

## **CNC & DRIVE UPGRADATION OF SCHULER 8 TON (13/A/2012) OF PRESS SHOP DIVISION.**

Schuler 8 Ton Autonotch (13/A/2012) of Press Shop is a special purpose CNC machine (SPM) used to manufacture circular punchings for industrial motors. It consists of six stations which have different functions and the sheets are transported from one station to the another by electromagnetic arms fitted on a spider. The Machine is fully automatic and is used to produce different types of punchings as per requirement. It is fitted with a special purpose CNC Controller supplied by Schuler which has the necessary softwares for making different types of jobs. The Machine is presently fitted with a Siemens make PLC S7-300 which controls all the machine functionalities other than position control of the axes. The Machine is supplied with Siemens make DC Servo Motors and Drives. The Machine has the facility to run the machine without CNC control in PLC Controlled mode also.

It is proposed to upgrade the CNC Controller and Servo Drives with the latest make Digital CNC Controller and Digital Servo drives and Motors. The new CNC Controller may be interfaced with the existing S7 300 PLC (having 400 inputs/300 outputs approx) or can have its own PLC. The complete software for the manufacturing of punchings has to be made in a way that a Universal and operator friendly "On Screen menu driven" program is made in such a way that the operator is only required to input only the punching data for any job.

### **A. SCOPE OF SUPPLY:**

ITEM	QTY
<b>1. CNC Controller SIEMENS 840D series/FANUC 18 series/Schuler make,</b> capable of controlling 2 axes with the following basic features and operating features/screens as per Annexure I: <b>1.1</b> Open Architecture, Modular Concept, Industrial PC Based, Windows XP Operating System, 10.4 inch or more color LCD/TFT monitor, mechanical /membrane keyboard, Machine control panel with mechanical keys, Integrated PLC( 72 inputs/64 outputs), USB port,	1 Set
1.2 Feed rate in mm/min . 1.3 Machine control panel with mode selection/Axes selection/Jog direction / Feed Override/Spindle Override(All Hard Switches) 1.4 ISO (G & M Code )/Absolute/ Incremental / programming 1.5 Compensations: Pitch error/Tool radius and length compensation/Backlash. 1.6 User Program Memory 1 MB or more 1.7 99 Tool offsets, 4 Zero Offsets, 2 Additional Zero Offsets ,Preset offset 1.8 Program Management with Protection of subroutines (Cycle Lock) 1.9 Fault display and diagnostic facility. 1.10 Remote monitoring facility.	
<b>2. Software for different type of jobs:( special screens have to be developed)</b> <b>1.Circular laminations</b> <b>2.Stator laminations without skew</b> <b>3.Rotor laminations without skew</b>	1 set

<b>4.Rotor laminations with skew</b> <b>5.Intermittent /Skip Notching</b> <b>6.Parallel Skewing</b>	
<b>3. AC servo motors of SIEMENS/FANUC/Bosch Rexroth/Aradex make with matching AC feed drives</b> of appropriate rating for X & Y axes. Ratings of the feed motors presently fitted on the machine are detailed in the appendix. (Motors with higher ratings are acceptable ).The motors should be fitted with position feedback encoders.	2 sets
<b>4.</b> All the Push Buttons with LED lamps(100 No.),indicating lamps LED type (50 No.),key switches,mode selection switches ( 5 position ,Qty 4 No.)fitted on the different operator panels to be changed to new.The main operator panel has to be modified to incorporate the new CNC Controller. Key switches for machine functions as detailed in the annexure must be provided.	1 set
<b>5. Standalone PLC for clutch and brake control: A standalone PLC to be provided with 10 inputs and 5 outputs for control of clutch and brake.Details as per the annexure.(Make :Siemens/Fanuc)</b>	1 No
<b>6. Cables &amp; Conduits.</b> All CNC interface cables and Motor and Drive power, control, signal and interface cables on the machine should be replaced by equivalent cables. The cables should be of trailing type, oil & coolant resistant and of reputed make.	1 set
<b>7. Miscellaneous Items.</b> Based on requirement, miscellaneous items like shaft & flange adapters for replacement motors, cabling & cable termination items (like glands, channels, terminal blocks, lugs, ferrules, sleeves, ties etc.), fittings for pendant & cabinet should be supplied.	1 set
<b>8. Documents.</b> The following documents should be supplied: <ul style="list-style-type: none"> <li>• Operation, maintenance &amp; programming manual for the CNC controller &amp; drives.</li> <li>• Modified electrical schematics with cable schedules</li> <li>Backup of all Machine Data and PLC in CDs (Softcopy)</li> </ul>	4 sets
<b>9 The following items of the Machine can be retained:</b> <ol style="list-style-type: none"> <li>S7 300 PLC</li> <li>Electrical cabinets</li> <li>Operator Panel</li> <li>Existing AC main Motor.</li> <li>Electrical cabinet switchgear. The present electrical cabinet is to be used .</li> <li>General Electrical wiring of the Machine.</li> </ol>	

### **B. SCOPE OF WORK:**

- Dismantling of the existing CNC controller,DC Drives, switchgear in the operator panel/electrical cabinets, feed motors,cables(power and signal) etc.
- Installation of new CNC Controller in the existing operator pendant, incorporating the new CNC system with accessories.
- Interfacing of the new CNC Controller with the existing Siemens make PLC S7 -300.
- Installation of new AC Servo motors and Drives for X axis and Y Axis.
- Installation of a standalone PLC in the electrical cabinet for control of clutch/brake.

- Replacement of push buttons, indicating lamps and selector switches on the operator panel as per requirement.
- Start-up and commissioning of CNC controller and servo drives.
- Installation of new Operating software for different types of jobs with user friendly screens in such a way that the operator is able to input all the data himself for different types of jobs.
- Final commissioning of the machine.
- Job proveout : 3 Types of Job: 1) BHEL Drawing No: 24026240022  
2) BHEL Drawing No : 24028141429  
3) BHEL Drawing No : 24028140095

### **TRAINING:**

Training shall be arranged by the vendor for **two persons** in the fields of Operation, Programming & Maintenance . for 2 weeks.

### **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 successful commissioning of the machine.

**D.QUALIFYING CRITERION:** Only those parties who have executed similar projects for CNC lamination manufacturing applications/Press manufacturers/OEM of presses would be considered and would be required to furnish documentary proof for the same.

## ANNEXURE I

### **SPECIFICATIONS**

#### **A. Axes:**

The axes configurations are as follows:

##### **1. AXIS X,Y,:**

- ❖ X axes Motor: Make: Siemens; Type: DC Servo; Static Torque: 2.5Nm; RPM: 2000; With brake, with encoder 2500 ppr, TTL output
- ❖ Y Axes Motor :Make : Siemens ;Type : DC Servo Motor; Static Torque: 14 Nm; RPM 2000 With brake ,with encoder 2500 ppr, TTL output

#### **B. Operator Pendant:**

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

- ❖ CNC on
- ❖ Mode Selection(Jog, increment, auto etc)
- ❖ Axes selection
- ❖ Jog +/-
- ❖ Feed Over ride
- ❖ Strokes speed override
- ❖ Alphanumeric key board

#### **C . Operating Features of CNC System : (the same to be incorporated in new system)**

The present CNC System has the following features:

- 1) **Make : Siemens SMP System.** It has different PCBs like CPU, Video board, Co processor board, Digital and Analog Input /output board, Position Control boards ,power supplies, monochrome 12 inch display, keyboard etc.  
**This system has to be replaced by the CNC Controller with the features as mentioned below.**

##### **2 )Operating Modes:**

- 1) Jog ( +/-) mode
- 2) Increment mode
- 3) Reference Mode
- 4) Automatic single step
- 5) Automatic mode

##### **3) Present Operating System:**

There are three menus which are available on the display :

**A)Operating Menu**  
**B)Programming Menu**  
**C)Maintenance Menu**

A)Operating Menu consist of following parts:

**A.1)Order Data** : This helps to enter the following:

- a)part program number
- b) selection sub stack
- c)selection height of sub stack

**A.2)Setting Data** : This helps in setting the following data for X axes and Y axes.

- a) zero point correction
- b) starting position
- c) changeover selection
- d) increment preselection

**A.3)Actual Values**: It shows the values of stacks and axes.

**A.3.1) Stack** : It shows the actual and programmed value of laminations and stacks

- a)Height of total stack
- b)Total skewing
- c)Number of sub stacks
- d)Height of sub stack
- e)Number of layers
- f)Number of operations
- g)Material thickness
- h)Strokes per minute

**A.3.2) Axes** ;shows the actual position of the axes

- a)X axes
- b)Y axes

**B) Programming Menu** consist of following parts:

**B1) NC Directory** : It contains the list of programs

**B2) NC Data** ( can be modified suitably)

There are 5 different program modules with distinct functions. (sub programs in which the relevant data can be entered).

**B2.1)Notching Data Module** : This contains the Data describing the geometry of laminations to be made.

- a)Number of notches.
- b)Punch radius
- c) Feeding phase
- d) SPM Line

- e) Strokes per minute

**B2.2)Skewing Data Module:** This contains the Data for necessary skew laminations.

- a)Total skewing
- b) Leading skew

**B2.3)Skip Notching Module :** This contains the Data describing skip notching

- a)Number of notches 1

- d)Number of Notches 2

- c)Number of notches 3

- d)Number of notches 4

**B2.4)Stack data:** Data describing the geometry of stack of laminations.

- a) Height of total stack
- b) Thickness of Lamination
- c) Thickness of end lamination

**B 2.5)Sub Stack data :** Data for necessary sub stacks for skew type of jobs.

- a) Lamination at beginning
- b)Height of sub stack
- c)Lamination at end
- d) Height of vent spacer

**B 2.6) Tool Data:**

- a) M Function 1:
- b) Number Lubrication Dots:

**C) Maintenance Menu** consist of following parts:

**C.1)Diagnostic menu :** This shows

- a)Status of Digital I/Os( High or low)
- b)Axes diagnostics

**C.2)Machine data menu:**This menu contains:

**C2.1) Axes Menu:**This helps in setting the various machine data for X and Y Axes.The data are as follows:

- a)Max speed
- b)KV factor
- c) Acceleration
- d) Deceleration
- e)In position error
- f)Reference position

g) Limit position etc

**C2.2) SPM Lines menu:** This menu consists of various parameters for the SPM Characteristics of the press.(SPM1 to SPM5).Each SPM data consist of following :

- a)acceleration
- b)deceleration
- c)kv factor
- d)feed
- e)min no.of notches

**C2.3) Main Drive MENU :** This consists of following parameters:

- a) min /max strokes per minute
- b) mode of skip notching etc

**C2.4)Parameter menu :** This consists of parameters like lubrication time,offset TDC etc

**4) Disabling of axes by selector switch.The axes which is not selected need not be referenced.**

**5) Repunching of any lamination to be possible at later stage.**

**6) The parallel Skewing should take care of the following parameters:**

- Total height of stack
- total skewing
- Leading skewing
- Theoretical sheet thickness
- Intermediate Stack 1
- Total edge thickness front
- Height of part pack
- Total edge sheet thickness rear
- Width of cooling slot
- Possible input of max 30 different part packs

**7) The intermittent/skip notching should take care of the following:**

For notching a pattern of notches with a punching of notches(1) ,then skipping of certain notches(2), punching of certain notches again (3)and then skipping of certain notches(4). The display on the main screen should show the number of sheets cut in the skip notching mode also.

**8) Facility to run the machine without CNC control in PLC Controlled mode also.**

**9)Standalone PLC requirement for Clutch/Brake Control.**

Presently there is a hardwired logic control consisting of discrete logic gates and other elements of Siemens make which are used to control the Clutch and brake.The following Siemens make modules are connected presently:

- 1)6EC1-873-3A
- 2)6EC1-700-2A
- 3)6EC1-230-2A : Memory module
- 4)6EC1-040-2A : NOR gate
- 5)6EC1-000-2A : AND gate : 3 No
- 6)6EC1-010-2A : OR gate : 2 No
- 7)6EC1-651-2A: Output Relay

A suitable standalone PLC with suitable software to be incorporated for the clutch and brake function.