

Process Control with Patent

Steel heating treatment is a special process that Refrattari Brebbia has greatly innovated thanks to the transporter, which slides on inert gas cushions, patent system and where the whole process is totally controlled by Movicon.



Fig. 1: Front view of the patented System Pat designed by Refrattari Brebbia, a very innovative system for heat-treating steel and light.

Refrattari Brebbia Srl has been operating for over forty years in the industrial furnaces sector with plants occupying over 6000 square meters of land in Brebbia and Malgesso, in the province of Varese (North Italy). Years of experience in the heating treatment sector has contributed to manufacturing atmosphere controlled furnaces, systems for solution heat and ageing treatment of light alloy parts for aircraft, aerospace and civil industry, air or atmosphere controlled furnaces, resin polymerization furnaces, vulcanizing systems for thermopolymers and tunnel kilns for brick firing.

Great experience gained in this sector has allowed Refrattari Brebbia Srl to create a very innovative system for heat-treating steel and light alloys where the fundamental feature is the sliding transporter with an international, European and American patent.

The deployment of this unique PAT conveyor system, which moves along on inert gas cushions, allows other extremely compact ROUND and LINEAR modular systems, which are characterized by their unrivalled flexibility of use and capability to produce high quality products.

The PAT system, both in linear and round architecture, can be fitted with a series of standalone workstations for the complete heat treatment, each one

assigned specific tasks within the whole automated heat treatment process cycle. These workstations, a part of the system's main structure, can be configured due to the flexibility of the system's modular length.

The standard workstations that can be applied to the PAT system are:

- **High Temperature Furnaces:** The AT furnace manages the reheating, cementation, carbonitriding, and annealing functions in automatic mode.
- **Medium Temperature Furnaces:** The MT furnace manages the tempering, nitriding, isothermal, pre-heating functions in automatic mode.
- **Quench:** This manages warm oil, polymers, salt and inert gas.
- **Wash:** The wash station manages hot water, alkaline, spraying and dipping.
- **Load/Unload:** This station is used for feeding loaded products into the plant system through single or multiple stations and in continuous feed mode.

The heating treatment chambers are gas tight cylinders with giant impellers for immediate atmospheric conditioning to obtain perfect and even temperature and atmosphere distribution.

In addition to this, powerful mixing systems have been fitted inside the quenching tanks to ensure that a perfect and even cooling rate is maintained.

All the mechanical movements are automated, extremely reliable and totally operational in power blackouts.

The system has been designed to work 24/7 non-stop complete automatic mode. Each station is independent and controlled by a supervision station, whose architecture is based on an Industrial PC with the Movicon scada system onboard under Win32 operating system.

The Movicon control system ensures constant supervision of all the process, temperatures, atmosphere, gas flow and loading movement time parameters.

The Refrattari Brebbia Engineers had been using another type of supervision system for years, but could not get the appropriate control system they wanted to interface with their rather ambitious requirements. They realized that the system PAT needed to have one system with just one intelligence capable of doing everything to guarantee total control of workloads, working and downtimes, a control system capable of invoking the appropriate commands to the different stations and transporters. Keeping in mind that each workload needs to receive different cycle sequences while moving from one station to the next through the system.

Obviously a system of this kind not only had to be geared for supervision but also capable of sophisticated control guaranteeing total reliability, without risking damages to materials

(the materials of each workload can be very costly) remaining in or out the system stations beyond the preset treatment cycle times. It is fundamental that the thermochemical treatment of each load

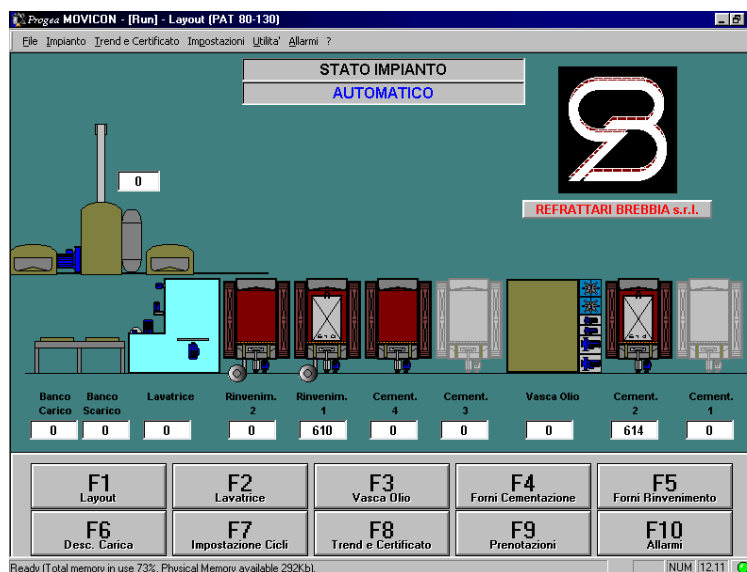


fig. 2 : A Movicon screen page showing a general layout of the Linear Pat system.

completes the duration of the time preset without being interrupted otherwise materials may get deformed.

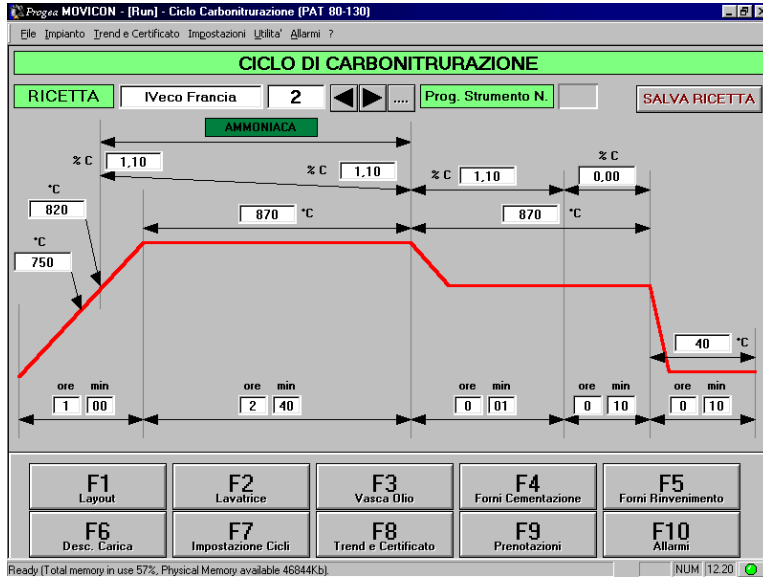


fig. 3 : From the Movicon supervision system the operator can visualize the heat treatment curves, theoretic or effective, for each workload.

Movicon, the Progea Scada system, created the ideal product for Refrattari Brebbia both being powerful in functionality and reliability. Its first prototypes, applied to Turin companies operating in the motorcar sector, gave excellent results by exceeding all expectations.

All control has now been transferred to the Movicon system. The operator decides which treatments are to be executed by setting or scheduling the load quantities to be treated and work cycles. All data is calculated by Movicon, which then puts the workloads into action and supplies the necessary work parameters to the PLCs of the transporter and the Eutotherm tools that manage the furnaces.

The Movicon application then calculates the times of the workloads being processed and, in function with the results

obtained, manages the startup of the transporter missions, which receives the tasks of the workloads to be withdrawn from one station and deposited at another. The transporter is managed by a small PLC and oblivious of the cycles in progress is programmed to receive loading/unloading missions only to physically transfer workloads by executing the transporter's movements, governed by motors and hydraulic cylinders of the transporter's mechanical parts.

The operator can constantly view the contents of each station, loads being processed, cycle phases, the pre-estimated heat trends and those effectively obtained on screen. The operator has been provided with a series of commands to use their discretion to force cycle status or intervene manually, whenever they deem necessary or in cases of emergency.

The work cycle plans allow work times to be scheduled so that pieces are not kept waiting in each station, improving production efficiency, quality and reproducibility of results.

The Movicon application has the delicate task of ensuring that overlapping and waiting times aren't generated in each of the individual stations (ie. in the various furnace, quench and wash stations, etc), by providing the possibility to record the different paths linked to each single workload in function with their specific heat treatments and supplying accurate calculations on the times needed for each of their transits through the various stations.

The complex calculations are executed by Movicon using the integrated VBA language (Visual Basic for Application) and by supporting the multithreading in the various system routines. This applied solution permits total product line control, ensuring the greatest of flexibility, just what Refrattari Brebbia were looking for.

In addition to these particular functionalities, Movicon also carries out the task of system supervisor through graphical pages that make running the system very simple and intuitive.

Movicon visualizes complex graphical system layouts from which each of the individual stations can be zoomed in or out of and where all the information on work cycles, current parameters, treatment curve trends can be obtained in real time.

The operator is guided in running the plant system with simple, very comprehensible and intuitive commands and menus.

Diagnostics are ensured with accurate alarms management through which the operator or maintenance worker can immediately single out any anomaly and intervene straightaway by interacting using the commands manually in safety while restoring the anomalous situation back to normal. The functions integrated in the remote Movicon control permit plant telecontrol, both in network or via modem, a feature highly valued in systems working three shifts 24 hours a day. Great care has been taken in certifying the results gained, a fundamental and very important aspect where customers can be guaranteed with certified high quality material by certifying each single load of each product batch.

Movicon continuously records all the significant parameters during the thermochemical treatment of each load being processed, both on reports and Historical Trends managements. The system archives all the values of each station in an ODBC standard database (being treatments which need time and care to carry out, data is gathered every minute). At the end of each completed treatment, Movicon creates a backup file of the recorded values for each station the workload passed through according to the path executed.

This data is available in reports containing the values archived, the averages, work times and graphics obtained from the treatment process. The operator can then link the quality approval certificate to each workload of each batch, or refer to the files of each completed workload and print or display treatment data graphs for future reference whenever needed.

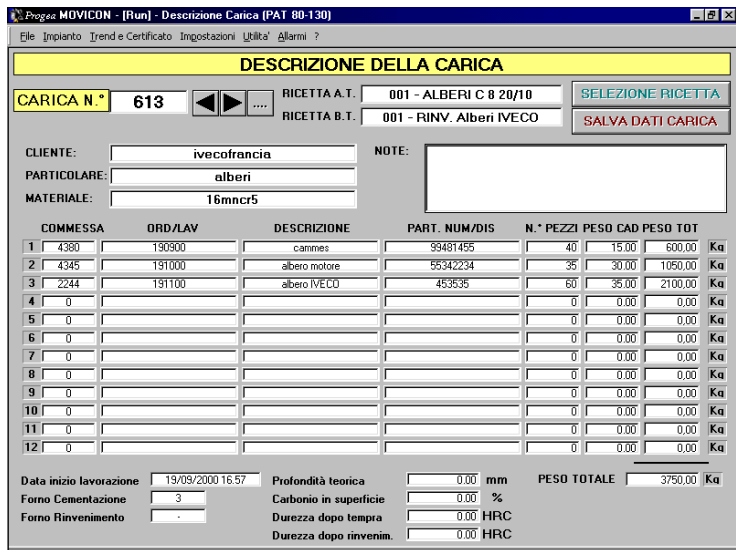


fig. 4 : This system has been designed for setting the data of product loads to be treated, data necessary for presetting cycles, calculated times and the attached certifications.



fig. 5 :The linear version of the System PAT.

The PAT System is the only system of its kind in the world today capable of executing thermochemical treatments with the greatest flexibility, with exceptional quality automatically approved with quality treatment certification issued upon each workload. The innovative characteristics guaranteed with a sliding transporter on inert gas cushions, patent system, and by the particular and sophisticated Movicon control System, make System PAT an extremely innovative heat treatment system and very competitive in terms of performances and costs.

Success had been gained and demonstrated by great interest shown in the system by big important users of these products, above all in the motorcar industry. This motive of great satisfaction by Refrattari Brebbia, crowned by their success resulting from vast and long experience together with Progea's active collaboration with the Refrattari Brebbia technicians, have contributed to the perfect outcome of the Movicon supervision and control application, the core of the system.

A big thank you to sig. Barboni from Refrattari Brebbia Srl