Forehearth selection considerations

With a lifetime's involvement in the world of forehearths, John McMinn admits to a fascination with forehearths and how they operate.

Forehearth Services has conducted forehearth audits and troubleshooting on all mainstream, as well as some slightly more bizarre systems. These technical audits identify exactly how individual forehearth designs operate under production conditions, how they perform with different glass colours, how fast they react to temperature variations, which design provides greater gob temperature and tonnage ranges etc and crucially, what steps need to be taken to return the systems to optimal performance.

A commitment to preserve client confidentiality means the company neither could nor would share the results of audits or individual contracts with any third party. However, it is fair to say that the operation and capabilities of individual forehearth designs are known and it is this knowledge that will be shared here.

There are different reasons why glass companies choose which forehearth design to adopt for their production. Among these are cost, comfort with existing forehearths, concerns about the gamble of trying a different technology and the relative persuasive skills of individual forehearth sales people.

Figure 1: Ensuring maximum thermal efficiency.

MATCH THE SOLUTION TO THE APPLICATION

There are more forehearth 'solutions' available today than at any other time, all claiming to offer optimum conditioning power. After years of designing and studying individual forehearth systems, I can tell you quite categorically that some do, others do not and most are somewhere in between!

Imagination and the presence of patents have produced an interesting, sometimes fanciful array of forehearth designs. But does the glassmaker know which is the best and which should be avoided?

In fact, it is more complicated than this simple choice. Apart from the issue of whether or not the forehearth design actually works like the sales person promised, the choice of design should reflect the type of production for which it is intended. The production requirements of glass manufacturers are as diverse as the products they make. The needs of tableware production are significantly different to those of quad gob NNPB, for example. It is vital to match the solution to the application.

The choice of forehearth is difficult for other reasons too. The majority of suppliers offer visually different superstructure designs. This normally avoids patent infringement and differentiates between competitive systems. However, in a further attempt to maintain technical differentiation, forehearth suppliers muddy the water somewhat in their choice of subsystems (combustion, control etc) supplied with the forehearth.

The major suppliers, for example, all offer different combustion technologies, which, incidentally, in terms of performance, operation and maintenance are substantially different.

What if you like an individual forehearth but for a variety of reasons, prefer an alternative combustion technology? It is possible the forehearth supplier will concede to the user, specifying different control and combustion configurations but of course, if the overall result in terms of forehearth performance is below expectations, it will inevitably be due to the user-specified equipment. So it is a choice of either preferred technology or supplier performance guarantees.

FOREHEARTH-DISTRIBUTOR DESIGN LINK

Linking forehearth design with distributor design is not as simple as it may appear. As with forehearths, distributor design and performance also vary greatly between suppliers. In fact, the operation of good forehearths can be greatly compromised by the choice of distributor.

Distributors are generally sourced in one of two ways, either the furnace supplier supplies the furnace and distributor or the forehearth supplier supplies the forehearths and distributor.

It is possible that forehearth supplier A offers the most appropriate design for a particular production requirement but supplier B has the most appropriate distributor design. In such situations, it would obviously be better to source from both. The problem, of course, is knowing what to source from A and what from B.

PERFORMANCE

In terms of performance, different forehearths and the subsystems supplied with them vary significantly. The potential user needs to know
the following before making a choice:

- Which forehearth design would be expected to provide the highest gob temperature and tonnage range?
- Which system performs best at job change time?
- Which forehearth design produces the fastest reaction time?
- What are the relative susceptibilities to blister production?
- How easy is it to recalibrate the system?
- How often does the system need recalibration?
- Which combustion system provides the most stable and linear heat input?
- Which are the best temperature sensors for the application?
- Which cooling system is most suitable for specific applications?
- What are the maintenance requirements of one system compared with another?
- Which systems are more susceptible to refractory failure?
- What thermal efficiency values can be expected? As shown in figure 1, this is not only a function of forehearth design but also clever placement of the tri-level thermocouples on which the efficiency is calculated.

Glass producers are invited to consider carefully where best they can obtain answers to these vital questions. ■

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