HOTSEAT

jack**TITUS**
Director of process and developmental engineering, AFC-Holcroft

If you're considering bringing heat-treating in-house, first study existing outsource processes so transition is seamless.

YOUR COMPANY ANTICIPATES INCREASED COMPETITION in your market so bringing heat treating in-house is one of your cost control strategies.

First, you identify per part manufacturing costs. Second you break down that cost into in-house machining, material costs and the cost for outsourced heat treating. Third, if possible you determine what heat treat equipment the existing supplier is employing because many times although the specific results are conforming, the supplier is using equipment different from that which you the OEM will likely purchase due to production needs, space limitation, etc. Unless there was a specific requirement by you the commercial heat treater will use whatever furnace equipment that would accommodate your production and allow them to optimize efficiency. One case in point relates to normalizing:

The OEM in an effort to reduce cost and preserve the quality they were receiving from their heat treater, purchased a large 36" x 72" x 36" endo-gas batch furnace capable of processing a gross loads of 6,000 pounds. Since normalizing requires a slower cooling rate than oil quenching but not so that the parts will be annealed, a batch furnace with a top cool was the product that fit their production, application and budget even though it was not the most ideal equipment type for the process and most important it fit into their allotted floor space.

Tests were conducted prior to the purchase to confirm everyone's expectations and all went well. During start-up we learned that the heat treater that provided parts was not using a batch but a pusher furnace, however, no one, not even the OEM had any knowledge about how the parts were cooled. They just knew that the parts met the specifications and the appearance was acceptable.

Once the OEM was instructed on the operation and their maintenance department was well acquainted with the PM schedules, the furnace, prewash, charge car and preheat temper were signed off and accepted.

After several months of successful operation we received a call from the customer regarding discoloration and spotty hardness on some parts. Normalized hardness results are not measured on castings or forgings the same way as on quenched parts since the slower cooled microstructure is a mixture of pearlite, bainite and perhaps martensite if the steel has enough alloying elements. Instead of a very small diamond indentation produced by the Rockwell "C" scale a Brinell hardness test is used. The Brinell test consists of a 3000 Kg. load applied to a 1/8" diameter ball that leaves a dimple on the casting that measures an average hardness. The hardness number, cross-referenced with a Brinell scope measurement, is a result of the diameter of the impression; large equates to a soft material; smaller diameter a harder one.

Upon investigating the customer's concerns we learned that in an effort to increase production they purchased different baskets that allowed them to increase the number of parts and had graduated to different size parts some which were much smaller than those originally tested. Compounding the problem the customer attempted to run a nearly identical recipe of heating and cooling time again to reduce the floor-to-floor time that was used in the original smaller loads. Besides just reaching the required heat-soak, cooling heat transfer was insufficient to meet the microstructure transformation product in parts located near the center of the massive load; this also resulted in the mid-load parts turning blue when removed prematurely from the top cool chamber. Loads processed by the outsourced heat treat in the pusher furnace were smaller therefore no non-uniform cooling issues were observed and because the parts were cooler when exposed to air.

Our customer was also questioning the overall appearance of the processed parts. In an effort to reduce cooling time in the heat treater's pusher and likely because the furnace had that capability, after the parts had cooled slowly to below the lower transformation temperature the parts were apparently quenched in oil. This gave the parts a black appearance that when washed provided an ideal surface finish for the subsequent phosphate coating that could not be duplicated in the batch furnace top cool chamber. And since the presale test load gross weight was somewhat smaller and the load was allowed to cool completely all of the parts retained a uniform gray color that also accommodated the phosphate process. A specific color was not an issue as long as all parts in a load were the same.

Solution: We instructed the OEM on loading arrangements that would produce more uniform structure by, one: adding a cooling system to the top cool water to mitigate seasonal changes in the plant water temperature, two: a cycle alteration that provided for longer time in the top cool chamber that reduced the color variation to an acceptable level.

Lessoned learned: Any OEM contemplating in-house heat treating should first learn all they can about the existing outsourced heat treat process so the transition can be as seamless as possible and eliminate the eleventh hour surprise. As the OEM it's your responsibility to make sure that production and quality control are on the same page when relaying information to the equipment supplier.

ABOUT THE AUTHOR:

Jack Titus can be reached at (248) 668-4040 or jtitus@afc-holcroft.com.
Go online to [www.afc-holcroft.com] or [www.ald-holcroft.com].