing program
- ❖ Dressing of grinding wheel in intervals
- ❖ Dressing both sides of grinding wheel.
- ❖ Grinding individual workpieces manually.

3. **Cycles:**

- ❖ Internal grinding including:
 - Infeeding with sparking
 - Infeeding without sparking
 - Intermediate dressing
 - Taper Grinding
- ❖ Face Grinding including:
 - Infeeding with sparking
 - Infeeding without sparking
 - Intermediate dressing

4. **Control Modes:**

- ❖ Automatic:
 - Automatic internal grinding
 - Automatic face grinding
- ❖ Partly Automatic:
 - Partly automatic internal grinding
 - Partly automatic face grinding
- ❖ Regrinding cycle

5. **Menu Screens:** The following data menus/screens should be available for the operator so that he can input the corresponding values and the part program should be self generated.

- ❖ Infeeding speed:
 - Sparking
 - Rough Grinding
 - Finish Grinding
- ❖ Step size
 - Rough Grinding
 - Finish Grinding
- ❖ Sparking out time
 - Rough Grinding
 - Finish Grinding
- ❖ Number of Sparking out strokes
- ❖ Amount of Dressing
- ❖ Pre halt, back jump
- ❖ P max, Output limit