Dave Fontes demonstrates hydrogen firing of an oxy-fuel flat flame staged burner in its testing-lab furnace.

Hydrogen combustion feasibility for glass industry burners

Dave Fontes* describes how Selas staff recently outlined the effectiveness of its burner technology to glass industry partners when firing 100% hydrogen.

In the ongoing quest for sustainability, the glass industry is increasingly focused on reducing carbon emissions. Selas Heat Technology, an industrial burner manufacturer, is at the forefront of this movement.

Recently, Selas engineers conducted demonstrations for its glass industry partners, showcasing the efficacy of its burner technology when firing 100% hydrogen.

These demonstrations not only highlighted Selas' commitment to staying ahead of its customers' decarbonisation efforts, but also provided valuable insights into the performance and adaptability of their burners under various conditions.

Many Selas industry partners were already in the US for the annual Conference on Glass Problems in Columbus, Ohio, so it seemed an opportune time to invite some of them to visit Selas's lab in nearby Streetsboro for a demonstration of the burners' ability to burn hydrogen.

Over the course of two weeks, three different glass industry partners from Asia, Europe, and USA were shown glass melter burners, forehearth burners, and downstream process burners.

The following burners were tested: Selas 05000 Oxy Flat Flame Staged Burner (293 to 1465 KW); Selas 02500 Oxy Flat Flame Staged Burner (146 to 732 KW); Selas 00500 Oxy Conical Flame Burner (36.6 to 146 KW); Selas 0030 Oxy Forehearth Burner (0.8 to 8.7 KW); Selas 0100 Oxy Forehearth Burner (11.6 to 29.3); Selas Superflame Series 250 - High Velocity Air Fuel Burner (0.25 MMBTU ,73 kWh); and Selas Package Burner PC Series: 0A (0.25 MMBTU, 73 kWh).

Flat flame staged burners

The oxy-fuel flat flame staged burners (***Pic 1***) are designed for high-efficiency combustion. They are commonly used in glass melting furnaces where precise temperature control and uniform heat distribution are crucial.

During the first trial of both the 2500 and 5000 model burners, the complete firing range was demonstrated, including staging from 0 to 50%.

Flame length and width were recorded during the trial. It was observed that staging was ineffective at minimum firing with these burners.

The close-up photo of the H_2 flame shows the clear centre core (***Pic 2***) as the hydrogen has no carbon and soot generated with the flame.

The flame is evenly distributed in the block with no overheating evident.

Conical flame burner

The oxy-fuel conical flame burner was demonstrated at low, mid and high firing.

Staging with hydrogen firing with this burner is effective up to 30%. Beyond that point, additional oxygen staging results in expansion of the hydrogen, to the extent that it begins impinging upon and overheating the burner block.

The conical flame burner is still appropriate for hydrogen burning below 30% oxygen staging, making it a suitable burner for smaller furnaces.

One glass partner is planning to apply the conical flame staged burner in this manner for its system with natural gas.

Oxy-fuel forehearth burners

For the 0030 Oxy Forehearth Burner, prior experimentation had shown that minor modification was necessary for effective hydrogen combustion, so this burner was demonstrated with a new oxygen nozzle and new tapered gas nozzle to accommodate hydrogen firing.

After the nozzle exchange, the burner proved to be quite effective throughout most of the firing range, only reducing peak firing by a small amount.

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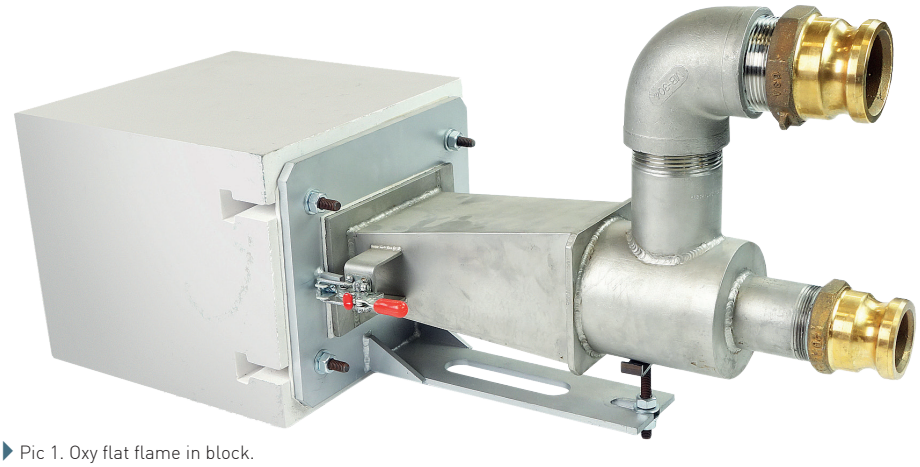
Also shown was the 0100 Oxy Forehearth Burner. A new oxy nozzle was used that is slightly larger than the nozzle for the 0030 Burner. This nozzle, along with a smaller gas tip, was able to effectively fire with hydrogen from about 40 to 100 SCFH (11.6 to 29.3 KW) natural gas equivalent.

The modified oxygen nozzle and tapered gas nozzle was able to accommodate hydrogen firing.

The current nozzles were found to be less flexible with hydrogen, as the hydrogen expansion could overheat the burner block or the opposite wall. The new nozzles proved effective, with only a slightly reduced firing range.



Pic 1. Oxy flat flame in block.

Air-fuel burners

In addition to the aforementioned oxy-fuel burners, two air-fuel burners were also demonstrated: the Selas Superflame and a Package Burner.

The Superflame High Velocity Air-Fuel Burner is designed for use in a variety of applications and industries, including tunnel kilns and metal applications. Lower velocity versions have been used in glass refiner applications such as binder ovens.

The PC Package Burner (***Pic 3***) is ideal for low-temperature applications of 100 to 500°C. In the glass industry these burners are used in drying applications, including ovens for binder drying in wool fibre and drying ovens for E glass.

Trials of both air-fuel burner types showed full functionality when burning hydrogen.

Conclusion

These demonstrations validate the feasibility of hydrogen firing with the selected Selas technology. In most instances, this can even be achieved without modification, or, in the case of the oxy forehearth burner, only the minor modification of changing out the oxy and gas tips.

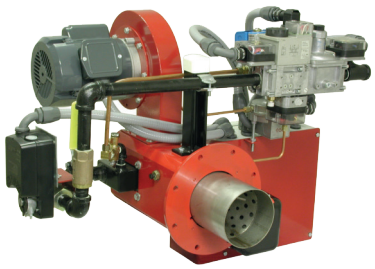
The demonstrations conducted by Selas provided clear evidence of the efficacy of its burner technology in supporting the glass industry's decarbonisation efforts.

By successfully firing 100% hydrogen, Selas showcased the adaptability and performance of its burners under various conditions. The data collected and shared with industry partners will be instrumental in planning future transitions to more sustainable practices.

As the glass industry continues to pursue sustainability, Selas Heat Technology remains a dedicated partner in these efforts. The recent demonstrations not only highlighted the potential of hydrogen firing but also reaffirmed Selas' commitment to innovation and collaboration.

By understanding the goals and needs of their strategic partners, Selas is well-positioned to support the industry's transition to a decarbonised future. ■

Pic 2. A view of the hydrogen flat flame in the Selas testing-lab furnace.



Pic 3. A PC Package Burner.

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