ECM Technologies reduces installation and commissioning time by 50% using digital twin technology

Virtual commissioning and parallel work streamline automotive heat treatment plant timeline with Emulate3D software in industrial processes virtual environment: reproduction of real road and off-road conditions.

by Arianna Locatelli
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By integrating digital twin technology with advanced process simulation and visualization software, ECM Technologies has found a way to significantly simplify the design, installation, and commissioning of large-scale heat treatment facilities for the automotive industry.

Through the use of Emulate3D software, ECM Technologies, a world leader in the design and manufacture of innovative and modular low-pressure carburizing industrial furnaces, has developed a solution that eliminates many of the traditional installation and commissioning challenges associated with the design, testing and deployment of large-scale heat treatment facilities.

The challenge: complexity of heat treatment at scale

Heat treatment is a complex, multi-stage process with many variables that must be precisely controlled to ensure product quality and consistency. ECM Technologies specializes in low-pressure carburizing, a process that infuses steel with carbon to increase its wear resistance and fatigue strength. The company's vacuum process allows operators to control the diffusion of carbon into the metal by managing several variables, including the duration of each stage and the critical vacuum pressure.

Christian Dugit-Pinat, Automation Expert at ECM Technologies, explains: "There are several steps in the process. The parts are washed, heat treated, and carburized in a vacuum, a process that can take up to six hours. They are then rapidly cooled by gas or oil quenching, followed by tempering and final machining. The total process time for a typical automotive gearbox component is between ten and 13 hours."

"Our heat treatment facilities are of multi-chamber design," continues Dugit-Pinat. "This allows us to process several parts in parallel, each often with its own unique heat treatment recipe, with between 50 and 80 loads moving through the line at any one time. Each load must be individually controlled to ensure the highest quality."

The solution: virtualization and digital twins

Modern automation systems can efficiently manage heat treatment facilities within optimized parameters, but the design, installation, and commissioning process presents unique challenges that often become apparent during the start-up phase. To address these issues, ECM Technologies turned to digital twin technology.

Philippe Reymond, Project Manager at ECM Technologies, explains, "When we were asked to install one of our ICBP Jumbo vacuum carburizing systems at a large automotive plant in Mexico, we were faced with additional challenges. Not only did we need to get production up and running quickly, but the customer also required us to use their software standard, which meant rewriting our existing code. Given the complexity and tight timeline, we knew we had to find a way to streamline the project and speed up the implementation."

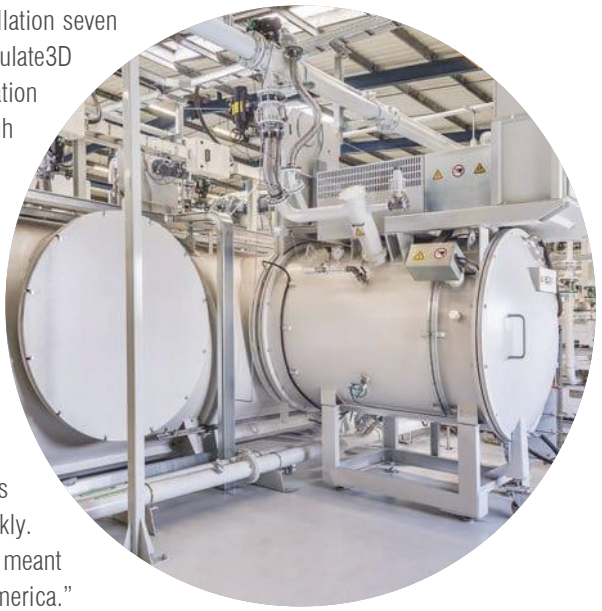
The company decided to use Rockwell Automation's Emulate3D software to run some simulations and optimize the design before physical installation. "By using virtualized models, we were able to test and fine-tune the PLC code in parallel with production, saving a significant amount of time," adds Reymond.

The software's ability to integrate with other systems, such as MATLAB for thermodynamics and process physics simulations, made it an ideal solution for ECM Technologies' needs. "We were able to simulate the mechanical design while simultaneously taking into account other critical factors such as process flows and thermodynamics," explains Reymond.

The results: significant time and cost savings

Using Emulate3D, ECM Technologies was able to fine tune and finalize much of its PLC code before the line was delivered. The company estimates that by debugging the code in parallel with production — rather than after installation — it saved up to five months of lead time on the ICBP Jumbo project.

"We completed a similar installation seven years ago without the aid of Emulate3D or other Rockwell Automation control solutions, and although the software used was our own, the project was still very complex," adds Reymond. "However, this new project was not only delivered on time, but we also reduced the commissioning time by 50%. Even though we were using the customer's code, we were able to complete this second project more quickly. Fewer on-site meetings also meant less travel to and from North America."



ECM Technologies has since received a follow-up order from the customer and has been asked about other opportunities. "The customer was impressed with the speed of the installation and commissioning," says Reymond. "We are now looking to use Emulate3D on other projects, three of which are currently underway, and we will continue to implement digital twins as part of our internal procedures."

Looking ahead: streamlining more projects with digital twins

Reymond concludes, "Virtualizing our projects has allowed us to manage multiple projects simultaneously, thanks to the quality and speed of the output. By spending less time at a client's site, we have reduced the pressure on the team and eliminated many of the stress points traditionally associated with on-site work. We are also much more confident about meeting deadlines. When we say the first of July, we really mean it!"

Nicola Iovine, Strategic Business Developer for EMEA of Digital Designs and SaaS at Rockwell Automation, comments, "Emulate3D is quickly becoming a leader in industrial design as more companies recognize the incredible benefits of digital twin technology. This application with ECM Technologies is a prime example of how design and commissioning can be streamlined. We look forward to supporting ECM Technologies as they continue to innovate and expand further into the digital realm."

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