Hot Isostatic Processing in Todays Market

From limited user beginnings and high costs, Hot Isostatic Processing (HIP) has become a user- friendly addition to the foundry and powdered metal industries. HIP costs are now low enough that the process can be incorporated into the cost of the part, just like heat treat, and scrapping out of parts should become a thing of the past. There is a definite need to casting manufacturers to re-evaluate the cost and value of Hot Isostatic Processing. Today, the cost of HIP is at an all time low.

Today, the majority of the HIP capacity in the United States is used by the casting industry. HIP is most commonly used because of specification requirements imposed by the aerospace Prime Contractors. They incorporate HIP requirements into the production process because they can gain fatigue strength, eliminate porosity, minimize scatter and gain higher yields.

Designers and purchasers of metal castings find themselves increasingly under scrutiny for improved cost and performance demands. To keep up with the increasing demands on quality of design and performance, while being restricted to substantial reductions in total costs, design engineers are being asked to sacrifice one asset for another, i.e., strength, weight, service life and/or other consideration may be forfeited to minimize costs.

One of the best ways to save time and money is by improving or eliminated the scrap rate problem. By incorporating **Hot Isostatic Processing** as part of the manufacturing process, casting manufacturers who use **HIP** are experiencing greater freedom in producing precision and complex castings,. Production yields are increased while improving mechanical properties tensile and elongation properties, and fatigue life.

Hot Isostatic Processing was first introduced in the mid - 1950's for relatively small and specialized applications. In the 1960's the first studies were conducted for aerospace and commercial applications. The 1970's experienced the first toll HIP operations. During these years, high-priced limited the use of HIPing to high-ticket items in the aerospace and commercial industries. HIP was costly; fifteen to twenty dollars a pound prices were not uncommon. Cycles with special requirements would drive the load prices even higher.

*The **HIP** process subjects components to the simultaneous application of heat and high pressure in a inert gas medium. The pressure is uniform in all directions or isostatic. Using Hot Isostatic Pressure, the material is changed, in simple terms, to a plastic state, which collapses the voids. The clean surfaces of the void bond together making*

components or parts stronger. In most cases the voids that were collapses do not change or alter the shape of the parts or components

With the advent of toll HIP and the realization that more intricate and larger castings could be made with properties much the same as wrought and forged products, the demand for larger size units became apparent. The one consumer that could justify the larger capital expense for this equipment was the aerospace industry. This industry made the investment, allowing more cast prices to be used in more application. Soon, other like the oil, maritime, and chemical industries began to see the value of the HIP process. Consumers began to see prices decrease into the eight to twelve dollar per pound range. This was definitely a move in the right direction but there were still limits on which companies could afford the process.

In the 1980's toll HIP facilities were working with single customer loads and larger batches of only one or two different parts. This was beneficial for the large foundries holding large contracts; however, second and third sources with small quantities were forced to wait for openings in the unit and the schedule. Also, they did not see the same prices as the high volume user. The late 80's saw new players like the automotive and powdered metals industries enter the market. These new players helped drive the cost of HIP to more user-friendly prices because large quantities and sizes were being produced thus maximizing the volume of the larger units now coming on line. Prices were now moving into the five to seven dollar per pound range. The HIP industry continued to move towards affordability for all potential users when we were faced with a new wrinkly.

JIT (just in time) became the preferred method of delivery for most of the prime contractors. JIT presented a unique situation. Most larger users of HIP were now required to deliver smaller quantities for the same products while still requiring the same or better turn time. HIP Customers were no longer able to wait for full loads in the HIP cycle. The answer was found in batching parts or **Piggybacking** many small quantities from assorted customers into one cycle.

Today, the cost of HIP is at an all time low for materials that can be bulk loaded (piggybacking of parts), either by nesting together well or by supporting additional weight of other parts loaded into the vessel. Materials, cycle time, temperature and pressure are matched up into loads that are common to various customers. This is the break that all the smaller users of HIP need. Piggybacking allows the low volume user to move onto the same playing field as the larger consumers. Piggybacking also insures that the large consumer gets the turn-around time needed on smaller batches of parts. Concurrently, all consumers see the pricing continue to move downward because it becomes easier to fill the volume of the furnace. Piggybacking of parts allows flexibility in pricing, using either size or weight.

Reducing turn-around time and price is still a majority priority in the industry. Maintaining an open and efficient relationship between the casting house and HIP facility

can eliminate speed bumps. Communication has a tremendous impact on both turn time and pricing in three ways;

First, there is scheduling. A simple phone call can cut days off the turn time. Knowing what parts are in transit allows the HIP facility to set-up HIP cycles and round up other material to fill the cycles quickly. 'I can't tell you how much easier life become for all concerned when the HIP scheduler knows what is going to happen on any given day or shift and the customer can feel confident that his parts are running and not sitting on the floor'.

Second, the next biggest issue to hamper the turn0around time is the wide diversity in requirements mandated by the end use in regards to temperature and cycle time. If during the bid process the casting house is communicating the HIPer, common cycles can be offered which in turn is rewarded by the best pricing and turn time,. When an RFQ goes back tot he customer and price and time differences are compared, the best price and time usually win out over a locked specification requirement. At least, the end-user is free to make an informed decision.

Lastly, there can be huge delays caused by incomplete paperwork, lack of paperwork and the failure to send the test material required. the HIP customer needs to understand what requirements of the specification on the purchase order are.

In short, the lower price and quicker turn times are easily achieved with a few phone calls, e-mails or faxes.