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Successful revamping of existing processing lines in record time

Tenova Presind Automation (Techint Group) revamped and modernized the electrical and automation equipment of the No. 1 pickling line at the Duferco plant in La Louvière, Belgium. The order comprised the revamping of the automation and drives for the entire line within a very tight schedule: during the two-week plant shutdown in August 2006. The objective was to replace obsolete equipment which had reached the end of its life cycle and for which spares were no longer available.

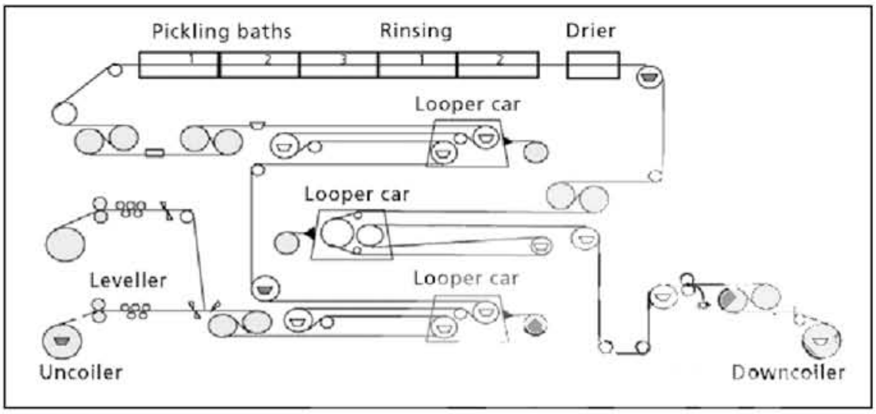

Figure 1. Process layout of the pickling line No. 1

Introduction

In December 2005 Tenova Presind Automation (Techint Group) was awarded the order to revamp the drives and automation equipment of the pickling line No. 1 at the Duferco plant in La Louvière, Belgium. This order was received shortly after the award of another order for the electrical and automation part of a new push-pull/semi-continuous pickling line (pickling line No. 2) built by Tenova Strip Processing at the same site.

The principle layout of the pickling line No. 1 is shown in figure 1. The revamping encompassed the replacement of the DC drives as well as the re-engineering and new design of the automation system for the complete line within a very tight schedule. The entire project was scheduled to last 8 months. Plant shutdown was slated for two weeks in August 2006. What made this revamping project even more critical was the fact that the pickling plant provides most of the coils for the cold rolling mill working at the same site; consequently, a delay in the restart of the pickling operations would have led to serious production losses of the whole plant.

The purpose of the revamping was to increase the reliability of the plant reaching a 99.5% working ratio. (Working ratio is defined as the ratio between running and operating time, i.e. the period of availability of the plant for operation.) To reach this ambitious target, firstly all obsolete equipment had to be replaced. Secondly, the entire automation had to be re-engineered to:

- improve the human machine interface, especially for diagnostics and troubleshooting,
- update documentation.

Finally, new functions had to be designed and implemented, e.g. tracking of welding and level 2 automation.

Re-engineering

The plant had been active for about 30 years and had undergone many changes and additions, but always on a piecemeal basis. Due to the lack of reliable and updated documentation re-engineering presented a highly challenging task to Presind. Specifically, there was only very little information about the interfaces between the original plant and the PLCs installed over the years. Figures 2 and 3 give an impression of the status of the equipment before revamping.

The first step undertaken consisted in a series of site surveys to check the existing documentation, select the equipment to be maintained and design the interconnection between the various components of the system. Since the cable lists and the wiring

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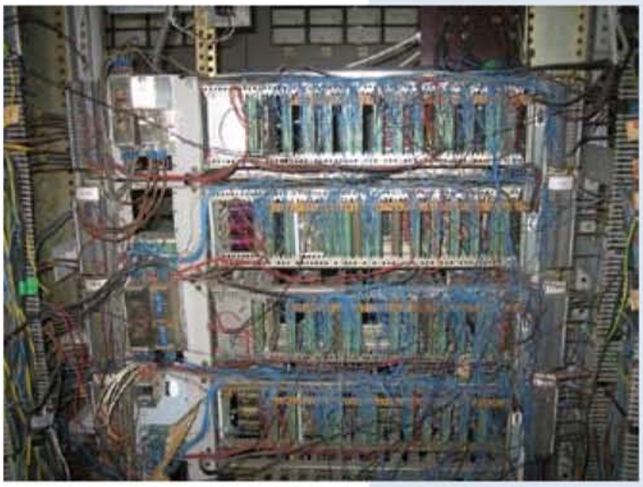

Figure 2. **One of the main difficulties was to identify the cables and their wiring schemes**

Figure 3. **Before the revamp the plant had been in operation for 30 years**

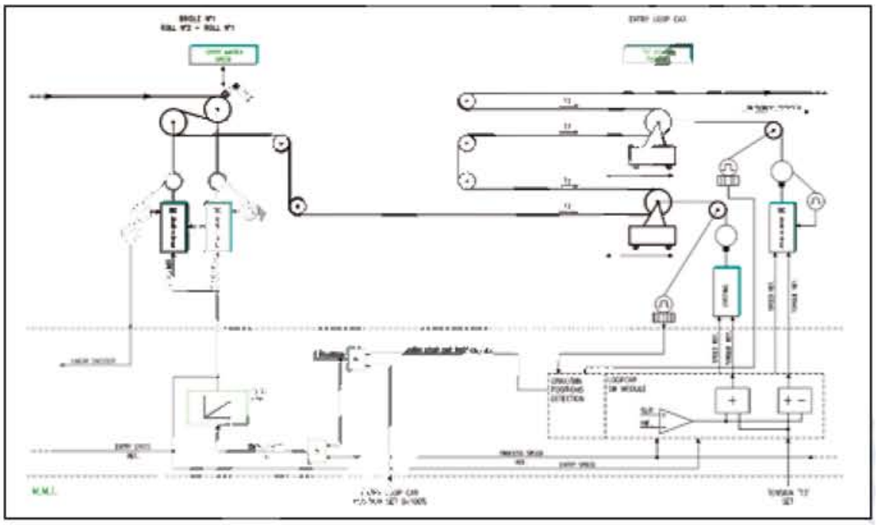

Figure 4. **New automation scheme of the entry looper cars**

diagrams were missing or incomplete, one of the main difficulties was to identify the cables and their wiring schemes.

Line re-engineering resulted in designing new equipment, re-arranging and updating the existing ones and defining the interfaces between the various parts. Distributed input/output automation architecture was chosen, with a high level of decentralization to permit signal interception without the need for new cabling. All the existing cables were maintained. Cables for the Ethernet and Profibus communication networks were added, as there had been none before.

New pulse generators for speed control replaced the existing tachometers to serve as feed-back to the new digital drives. New automation architecture and control strategy were designed **(figures 4)**. The automation was updated by re-designing the entire software including new parts coming from the existing relays logic. The most critical issues were the new control strategy for the entry looper cars (which both work in parallel), the tracking of welding, receipt management (level 2) and its interface with level 3.

Revamp during a short shutdown

During the shutdown of the plant the most critical phase was the disassembly of the switchgears, control desks and local control boxes, and the erection and re-wiring of the new ones. Moreover, two new operator pulpits, which had not existed before, were installed in the entry area.

The entire dismantling and erection phase was completed in only six days. Various sections of the line were re-energised starting from the 4th shutdown day, so that the first tests could be conducted. By the 6th day the entire line was ready for testing.

Commissioning began on the 13th day and the plant produced the first saleable coil on the 16th day after the shutdown, as scheduled. The revamping fully reached its main goal through the enhancement of the diagnostic and automation functions. But also other important results have been achieved.

The efficiency of the speed and torque control was improved leading to a significant reduction in line shutdowns due to rope breaking of the entry looper cars; before revamping this had occurred 2-3 times a month, afterwards this problem disappeared.

The new speed control by the new DC drives **(figure 5)** has eliminated the unnecessary switching off of the overcurrent protection upstream the drives, which had previously occurred about five times a week, resulting in around 15 minutes shutdown each time.

The new weld tracking system has finally solved the problem of the strip

Figure 5. New automation equipment

Figure 6. New pickling line No. 2

tail end running into the entry looper car instead of stopping at the welder. Before the revamping that problem had led to 5-6 hours shutdown each time and usually happened 2-3 times a week. The success of the project has enabled Tenova Presind Automation to establish a close relationship with Duferco, leading to other upgrading orders for the same line, for pickling line No. 2 (figure 6) and for a skin-pass rolling mill. ■