HOT SEAT

Jack Titus
Director of Process and Developmental Engineering
AFC-Holcroft

This month's column will focus on heat treating in the United States – where have we been and where we are going.

I CAN REMEMBER WAY BACK in the mid-seventies when the programmable logic controller (PLC) was just starting to make its way into heat treating by replacing hard-wired relays in control cabinets. The term Man-Machine-Interface (MMI) was emerging as a replacement to the stand-alone temperature controller and an integrator of logic and process control.

PLCs prior to their entry into the heat treating industry had been the logic system providing control of plastic injection molding equipment where relays had been replaced years before. There are a number of advantages for the PLC over relays including elimination of labor intensive hard wiring and lower hardware cost, allowed smaller electrical cabinets, but operational reliability with increased logic (scan speed) was and is the primary advantage. Also, back then, some PLC manufacturers employed software configured onto Erasable Programmable Read Only Memory (EPROMS) where changes to logic could be made by exposing a small window on the prom to ultraviolet light thereby provided the ability to erase and create new logic without running wires between and or adding relays. Now, PLC logic is created using specialized software that's as simple as constructing an excel worksheet on a PC and uploading it into the PLC.

The integration of the PLC and MMI began in earnest in the 1980s creating the evolution from manual furnace control to automating the motion logic function and process control for heat treating. The movement was especially embraced by the automotive industry. Their mindset was to take decisions away from the operator or supervisor and allow furnace automation to control the process floor-to-floor. Many of those skeptical of the move would say, "If you make the furnace idiot-proof, you'll have idiots running it." The learning curve did create some head scratching along the way and still does to some extent. Peer-to-peer communication (COMS) has become the new recipient of the supervisor and process engineer's concern where data transfer reliability is involved between the MMI, PLC, and computer. Those tasked with managing the heat treat department today must have a different a set of skills; a knowledge of some PLC function and computer (MMI) operation.

Microprocessors — mini computers actually — are now integrated into all manner of process "smart" sensors communicating with PLCs and recipe management PCs. As control systems became more complex, the need to understand and maintain them has increased the need for higher-level operators and engineers to not decrease them.

Heat treat production has always been separated into captive and commercial enterprises. Captive heat treats or OEMs can further be divided into automotive, off-road/trucking, aerospace and commercial, or consumer products. Since OEMs have the primary product liability, their concerns have pushed the envelope into introducing technology for process reliability, historical documentation, and preservation of the same. That has produced much of the technology we see today.

Captive heat treats such as that of the auto makers and the other OEMs tend to process millions of like parts and that reinforced the need for even more automation. In-house or captive heat treating in order to streamline and lean-up production have been forced to move the heat treating process directly into the manufacturing chain, thus out from behind the fire doors and onto the manufacturing floor. This evolution has had the possibly unintended consequence of eliminating the need for experienced heat treat process experts and increased the need for those skilled in robot, material handling, and digital process control development, thereby leaving the new smart computer based process control systems to determine the outcome. This reliance on technology has all but eliminated the need for the full-time experienced heat treat expert resulting in the retirement and or the migration of experts to the commercial heat treater or into the consulting business.

Commercial heat treaters are the safety net for the industry. They provide a relief valve for the OEMs when there's a spike in short-term production and serve as the sole heat treat for those OEMs who prefer to outsource all of the heat treat activity. But the commercial shops in supporting the OEMs must also provide traceable documentation to protect themselves from litigation due to product failures. So, some degree of automated process control is mandated there as well but not to the degree that the OEMs require. Although commercials can provide like processing, such as carburizing, only the largest can afford to exactly duplicate the process like LPC and HPGQ required by the automakers and aerospace that is slowly moving away from traditional processes where allowed. Therefore, commercials to preserve their market share must retain flexibility of heat treat processing all the while maintaining proper historical documentation.

Obviously carburizing is not the only heat treating process lending itself to technology advancement, but it is the process that has the greatest potential for elevating a material's performance level.

ABOUT THE AUTHOR: Hot Seat columnist Jack Titus has an additional column in *Thermal Processing for Gear Solutions* in which he discusses scheduled maintenance of furnaces, distortion control, and low-pressure carburizing. Jack Titus can be reached at (248) 668-4040 or jtitus@afc-holcroft.com. More information can be found online at www.afc-holcroft.com or www.ald-holcroft.com.