



REBUILT CABINET OF THE WINDER MACHINE "BELOIT" IN MANTOVA PAPERMILL, 7 METERS PAPER FORMAT

IN THREE DAYS IT WAS RESTARTED THE NEW CONTROL OF "BELOIT" WINDER MACHINE AFTER THE OLD CABINET DISMANTLING AND SUBSTITUTION WITH NEW SAEL ONES. THE REBUILD WAS NECESSARY TO SOLVE PROBLEMS DUE TO LOW PLANT FLEXIBILITY OF THE PREVIOUS CONTROL; IT HAD AN IMPORTANT ROLE IN THE **MEDIUM SPEED INCREASE OF 25%** WITHOUT ELECTRIC AND MECHANIC MODIFICATIONS ON EXISTING MOTORS.

SAEL... WINDER "Beloit"

by: **Paolo Andrighetti SAEL s.r.l.**

It was again a nice team work, the one we carried on in Burgo paper mill between SAEL and the paper mill Electric department itself. After the positive experience made by the paper mill staff during the rebuild of the **paper machine** and the many update training courses followed in these late years by the paper mill

technicians, the job was carried on in a fluid end extremely fast way despite the great number of devices added and automation systems controlled (about 200 machine I/O). The experience of our engineers, acquired in twenty years of activity, with numberless applications made in the renovation of all kind of drives in the paper field, allowed us to make in

record time (unthinkable since a few years ago) the rebuild of the Beloit winding machine with the insertion for the WINDER-SAEL control supervising system. Aim of the supply was, over to renew old electric cabinets and control boards, the need to increase the speed from the previous 1500 meters to maximum value reachable using the same existing DC motors.



MANTOVA PAPERMILL "BURGO GROUP" BELOIT WINDER, SAEL Intelligent Drive



Mantovaa papermill, winder machine knives selection

Thanks to the precision of the SAEL drives control system that processes a mathematical model of the mechanical machine over a pull controlled motor (even without load cell we guarantee +/-3% precision), the speed of **1.800 meters/minute was reached with no significant electric modification.** The very good knowing of SAEL drives and architecture (that for Mantua paper mill technicians is by now well known matter in years of use), allowed to create a knit professional pool that worked side by side with our engineers. This team, which had been already tested the year before, had

the hart job to start up the Beloit winding machine as fast as possible. For the number of necessary expected tasks and the complexity of the machine itself, the job was normally to be carried out in two working weeks. The time table imposed from the paper mill management due to the short plant stop time already planned months before, didn't leave space for any mistake in the programming and performing of each activity, scheduled minute by minute during all the stop time. The sharp analysis and data reconstruction performed by paper mill technicians Mr. Salmistraro and

Mr. Stanieri, coordinated by Eng. Nicoli, allowed to have an up to date image of the present plant situation and of all devices connected to the winding machine to be integrated in the project and allowing to be covered by diagnostic. This was the key of our successful work, all the program timing was respected creating a great end quality system that allowed the machine operators to start all the operations at full-speed with no hitch. Constant attention in paper mill personnel involving in the final starting up and the delivery of up to date programming tools permitted to create a synergy that grew up plant after plant making each Burgo factory more independent over the years. Now all Mantua technicians have the same know-how of SAEL technicians and are able to attend independently on all PLC control loops, SAEL drives and system automation as much as we are. It was a great success for us who firmly believe in the policy of paper mill personnel training. Activity performed concerned four DC existing drives, updated with our REBORN system, and new making of all the electromechanic part in the cabinet for the auxiliary machine control (this part performed directly by the paper



Control pulpit of 7 meters use format winder machine ; run speed 1800m/min



LH: first reel wond with curves obtained from previous detections

UP: control electric cabinet wired on two faces to reduce space needed

mill personnel under our coordination). The system had to be interfaced with the many existing devices, an accurate and documented list of which was made, and controlled via remote S7 PLC I/O used in all of our applications. The renewing of the machine control, led to substitution of all existing cabinets with a new one designed and made in SAEL. The plant was composed by a quite large cabinet (6000x2500x1800 front/back

accessibility) containing '80 age motor drives. The original cabinet showed problems due to lack of cooling, obsolete component reliability and difficulty in finding electric and electronic spare parts. The second electric cabinet, built in 1995, contained logic controlled by an S5 PLC series 135. The supervisor PC was relegated in the operators room, where a very small space was dedicated to the cabinet contained the control keyboard and display. A significant part of the logic control was made only of electromechanic devices such as relays and contactors placed in the control pulpit to control

pneumatic and hydraulic actuators of the machine which along the years were added and modified. To end, some MCC trays controlled medium/small sized motors.

The first step involved the paper mill in finding out all the electric diagrams in computer format, mainly about the control board and the electromechanics in it contained. At the same time, all the wires were located and marked, as along the years and with so many modifications happened and that task wasn't carried on as it was supposed to be. Also the pneumatics cabinet, which was placed by the control pulpit,



Beloit winding machine carrying drums, Mantua paper machine

needed to be renewed to add components and integrate them in the new control system. The paper mill management decided in full autonomy to place the pneumatic circuitry inside the control board in an appropriate separate part. At the same time the paper mill redesigned the controls layout on the control board to maintain it, as much as possible, compatible with the old one, to keep it easy for the operators and at the same time updating it with the new options offered by the WINDER-SAEL system. After having designed the new schematic diagram in SAEL, the new control pulpit was mounted by T&B, including the pneumatics. The pulpit was taken in SAEL, where the electric part was tested concomitantly with the electric cabinet. In side it we placed a ET200 unit with 128 digital I/O and two analog outputs. The great advantage in renewing the control pulpit was in cutting of half of the machine wiring, and accordingly it was possible to reduce the wiring time and stay in the given timetable for the I/O testing. The main electric cabinet is the same size of the old one, 3 modules with front and rear accessibility, and contains both the PLC and the 4 drives that were substituted. All of that was connected to the control pulpit via few wires for



Mantova papermill “BURGO GROUP”, one shipping roll in every 4 minute

the auxiliary power supply and a Profibus-DP cable carrying the ET200 information. The start-up procedure was carried on as decided: dismantling of the old cabinets and mounting of the new ones on the first day. The next day we performed I/O test for signals directly connected to the main electric cabinet and , at the same time, placed and wired the control desk. The third day we tested the remote I/O and set up the drive parameters. We set the servo-diameters and verified the machine sequences on the fourth day. Already at the end of the last day of start-up salable paper reels were produced. At the end of the fifth day the machine was already in production condition,

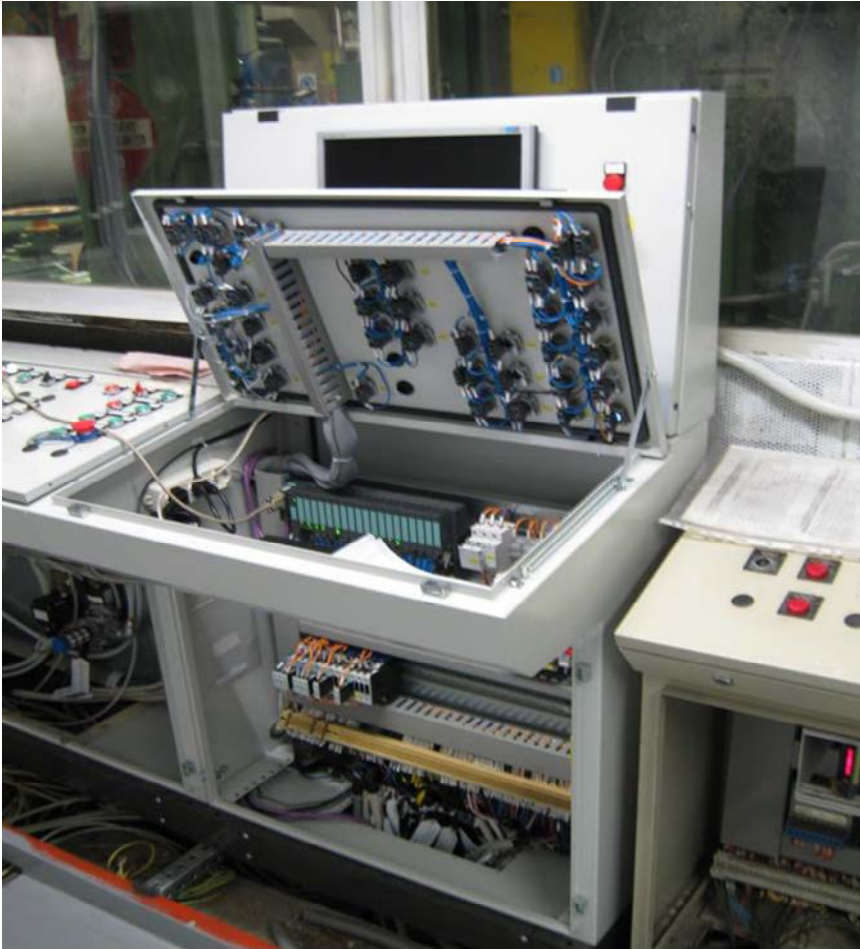
performing the first tests for maximum speed of 1800m/min.

Winding system architecture:

The application architecture used is no other than our consolidated “sectional drive”, consisting in a classic S7 PLC and a machine supervisor provided with **IWSA** (Internet Worldwide Sael Assistance) on site, allowing an easy and direct plant managing by the machine operators. The control boards, locating display, keyboards and mouse, were transformed, integrating many features directly on the display panel and eliminating many pushbuttons previously needed to run the machine. The video controlled



MANTOVA PAPERMILL “BURGO GROUP” BELOIT WINDER, SAEL Intelligent Drive



Control pupil with remote I/O

system allows to display processes, trends variables and work settings, supported by rich synoptic diagrams granting an easy comprehension and each predisposed winding machine function managing. To obtain this strong integration between PLC and supervisor system many managing utility were developed with easy and immediate analog input setting masks

and much more. All PLC parameters are memorized and managed as configuration files in the machine supervisor allowing, in case of fault, to restart rapidly, guiding the operator to the correct solution. The maximum machine stop time reduction is also obtained by the IWSA (always included in renewed plants supervisor systems) permitting in

every moment control of field systems, supervisor PC, PLC and motor drives (directly from our offices location or from anywhere in the world our engineers are). The “WINDER-SAEL” is a supervisor station proposed as an engineering station for

WINDER - SAEL

running more sophisticated winding machines nowadays available on the market, hosts many functional upgrades we will further describe. The product is designed, and practically remade, with a simple navigation graphic supported by many drawings and tables to guide even the less skilled operator. The system (we underline) allows, over the machine managing, to program and set parameters of all motor drives and program the control PLC. IWSA (Internet Worldwide SAEL Assistance) completes the product allowing to make any desired software modification directly via the Internet (in some cases even testing the drives from our offices) and is therefore needed its operation before plant start up. SAEL, differently from the other European competitors, has implemented in its WINDER-SAEL system trend logs of each produced reel: this is a function that our customers had been long hoping for, and is now implemented in machine automation. The function can be used



Synoptic main page and recipes with possibility to store each different type of manufacturing

to trace a reel made on a certain date and time, even after years, and to check if any machining problems occurred.

The file contains all the necessary variables: this is valid help for certification processes. Real-time trends is another important function: machine trends are stored in a 7-day circular buffer and on demand. The production recipes are peerless in terms of flexibility and user-friendliness: machine operators can call jobs carried out years ago and transfer them to the machine without needing to carry out the traditional adjustments which are commonly needed, on the basis of machining type, basis weight and material.

A previous order can be called up at a click of the mouse and transferred to production with the certainty that the machine will be set exactly as originally defined for the specific job. Alarm management is very flexible and functional.

Each alarm is stored on a hard disk along with intervention date and time, total intervention time, minimum and maximum duration time and other important information for preventive maintenance and practical troubleshooting. Windows XP architecture is managed using an off-the-shelf SCADA to make the system fully open and accessible to everyone. Specifically, the main functions of the



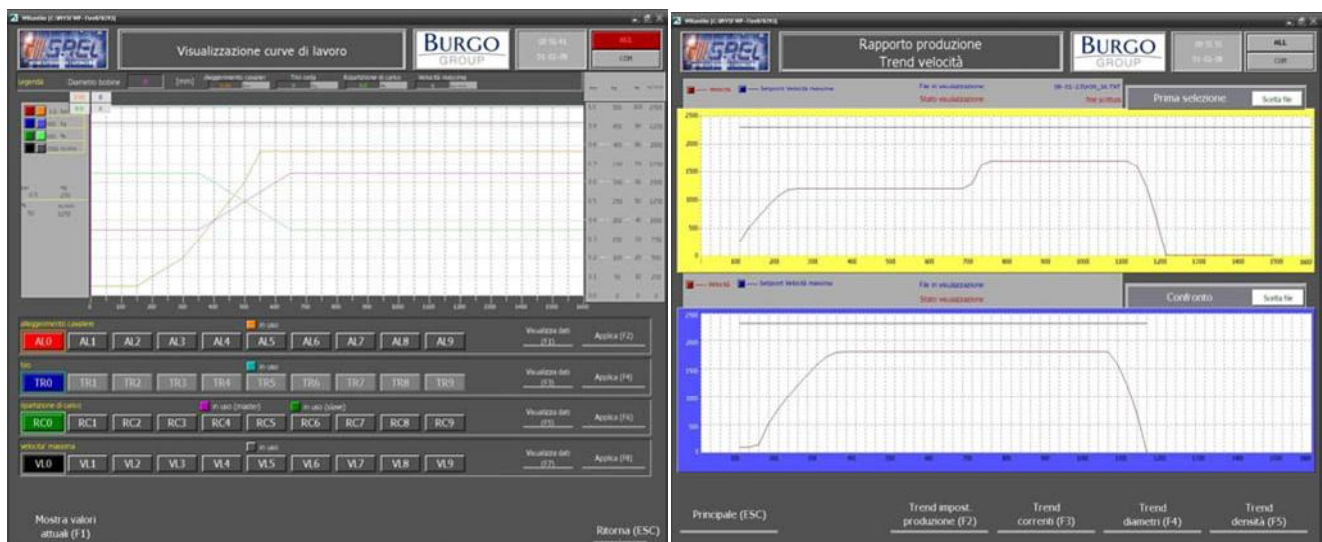
History trends with all main values for over 3 months

supervisor are:

- system synoptic panels for viewing all motors on the field by zone
- viewing of all electric magnitudes on bar graph and in numeric format
- continuous system alarm diagnostics with storing and filing on hard disk
- viewing of set point needed for managing the machine with content editing options
- real trends and trend logs stored on file for each produced reel

containing important magnitudes

- important machine trends stored for one week
- generation of tailstock unloading curves, rider roll, speed, draw and main roller load distribution
- recipes containing all stored machine set points, selected curved, production data with immediate transfer to working setup by pressing a function button for less skilled operators.



Some screens of the system. lh: programmed work curves; rh: work curves stored on change