

Main drives and control system reconstruction of temper mill TM-1700

Mill is destined for dry temper rolling of cold rolled annealed steel strips with compression till 10 %.

Main technological units include as follows:

- Console uncoiler
- Temper stand quarto
- Coiler.
- Tensioning device in front of stand.
- Screw Down

Technological parameters:

- Strip width – $700 \div 1550$ mm.
- Strip thickness – $0,4 \div 2$ mm.
- Coil internal diameter - 600 mm.
- Coil outside diameter - $1550 \div 2700$ mm.
- Coil weight maximum– 45 tn.
- Threading speed – 4,5 mps.
- Speed maximum- 25 mps.



Figure 1

Equipment of main drives before reconstruction.

Two rotary converter units, with total power 5megawatt, provided speed regulation of main mill drives.

The first rotary converter unit is destined for uncoiler motors, coiler and stand, the second one is tensioning device and Screw Down.



Figure 2

Ten converters on the analog element base VUK-50/500 made in 1969 were used as generator exciters.

Control signal was formed by system, mounted in five cabinets with modules UBSR, which went out of date physically and morally.

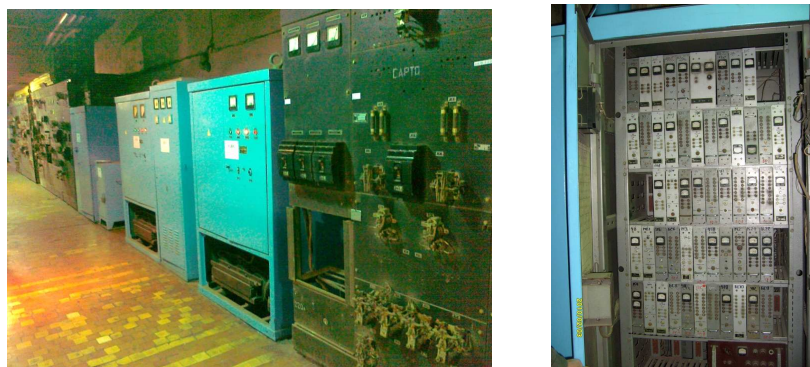


Figure 3

Control system of 1969 consisted of DC relay, located on 17 control panels 600x1800mm and logic blocks-T. Scheme power supply of the mill was carried out from two DC sources through voltage 220 V.



Figure 4

Control pulpits weren't modernized from the moment of equipment commissioning, while technology and individual control systems were

reconstructed. It had effected on pulpit condition and control elements fatally. It was required frontage reconstruction of four pulpits.



Figure 5

Element base of reconstruction

The task was using equipment of reversing mill Sidex to the maximum.

Main drive bridges of reversing mill from the firm ASI Robicon were used as a power part of DC thyristor drive.

Rumanian power reactors were installed for current shape smoothing.

Power circuit commutation is realized through Russian line contactors and automatic circuit breakers Rapid, made by the firm General Electric.

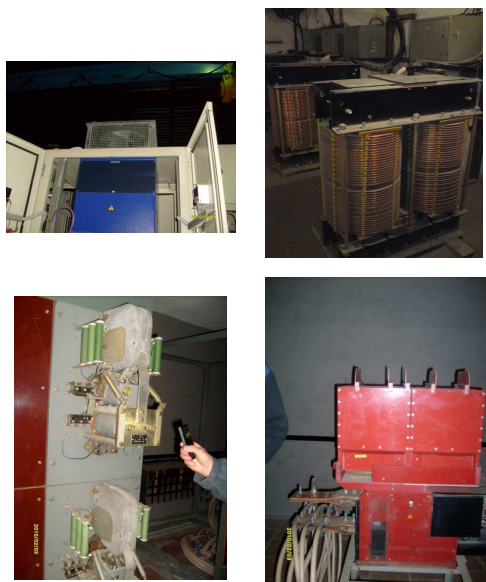


Figure 6

High-voltage vacuum circuit breakers from SIEMENS were used for high-voltage power supply commutation of converter transformers.

Compensation of reactive power and higher balanced sinusoidal voltage components suppression, appearing during thyristor converter work, will carry out with the help of filter compensating device from the firm NOKIAN.



Figure 7

Nine dry-type transformers with power 1250 kilovolt-ampere and 630 kilovolt-ampere from SIEMENS are installed for coordination of converter power supply voltage with the network 10 kv.

Transformers have forced ventilation, it increases their power on 40%.



Figure 8

Digital control modules are used for thyristor converter power bridge control of stand electric drive, coiler and uncoiler.

Thyristor converters of Screw Down and tensioning device have own power bridges. All equipment is from SIEMENS.



Figure 9

Nodes are included in the reconstruction volume of mill control system.

- Main drive speed task.
- Uncoiler and coiler tensioning task.
- Motion and positional control of electromechanical pinch device.
- Auxiliary mechanism control of head, middle and tail part.
- High-voltage cell remote control at electric power substation-8.

- Remote gathering of control signals from pulpits
- Compression measurement system
- Temperature control system of liquid friction bearings for main mechanisms.
- Visualization and diagnostic system of operating parameters.



Figure 10

S7-mEC of the firm SIEMENS is used as a master controller which combines with computing power S7-400, ease of installation S7-300 and PC flexibility of compatible industrial computer under OC Windows XP embedded SP3control.

Controller configuration includes as follows:

- Win AC virtual programmable processor module
- RAM 1gigabyte
- Hard drive on the basis of SD card in volume 8 gigabytes.
- Built-in ports Ethernet.
- USB ports with possibility of keyboard and manipulator “mouse” connection
- Unit for control card connection with network PROFIBUS/
- Expansion unit with SD card in volume 8 gigabytes and port of video signal VGA for monitor connection.

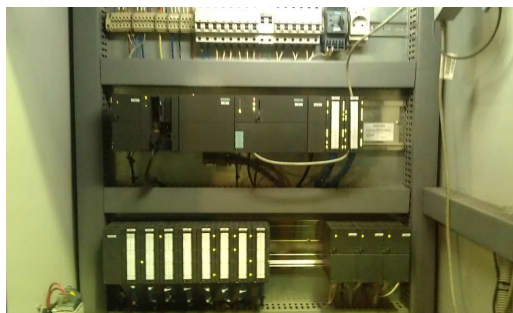


Figure 11

All mill control nodes are connected with informational digital network PROFIBUS. Through the network it is carried out controller signal exchange S7-

mEC with control modules Simoreg of main drives, remote I/O stations, operator panels, sensors.

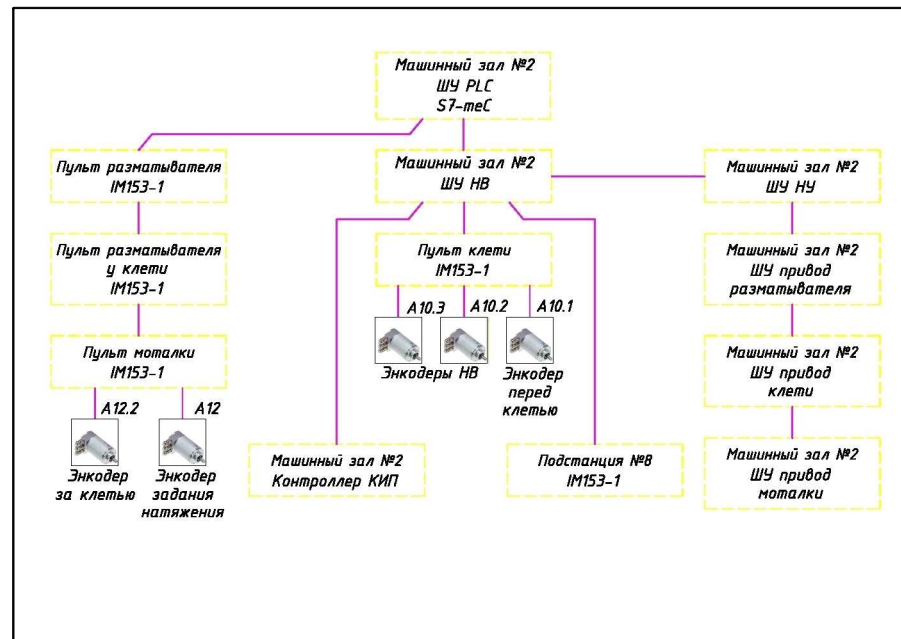


Figure 12

Mechanism control with the help of information network allows reducing the volume of cable products, improving reliability and quality of signal exchange essentially.

Controller programming is carried out with the help of standard package SIEMENS:

- STEP7 Professional ver. 5.4.
- Simatic NET.
- Net Pro.
- Win AC 2010.

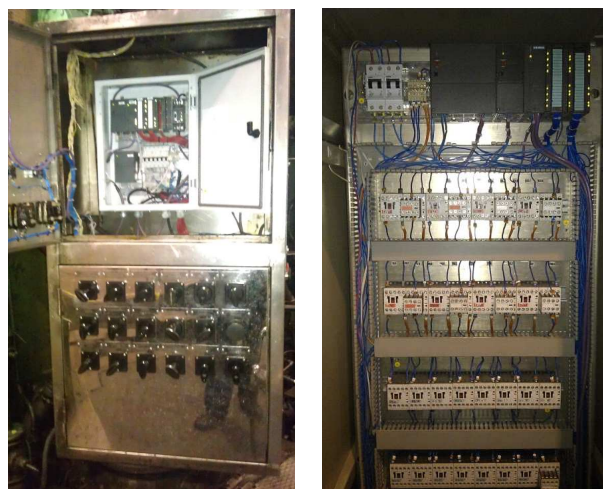


Figure 13

Visualization and diagnostics were carried out on operator panels SIEMENS and software package WinCC flexible.

Operating parameters were output to operator panels OP177, which were installed on pulpits, it allowed to refuse from pointer-type devices.

Panel installation allowed getting more information about equipment and operating process condition.

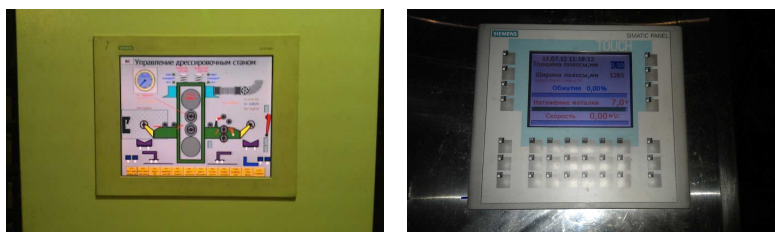


Figure 14