Efficiency, emissions, quality and flexibility

Irrespective the glass product being made, most furnaces generally consist of a melter, refiner/forehearth and cooling sections. As Jessica Irons explains, there are solutions along the process for helping to reduce emissions and improve efficiency, while keeping product quality intact.

Glass manufacturing is a complex and challenging process that requires a lot of energy. With ever-increasing focus on reducing emissions and improving efficiency in industrial applications, glass factories have a lot to gain from even small improvements in efficiency and emissions performance.

Of course, much of the energy intensity comes from the need to maintain temperatures high enough such that product quality is not compromised. Thus, as environmental regulations become even more stringent, the glass industry is very interested in improved combustion techniques, which reduce NO_x formation while maintaining glass quality.

No matter the product being made, most furnaces generally consist of the melter, refiner/forehearth and cooling sections; and there are solutions along the process for helping to reduce emissions and improve efficiency, while keeping product quality intact.

Reducing NO_x and improving efficiency

In the melter, using a burner technology called staged combustion coupled with oxy-fuel will help improve both emissions and fuel efficiency. The higher flame temperature of oxy-fuel firing increases the available heat and radiant heat transfer to most applications. Typical improvements include increased thermal efficiency, increased processing rates, higher product quality, reduced flue gas volumes and reduced pollutant emissions.

Honeywell Oxy-Therm FHR glass burners (figure 1) utilise a patented oxygen staging technology to reduce the formation of NO_x in high temperature furnaces. Through deep staging of the oxidant flow, NO_x is controlled to levels typically lower than conventional oxy-fuel burners. By reduction in total flue gas volume, the total mass of NO_x created is often lower than air-fuel firing.

Figure 2 shows an Oxy-Therm LE staged oxygen, conical flame burner.

In regenerative melting furnace applications, the best available technology to improve NO_x emissions is a dual gas injection technology burner from Honeywell Eclipse called the Brightfire 200. It is designed to allow two separate streams of gas to be injected through a single burner, inhibiting the formation of NO_x and improving flame control. It was designed to improve heat transfer for lower energy use; reduce NO_x emissions; improve ease of use, set up and adjustment; and enhance flexibility in flame adjustment and performance.

In one case, using the Brightfire 200 with an under-port firing arrangement on a large float furnace, NO_x was demonstrated to be 15% to 25% less compared to other burners on end port and side port furnaces. In another application, NO_x was reduced substantially on an end port furnace, a NO_x reduction greater than 20% was realised, achieving the goal of less than 550 mg/Nm^3 required for the application. Fig 3 shows the Brightfire 200 with mounting bracket.

Figure 1: Oxy-Therm FHR adjustable staged oxygen, flat flame burner.

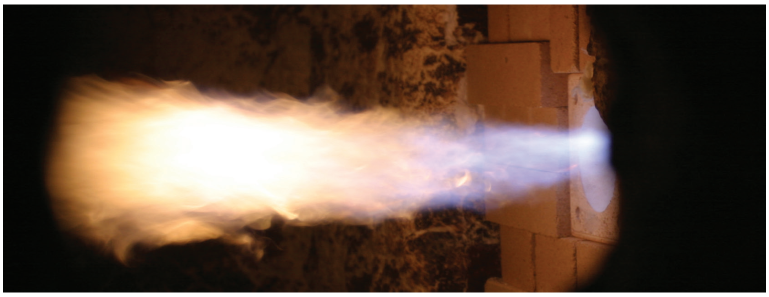

Figure 2: Oxy-Therm LE staged oxygen, conical flame burner.

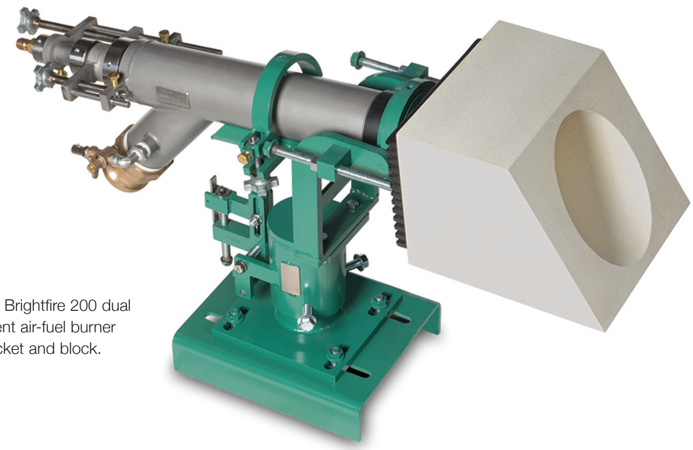

Figure 3: Brightfire 200 dual adjustment air-fuel burner with bracket and block.

Figure 4: The latest Primefire FH forehearth technology (front right) versus the old technology (rear left).

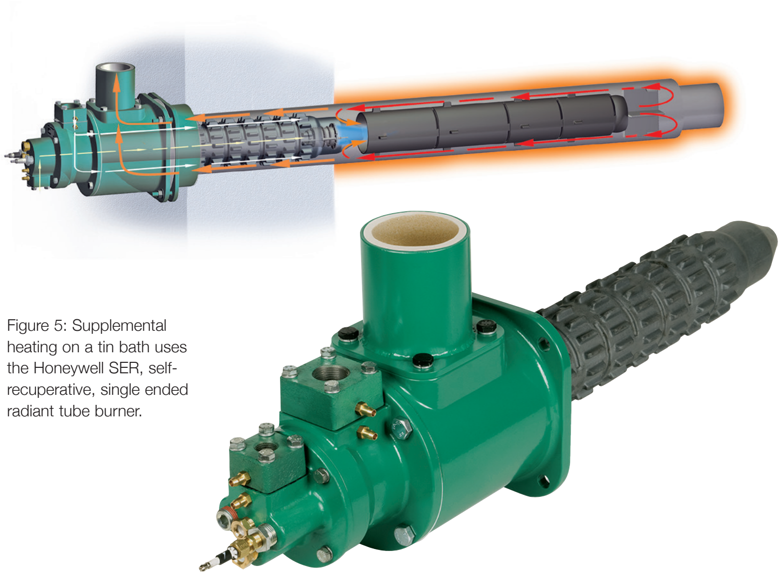

Figure 5: Supplemental heating on a tin bath uses the Honeywell SER, self-recuperative, single ended radiant tube burner.

The ability to adjust the flame characteristics and alter the location of the heat release within the melter has shown promising gains in energy efficiency. In one case involving a container furnace, the under glass electric boost was reduced by more than 10%, with a small reduction in natural gas use and no effects on production.

Next generation forehearth technology

In container and fibre glass furnaces, the forehearth is a critical step to ensuring the glass has the right temperature and consistency to allow it to be formed into special container shapes, such as wine glasses and beer bottles, or into fine fibre material used for insulation and structural components.

The key to advanced performance with a forehearth burner is having the right number of burners for the width of the forehearth channel, the appropriate capacity to ensure the glass is the correct temperature, the correct flame length to fit the chamber and the correct burner/block design combination.

The correct burner/block design combination helps ensure burner performance, reduce required maintenance and improve burner/block product life. Since a forehearth application could use up to several hundred burners, it is critical to use the latest technology available to ensure the integrity of the process and quality of the product. The PrimeFire FH (figure 4) is next generation oxy-forehearth burner technology from Honeywell. It features a patent pending burner/block combination that achieves all the above-mentioned targets with zero maintenance required and up to 50% longer life than old technology. Additionally, exact emissions performance may vary, depending on application but oxy-fuel firing versus air-fuel firing has yielded an improvement of 80% in emissions reductions and 60% improvements in fuel efficiency.

Figure 6: Heat up burner.

Maintaining quality with edge heating

In a float glass furnace, one of the key steps is the tin bath, where the glass floats on a bed of molten tin to allow a seamless, flat, high quality sheet of glass to be produced. One area that is more difficult to control is the edge, where temperatures can cool more easily. This can lead to glass quality concerns and in the worst case, production shutdown to allow additional heating in the form of electrical heating elements to be added to the furnace.

However, with the use of an efficient, self-recuperative radiant tube burner, a glass manufacturer can use a different form of supplemental heating that can be installed while the furnace is operational and help to significantly improve temperature uniformity, even at the edge and prevent a production stop and prevent product loss, as shown in figure 5.

Complexity and flexibility

In float glass applications, additional heat is sometimes needed in the working end of the furnace. This can add more complexity to the manufacturing process, so a packaged, high velocity ThermJet burner from Honeywell can be mounted onto a cart with integrated controls and combustion air and kept on site to provide heat up when needed or assist with regenerator sulphate cleaning. This burner features a special cone, mounted on a cart with a full control panel, blower, hoses and safety equipment so it can be easily transported around the plant to meet the needs of the factory.

The system (figure 6) includes air and gas hoses to remotely mount the burner away from the combustion control cart. The combustion air blower and natural gas systems, including flame monitoring and ignition components, are included on a cart. This solution differs from the typical solutions provided by contractors for heat up, which requires 24/7 manned monitoring and may not have a full range of safety functions.

Conclusion

In the glass industry, the development of flexible heating systems with minimised energy consumption and emissions has become the focus of attention due to rising energy costs and decreasing emission limits, as well as higher product quality requirements and changing production demands.

The advent of efficient, high velocity industrial burners enables glass manufacturers to optimise heating applications ranging from edge heating, to working end/refiner and furnace heat-up.

Oxy-fuel burners, deeply staged burners, dual fuel inlet air-fuel burners and high velocity furnace burners represent the latest advancements in industrial burner technology, including improved heat transfer for lower energy use; reduced NO_x emissions; ease of use, set up, adjustment and maintenance; and enhanced flexibility in flame performance. ●

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