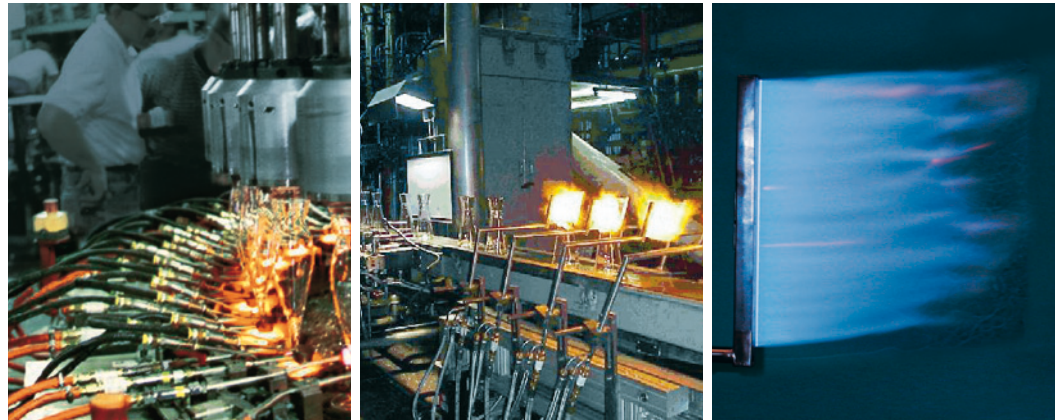


## HYDROPOX®. Optimal glass surface treatment with pre-mixing hydrogen/oxygen burners.



**Challenge** Glass manufacturers from various segments face constantly rising quality demands, especially in art and tableware, container glass/flacons, but also in the flat glass segment. They are looking for technologies that allow for a machine-made glass surface with the finishing quality of hand-crafted glass. At the same time, these manufacturers are under growing pressure to cut production costs and continuously increase process efficiency (examples are, amongst others, the replacement of acid polishing and the minimisation/elimination of mechanical post-processing during glass surface treatment).

**Solution** In order to meet the demand for higher productivity and quality, and in order to accelerate cycle times at the same time, Linde has developed pre-mixing burner technologies, which are based on oxygen and hydrogen or on natural gas and oxygen or on hydrogen, natural gas and oxygen.

The process parameters of these burner technologies, such as flow velocities and heat transfer rates, working distance of the burners, flame shapes etc., greatly enhance the efficiency of glass surface treatment as well as fire polishing and related processes. The experience of Linde, joint research and development projects with universities and industrial use have demonstrated again and again the high performance of pre-mixing burner technologies.

Linde offers the full range of pre-mixing and post-mixing burner technologies:

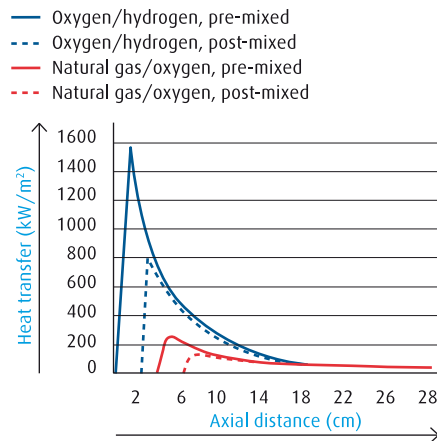
- HYDROPOX®: Pre-mixing hydrogen/oxygen burner technology
- HYDROPOX®-C: Pre-mixing natural gas/oxygen or hydrogen/natural gas/oxygen burner technology
- LINFIRE®: Post-mixing burner technology with all mediums

**Technology** The HYDROPOX® and HYDROPOX®-C solutions from Linde leverage the increased thermal efficiency of pre-mixing burner technologies and improve the heat transfer due to the higher flow velocities of these burner technologies and the shorter distance to the product. The heat transfer rates of pre-mixed hydrogen/oxygen flames are approximately 2 to 3 times higher than those of pre-mixed natural gas/oxygen flames. The heat transfer rates of pre-mixed natural gas/oxygen and hydrogen/oxygen flames are approximately 6 to 8 times higher than the heat transfer rates of post-mixing burners with the same mediums.

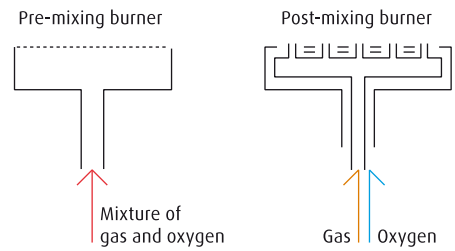
Basically, the HYDROPOX® and HYDROPOX®-C burner control systems always consist of the following components: an electrical control unit, a central mixing unit with an exact pressure regulation system and a gas ratio regulation system, an electropneumatic burner control unit and the corresponding number of burner flow trains and burners.

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### Axial distribution of the heat transfer for hydrogen/oxygen flames and natural gas/oxygen flames



### Fundamental difference between pre-mixing and post-mixing burners



#### Benefits (HYDROPOX® and HYDROPOX®-C)

- Increased profitability due to considerably higher glass quality (surface)
- Higher productivity thanks to shorter cycle times
- Fully developed and proven technology offers maximum safety
- Exact and reproducible conditions for every glass product
- Comprehensive fire polishing of flat glass

#### Specific benefits of HYDROPOX®

- Elimination or minimisation of the surface roughness
- Complete removal of pressing burrs and sharp edges on glass items
- Complete elimination of structural marks on the glass surface
- Comprehensive high-grade finishing of glass items (e.g. flacons) to enhance brilliance
- Removal of cold and flow waves
- (Fire) polishing of decorative surfaces with very deep reliefs and thin-walled glass items (e.g. 1–1.5 mm)
- Prevention of deformation due to very short polishing time (approx. 2–3 seconds)
- Precise heating of specific points

#### Specific benefits of HYDROPOX®-C

- Comprehensive high-grade finishing of thick-walled glass items (e.g. fire polishing of lead crystal items)
- Removal of pressing burrs and sharp edges on glass items
- Removal of the “orange peel” on pressed lead crystal items
- Cost and brilliance benefits compared to acid polishing
- Prevention of deformation due to very short polishing time (approx. 5–15 seconds)
- Removal of cold and flow waves
- Polishing of decorative surfaces with very deep reliefs

#### Features (HYDROPOX® and HYDROPOX®-C)

- Pre-mixing burner technologies
- Electropneumatic burner control units
- Water-cooled/medium-cooled burners
- Standard burners/customised burners/special burners
- Materials: brass, stainless steel

	HYDROPOX®	HYDROPOX®-C
Gases used	Hydrogen plus oxygen	Natural gas plus oxygen
Typical areas of application	Surface treatment/fire polishing of thin-walled, machine-made glass items	Surface treatment/fire polishing of thick-walled, machine-made glass items
Working parameters		
Working distance	Approx. 10–20 mm	Approx. 40–100 mm
Run time	Approx. 2–5 sec per item	Approx. 5–10 sec per item

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