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Glass SERVICE NEWS

Can the glass industry meet Net Zero targets?

"Considerable challenges face glass manufacturers, to both meet the requirements of reducing emissions, and to remain internationally competitive whilst doing so."

N.3 YEAR 2022
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Editorial

Advancing toward glass industry Net-Zero targets.

by Fulvio Puccioni
CEO Glass Service

As the International Year of Glass continues, Glass Service News provides details of the latest updates and innovations within the glass manufacturing industry. This third edition includes articles on sustainability and how businesses can use new environmental initiatives and standards to their advantage. In addition, we have provided important information about the manufacturing process and how to improve your operations.

We have included an article about how to detect and prevent the formation of bubbles, a common problem that is often difficult to resolve. Our top engineers have provided expert analysis to identify and avoid this problem in various scenarios. Continuing on the theme of sustainability, we explore the developments being made by Glass Service to reduce our customer's CO_2 emissions. This article details how improvements can be made and explores the financial benefits of doing so. Further exploration of sustainability is examined regarding recycling, detailing the market in recycled glass and how most manufacturers are not taking advantage of it. We also consider one of our client's innovative approaches to recycling and how they seek to be the most innovative and sustainable supplier of brand-build packaging solutions.

Glass Service attended this year's Glassman Latin America event, bringing together over 500 companies to discuss technical and commercial developments in the region. We look at how this occasion brought together peers and experts in the first B2B event for the region's industry in several years, and the exciting prospects for growth in Latin America. We have a fascinating interview with the director of Poltava Medical Glass, a Ukrainian company whose plant has been in existence for 90 years. The interview provides insights into the transition from the Soviet Union to a market economy, and why they have chosen to work with Glass Service.

Finally, we have an interview with Fulvio Puccioni, the president of Glass Service, who discusses how the glass manufacturing industry is evolving. Fulvio details how Glass Service is working with our clients to increase quality, efficiency and working practices; with innovative new technologies that have been developed by Glass Service thanks to our industry-leading research and development scheme. ■

Identifying and Eliminating Bubble Formation in Danner Lines

Glass tubing is used for several critical applications, from medical storage vials, ampoules, cartridges and more. Many factories focus exclusively on fabricating glass tubes rather than creating various glass products. Focusing on one specific task can be cost-effective, allowing a factory to streamline operations, reducing the need to stock other glass fabricating machinery, and becoming more efficient and skilled in this one product.

In recent years, many glass producers have begun manufacturing vials, ampoules, etc., internally to reduce waste in a process known as converting. They are able to cut out defects and utilise the remaining part of the tubes, something that is not possible when selling the tubes as raw materials to third parties.

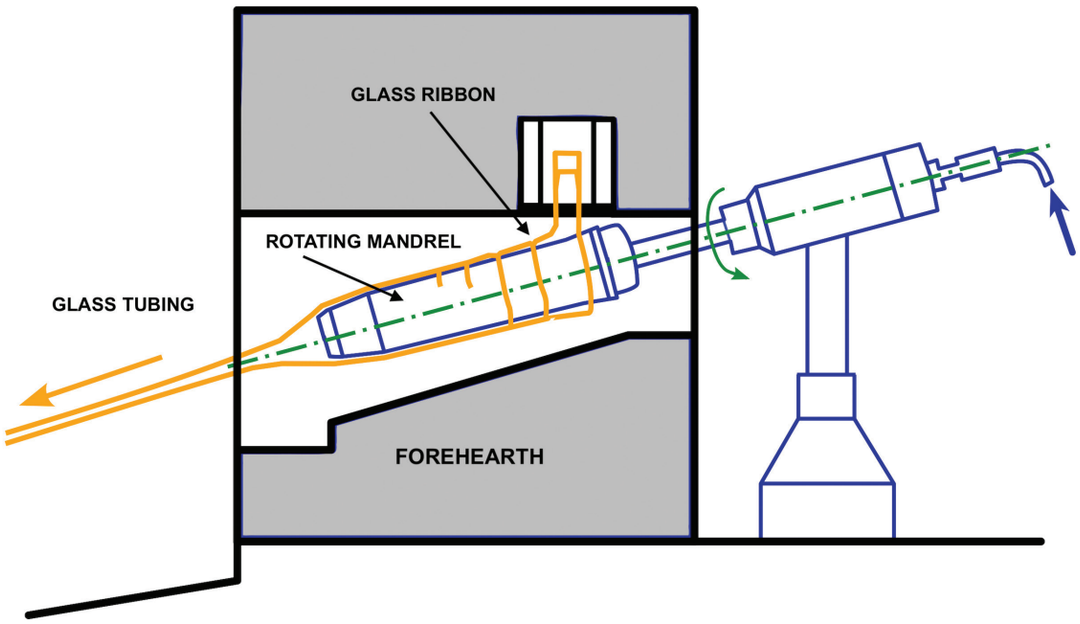
In the glass manufacturing industry, there are two main processes used to create tube glass:

Danner Process - is a dynamic process and was developed for the continuous production of glass tubing and rods. Melted glass flows in the form of a ribbon from the furnace forehearth, through the “lip block” and over a rotating hollow mandrel. The tubing is then drawn over a line of support rollers by a drawing machine. Controlling the air pressure through the mandrel and the rate of drawing controls the diameter and wall thickness of the tubing. Tubing is then cut off to required lengths.

Vello Process - is a static process utilising gravity to create a glass flow from a furnace forehearth into a bowl in which a hollow vertical mandrel is mounted (or a bell surrounded by an orifice ring). Tubing is formed by blowing air through a mandrel with a hollow tip. Glass rod is produced by using a mandrel with a solid tip. The glass then flows through the round space between the bell and the ring and travels over a line of rollers to a drawing machine.

In this article, we will concentrate on potential defects and bespoke solutions within the danner process.

Melted glass ribbon



Tube glass forming by Danner process. Credit: VMH, CC BY-SA 3.0 via Wikimedia Commons

STAGES OF THE DANNER LINE GLASS TUBE FABRICATING PROCESS:

1. This manufacturing method begins in the standard way, heating glass in a furnace until it is soft and pliable but not fully melted.

2. The glass then falls in a ribbon to a refractory sleeve, which is turned by a hollow shaft. The glass ribbon becomes wrapped around the sleeve, creating a smooth layer of glass which is then sent through a drawing machine.

3. A blowpipe fills the centre of the glass with air, creating the tube shape, and the drawing machine pulls the glass through the process, as the tubing is shaped by the form of the mandrel until it takes on the desired properties of the design. Tubing is formed by blowing air through a blowpipe with a hollow tip, and rods are made using a solid tip on the shaft. The combination of machine pull and air pressure gives you the required thickness and diameter.

4. The tubing is then drawn over a line of support rollers, known as the drawing line, by a drawing machine situated up to 70m away. The given range of size is based on the diameter of the refractory sleeve. Variations within the range are obtained by adjusting the temperature of the glass, the rate of flow, the pressure of the blowing air, and the drawing machine's speed; the final tube dimensions are determined once the glass cools through its setting point.

The combination of these stages requires delicate process control - with precise temperature, air pressure and speed management and coordination. Partially as a result of this complexity, quality defects can manifest quickly and require fast analysis and the identification of the best corrective actions based on the specific type of defect found.

Glass Service has an extraordinary amount of experience in glass tubing manufacturing process controls and has a clear understanding of where issues might arise and how to solve them.

DEFECTS IN THE GLASS TUBING

Bubble defects are a common phenomenon in all glass production. In the case of the danner process the bubbles, due to the machining (spindle movement and air), stretch into airline defects.

THE CAUSES OF AIRLINE DEFECTS IN GLASS TUBING PRODUCTION:

1. Bubbles are already present in the glass before exiting the furnace and are easily recovered by ribbon sampling:
    - Glass coming from the furnace due to an incomplete refinement of the glass
    - Bubbles of electrical origin due to red-ox reaction
    - Bubbles originated by sudden temperature variation or linked to mechanical instability, which promote the release in the glass of low soluble gases, the well known Reboil phenomenon

2. Bubbles not present on the ribbon of the glass:
    - Bubbles formed at the point of contact between the ribbon and the mandrel - are generally due to an incorrect speed of the mandrel itself or to a significant sudden variation of the pull. In general, unstable conditions which can affect the relative position of ribbon refer to mandrel
    - Bubbles originated by the contact between glass and metallic nose of the mandrel

HOW TO IDENTIFY AND DIAGNOSE DEFECTS?

In case of high levels of rejection caused by large bubbles or unacceptable large numbers of bubbles/seeds in the glass, it is important to find the origin/cause of these bubbles.

Important data points for diagnosing defect origin:

- size of bubbles,
- distribution / location of bubbles in the product,
- internal bubble pressure and gas composition,
- base level and type of bubbles during normal production,
- sometimes bubbles contain deposits (often very small droplets of condensation products) that can be observed by using light microscopy.

Diagnosing defects in the glass begins by observing the position, length and thickness of the bubbles. The size and position of the defect in the tube can indicate how and why the defect is occuring. For example, the defect may be located closer to the internal or external surface. Internal defects are the “youngest” ones therefore forming closer to the exit point.

In general it is not possible to accurately define the origin of the bubble just by observing the position, length, and thickness; the main investigation technique involves the analysis of bubble contained gas. In this way, mass spectrometry or gas chromatography can be used to measure the internal pressure and analyse the gas mixture present in the bubbles to address the main probable cause.

Gas in bubble	Source
H_2O	• Dissociation of hydrated raw materials or in raw materials pores • Absorption from furnace atmosphere
CO_2	• Dissociation of carbonates • Oxidation of carbon or organic impurities • From furnace atmosphere or lapping bubbles atmosphere feeder
O_2	• Dissociation of fining agents • Inclusion of air or from furnace atmosphere • Reboil of fining agent (antimony, arsenic fining) • Electrochemical reaction refractory or Electrolysis (in spout area)
N_2	• Inclusion of air or lapping bubbles furnace/feeder atmosphere • Dissociation of nitrates • Oxidation nitride dissolved under reducing conditions (no argon!) • Oxidation of nitrides (e.g. from refractories)
SO_2	• Dissociation of sulfates / sulfate reboil / limited SO_2 re-absorption • Absorption from furnace atmosphere
Ar	• Inclusion of air (often Ar:N_2 = 1:90) / lapping bubbles
$CO_2 + N_2$	• Different sources: e.g. outgassing of refractory

IDENTIFICATION OF AIRLINES

Closed and open airlines are instantly recognisable in the final product. Closed airlines are within the thickness of the tube, whereas open airlines are found on the inner surface of the tube.

Electrolytic cells that produce oxygen bubbles are most often formed close to the forming area mainly if platinum is present as with, for example, electrodes, platinum lip blocks, or platinum feeders.

Open airlines are formed at the nose of the mandrel near the detachment of the catenary due to chemical interaction between glass and the material of the nose that is, in general, stainless steel. The contact between those 2 materials and the relative high temperature can create an electrochemical cell and a redox reaction which involves the production of tiny oxygen bubbles, which have not enough time to rise up in the glass mass and remain trapped on the inner surface of glass tubing, resulting in an opening on one side.

ELIMINATING OPEN AIRLINES

The implementation of conditioning circuits can remove the formation of bubbles by forcing them to a dedicated area where they are easily removed, generally the chosen area is the overflow.

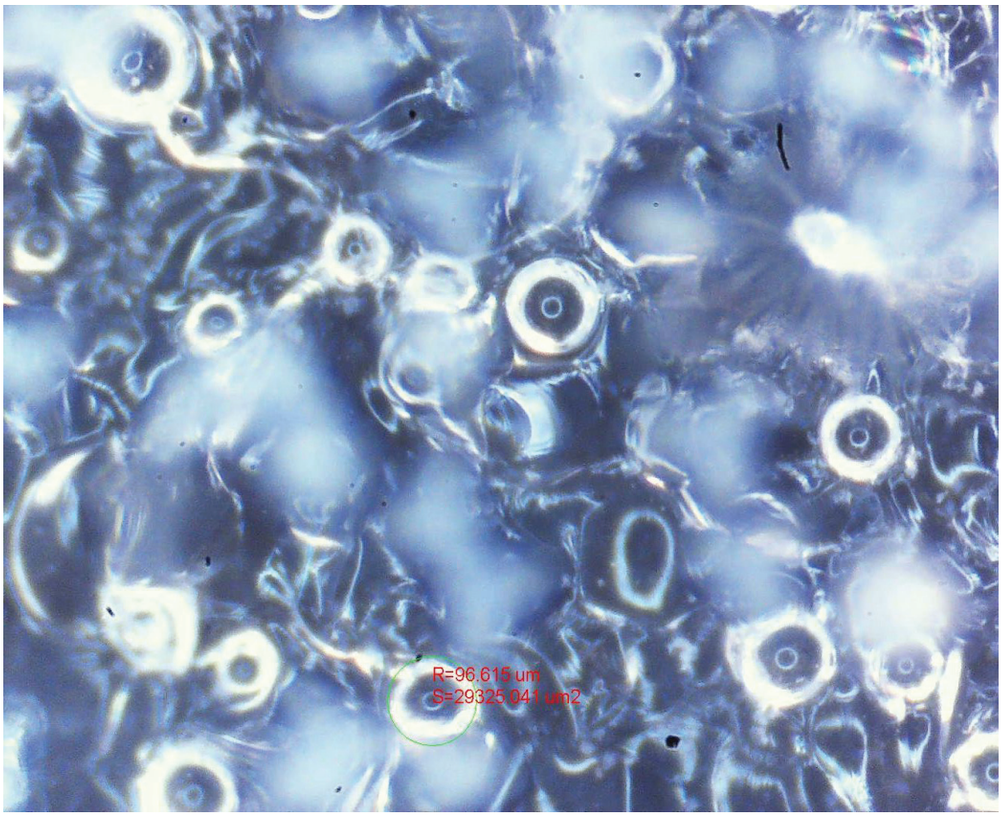
The mandrel usually acts as an anode (positive); however, with a conditioning circuit, the mandrel is brought to a lower potential transforming it into a cathode (negative). The overflow becomes the anode; thus, bubbles are no longer formed in the mandrel but in the overflow.

BUBBLE FORMATION BETWEEN THE RIBBON AND MANDREL

In the Danner process one of the main sources of bubble formation is the contact area between the ribbon and the mandrel. This specific kind of bubbles are long and wide airline defects, easily visible on the glass tube, but which are not present on the ribbon. These bubbles originate with entrapped air and generally reveal a high pressure and the content gases are N2/O2/Ar in correct ratio.

Several different phenomena can cause these defects—the following details the causes and actions to be taken:

1. Height from the lip block to the mandrel: The geometry of the ribbon when it touches the mandrel can cause entrapped air when the ribbon is too tight. The standard values are 75 to 90mm, any higher than 100mm is likely to generate bubbles.
2. Distance from the lip block: This is one of the main parameters that affect the geometry of the ribbon; the typical values are between 40mm and 70mm.
3. Mandrel rpm: Decrease the rpm by 0.5 rpm/min at a time, until the phenomenon disappears. If this has not solved the problem after two hours, check the tube section to see if the airlines are forming towards the outside of the section. If this is the case, increase the mandrel rpm, and the airlines should improve after 20 minutes.
4. Mandrel angle: Unless there are low temperatures or low pull, this is unlikely to cause bubbles. However, an angle between 13 and 14 degrees is advisable.
5. Mandrel wear and surface of the mandrel: The point of contact between the ribbon and mandrel is of paramount importance. If the mandrel is worn, then a light layer of showcase can form on the border between the back and ribbon, which can trap air. Moving the mandrel back by 4mm or 5mm should solve the problem.
6. Pull (kg/h), ribbon, and glass temperature: Constant geometric movement vertically, laterally, and the rotation of the mandrel are fundamental elements that must be correct. If the quantity of glass, the temperature, and the impact zone of the mandrel are incorrect, then bubbles are likely to form.



Defects in the ribbon

CHECKS TO PREVENT BUBBLES IN THE RIBBON

As previously explained, bubbles already present in the ribbon are not specifically linked to the Danner process, but are typical of glass production independent from the type of glass; it is possible to say that they are intrinsically linked to glass production.

To prevent the presence of bubbles in the ribbon in general it is necessary to maintain, as much as possible, the stability of the glass production (melting and fining) process in following ways:

1. Check the stability of the batch in terms of Raw Material chemical composition and grain size.
2. Check the batch stability in terms of batch homogeneity and cullet ratio.
3. Check the stability of Cullet quality.
4. Check the operating conditions of the furnace and forehearth in terms of temperature and verify that they are operating within the nominal values.
5. Check that the overflow pull is stable and maintain a constant glass level.
6. Check the setting of the bubbles (bubbler barrier) is within the nominal values.
7. Verify the blanket position inside the furnace and the presence of a mirror surface in the last third of the melting tank.
8. Avoid thermal and mechanical instability in the last stage of the working end in the distributor and forehearth.

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ELECTROLYTIC PROCESS

Molten glass is an electrolyte conductor; oxygen can develop due to electrolytic cells being formed because different materials are in contact or immersed in the molten glass. Regardless of the temperature in the furnace, there is always a difference potential; electrodes can be affected by the same refractory material, different refractory materials, or platinum. Without a forced current, oxygen in the form of ions stops in the lower potential area (cathode) and migrates to the higher potential area (anode), releasing positive ions.

This process leads to the saturation of the electrolytes; in the event the circuit is closed, forming a continuous passage of current; the anode then deteriorates. The oxygen that forms and migrates continuously between areas with different potential can remain trapped in the glass, giving rise to airlines in the finished product. Oxygen entrapment formation can occur on the mandrel nose, mandrel surface, platinum thermocouple immersed in the glass, and the lip block (if platinum).

Although there is a greater difference potential in different refractory materials than in similar refractory materials, in both instances, the application of external voltage to the cell causes the movement of the bubbles to the cathode rather than the anode.

PARAMETERS THAT CAUSE OXYGEN BUBBLE FORMATION

1. **Anode and cathode geometry:** Where electron accumulation occurs, areas with edges are more reactive.
2. **Electrical insulation of anodes and cathodes:** Impacts the closure of the electric circuit.
3. **Glass temperature:** The higher the temperature, the more conductivity increases oxygen mobility. Higher temperatures also trigger a short circuit, increasing the current and the likelihood of bubbles forming.
4. **Cathode/anode temperature:** Influences the chemical reaction.
5. **Cathode/anode material:** Changes the resistance of the circuit.
6. **Ionising properties of the combustion flame:** Especially when in contact with the glass, there is a higher likelihood of closing the circuit.
7. **Glass composition:** Impacts the conductivity and oxidising properties.
8. **Air composition:** The cathode can close the circuit either in the muffle or close to the anode.

METHODS OF ELIMINATING ELECTROLYTIC BUBBLES

1. Electric conditioning: With an electric conditioning circuit, it is possible to either prevent the formation of electrolytic cells or divert the forming bubbles away from the forming region.

   By applying an external difference potential, greater and opposite to the cell, the conduct of the electrodes can be reversed to form bubbles at the cathode. A difference of potential equal and opposite to the cell will interrupt and prevent the formation of bubbles.

2. Electrical insulation of the forehearth: Insulating the refractory parts in contact with the molten glass can be achieved by flame spraying metal oxides with low conductivity, then coating the same components with a noble metal that has relatively high conductivity. Alternatively, separating the part of the forehearth in contact with the molten glass with the upper part will provide insulation.

   The part of the forehearth in connection with the molten glass should be made of refractory in Alumina, Zirconium and Silica, whereas the upper part should be built with a high level of Alumina. The separate parts also require an exclusion zone between the two, consisting of a degrading composition.

WE'RE HERE TO HELP

Glass Service has decades of experience developing and manufacturing equipment for the glass manufacturing industry, especially glass tubing. Our expert engineers can problem solve any issues you may be having, providing first-rate customer service and support. We can also offer technical training assessing our customers' quality control and internal procedures to ensure that your operation runs as smoothly as possible.

At Glass Service, we pride ourselves on providing continual service to our customers; that does not stop once your equipment has been delivered and installed. If you are suffering from any problems in your production process, please do not hesitate to contact us, and we will rectify the situation.

Pharmaceutical vial demonstrating defects in the glass

Reducing CO_2 emissions in glass manufacturing

In March 2020 the EU announced that carbon-neutrality in Europe must be achieved by 2050 (with at least a 55% reduction by 2030). The European Commission launched the European strategic long-term vision for a prosperous, modern, competitive, and climate-neutral economy on 28 November 2018. The three main areas identified that can reduce emissions are transport, building, and energy. Glass manufacturers must do their part if these targets are to be met, significant progress has already been made but more is required. Considerable challenges face glass manufacturers, to both meet the requirements of reducing emissions, and to remain internationally competitive whilst doing so.

According to the Instiut du Verre, in France over the past 50 years, there has been a 69% reduction in CO_2 emissions by glass manufacturers, though the pace has slowed since 1990 as marginal gains have become more difficult to achieve. High-temperature heat is the largest contributor to CO_2 emissions from the industry, where fuel combustion for melting accounts for 75 to 80% of CO_2 emissions.

On site team training at new furnace build, Turkey 2021

Improvements have been made in the non-furnace area of glass production, through waste heat recovery, and greater use of recycled glass. Manufacturers still mostly use fossil fuels to heat furnaces, and although there have been improvements to the efficiency of furnaces, using less energy alone will not meet climate targets.

EU CARBON PERMITS

The European Union Emissions Trading System (EU ETS) is the world's largest and first major carbon market. Launched in 2005 it is the cornerstone of the EU's policy in reducing Europe's carbon footprint. The scheme aims to achieve significant reductions through market forces by making it increasingly expensive for businesses to produce CO_2, creating incentives for industries to find alternatives to fossil fuels. So far it has been very successful, achieving a reduction in CO_2 emissions of 3.8% between 2008 and 2016, which amounted to over 1 billion tons.

The 'Cap and Trade' policy affects power stations, factories, and other installations with a net heat excess of 20 megawatts or more. A cap is set during each trading period setting a limit for the amount of greenhouse gases that can be emitted. Each installation is given a specific number of credits, if they exceed their allowance then they must purchase more credits, but those who achieve a reduction in emissions can sell their unused credits to others.

The latest phase started in 2021 and will run until 2030, but factors other than climate change are now affecting the price, as the EU has committed to ending its reliance on Russian gas by 2027. EU Carbon prices are set to increase in the coming years, with Bloomberg NEF and Refinitiv predicting prices of €79 per ton and €89 per ton respectively. In the long and medium-term, the industry must factor in the cost of emitting greenhouse gases, as it will become prohibitively expensive not to do so.

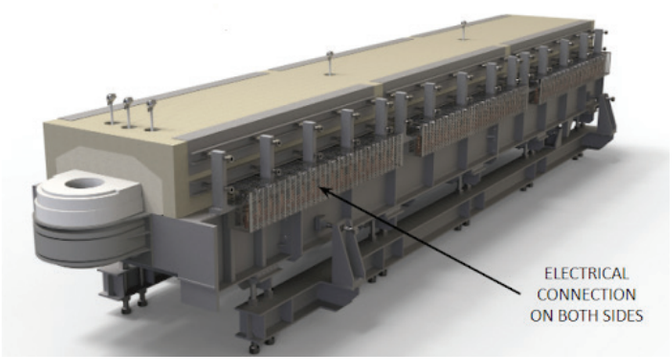
LEADING THE WAY

Glass Service Italy has produced alternative glass furnace designs to help glass manufacturers meet their targets in the reduction of carbon emissions, but also to reduce running costs and produce a higher quality product. They have developed the technology and supplied a number of Oxy-Fuel combustion systems for glass manufacturers providing the following benefits:

- Reduced energy consumption
- Reducing the space required for the furnace
- CO_2 emissions reduction
- NOx levels reduced
- Increased glass pull
- Fewer spares are required for the furnace
- Continuous firing (compared with regenerative furnaces)
- Easier control adjustment of the temperature profile along the furnace longitudinal axis

Compared to regenerative or recuperative furnaces, Oxy-Fuel furnaces require less investment as no regenerator or metal recuperators are required. Oxygen can be supplied using either cryogenic liquid tanks, VPSA or VPA. As the oxygen and gas flow must be extremely accurate, Glass Service Italy has developed and designed a high precision flow control system. Vortex instruments take into consideration temperature and pressure variations to control the flow of the burner. This system is suitable for both specialist and standard glass production.

Looking to the future, Glass Service Italy has already developed the advanced technology required for electric furnaces, so that in the future the industry as a whole can be both carbon-neutral and cost-effective. Electric furnaces can be used to produce oxidised glass such as lead crystal, using tin oxide electrodes, or using molybdenum electrodes for all other types of glass. All of the equipment required for an electric furnace is supplied by Glass Service Italy, with an innovative design that both reduces carbon emissions and produces glass at a much higher standard than a conventional furnace.



The above design shows the new electric configuration using radiant elements, as there are no tubes the electrical pipes can be changed when the furnace is hot, meaning maintenance is much easier as extraction is only from one side only. This new design is better at maintaining a steady temperature and keeping the glass at a consistent heat.

A customised installation allows for a variety of manufacturers' needs to be met, with two separate and independent circuits that control and modulate the generated power. The furnace is constantly checked by the control cabinet that automatically adjusts the power according to the resistance value.

Compared to its counterparts, the heating system developed by Glass Service Italy scores very highly in sustainability. Gas power produces 24.38kg/h of carbon, compared to 7.99kg/h for Oxy-Gas and zero CO_2 produced from electric furnaces. Whether a glass manufacturer is looking to drastically reduce, or completely eliminate their CO_2 emissions, Glass Service Italy is working with their customers to achieve their environmental and financial sustainability aims.

Oxy-fuel furnace Chongqing

CURRENT TECHNOLOGY

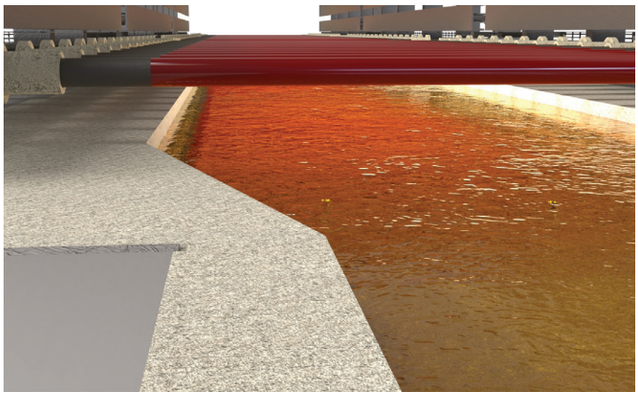
Glass furnace design improvements are essential for environmental targets to be met. The gas is ignited by burners and flue gases are exhausted out of the top of the furnace. The process not only uses fossil fuels but creates CO_2 emissions. Recent developments have provided alternative methods of heating, offering a range of solutions for glass manufacturers to reduce their carbon footprint, and these alternatives,including oxy-fuel, electric and hydrogen are under comparison to see if any of them might combine to take over from fossil fuels, or whether a new energy source altogether is required.

OXY-FUEL HEATING

Using pure oxygen rather than air in the furnace increases efficiency, improves the quality of the glass, and produces less CO_2 emissions. Adding oxygen to the fuel greatly reduces the amount of nitrogen from the oxidiser, resulting in a lower flow rate of gas out of the flue. The refractory materials are unaffected, making the conversion from a traditional furnace more straightforward. As well as providing a more stable temperature, there are significant savings, with energy costs reduced by 40% and a 65% reduction in CO_2 emissions.

HYDROGEN HEATING

Hydrogen has been successfully trialled as an alternative to natural gas, in 2021 hydrogen was used to power a furnace for three weeks, showing that it could run safely at 1,600°C. Several obstacles need to be overcome before hydrogen becomes a viable option. Firstly, the gas needs to be transported via tankers and is not available through the mains supply, although existing gas-pipe infrastructure could be utilised in the future. Secondly, although hydrogen is emission-free when used, the process of extracting hydrogen from water or fossil fuels requires energy. Despite these barriers, if processes such as electrolysis, which splits water into oxygen and hydrogen, can be powered by renewable energy, hydrogen stands as a good contender to provide a furnace heating solution.



Rendering of electrical channel

ELECTRIC HEATING

Electric heating uses radiant elements to heat the furnace, unlike gas it does not produce any CO_2 and is much more efficient as the conversion rate for electricity to heat is greater than gas burners. Furthermore, as there is no exhaust emitting gases through the flue, the furnace is much better insulated and runs more efficiently. Moreover, installation is more straightforward as connections to either mains gas, LPG tanks, diesel or heavy-oil tanks are not necessary. Only an electricity supply is needed along with the installation of a transistor unit and transformer. In addition, electric furnaces have a similar footprint to existing gas-fuelled furnaces, making an upgrade to an electric furnace more viable. Each furnace can be tailored to the customer's needs—depending on the temperature required—by customising the electrical resistance design.

Manufacturing Innovation and Glass Service Italy led the way at Glassman Latin America

Photo credit: Rick González, CC BY 2.0, via Wikimedia Commons

The global glass industry is currently estimated to be worth more than $120 billion, with 44% of this made up from the container glass segment (Grand View Research), meaning huge opportunities for those who can service hollow glass markets. Driven by increasing demand for both beverage and pharmaceutical glass, the glass bottle and container market in Latin America alone is estimated to reach $ 6.7 billion by 2026. This predicted expansion is already in evidence as we move into the middle of 2022 and multiple new production sites and developments are rumoured or underway in the region.

The huge global popularity of Mexican beers and tequilas have provided a welcome boost to the requirement for regional glass manufacturing facilities. Moreover, with Brazilian manufacturer Nadir Figueiredo flexing its muscles to purchase Cristar Tabletop, the glass manufacturing firm, from global player O-I, the region is on the up. As recently reported by Glass International's Greg Morris, "Combined, Nadir and Cristar have the largest production capacity in Latin America and one of the most comprehensive glass tableware portfolios in the world." It is an exciting time to be in the region and this industry.

GLASSMAN EXHIBITION AND CONFERENCE

Glassman Latin America took place on May 11 and 12, 2022 in Monterrey Mexico, returning to once again provide the platform for a constructive gathering focused on the region's glass industry. It brought together peers and experts to discuss technological and commercial developments and opportunities and was the first B2B event for the region's industry in several years. The whole industry was abuzz with excitement!

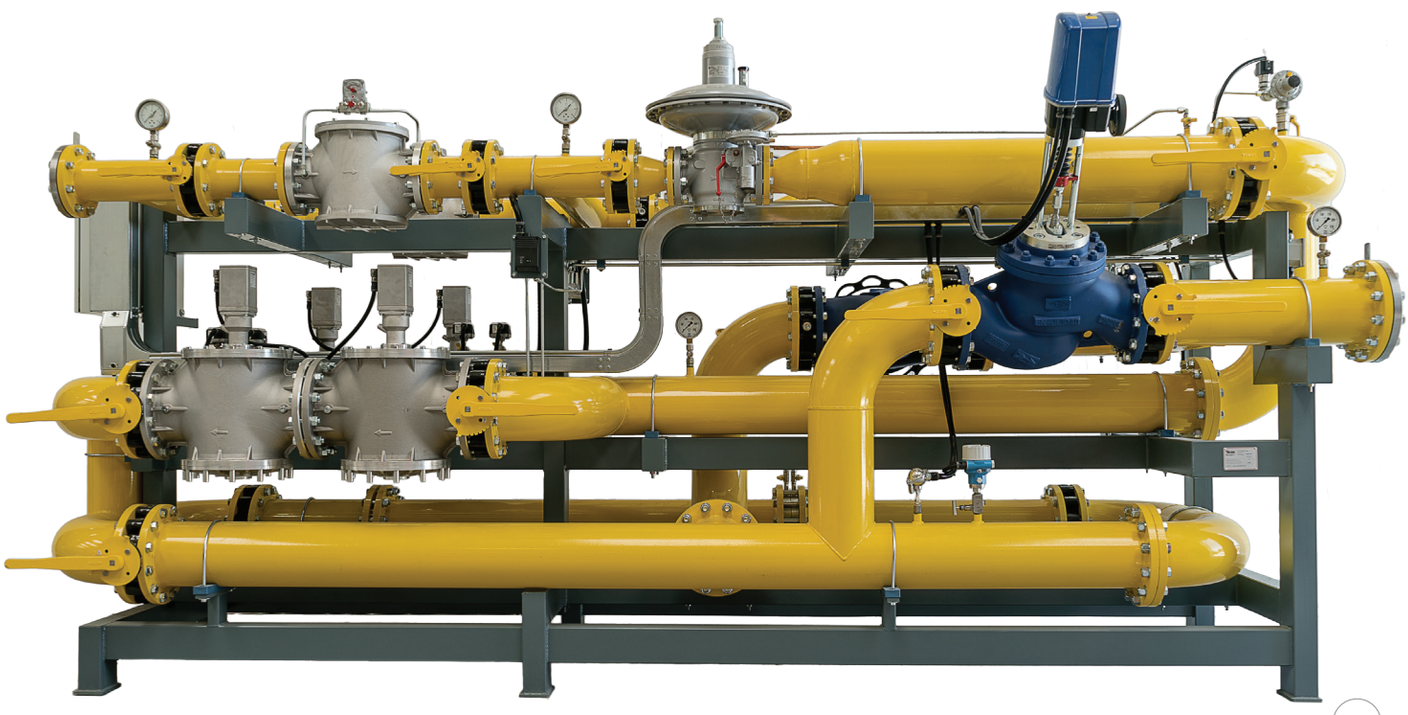
Attendees met more than 500 companies who were registered to visit the show, including O-I, Vidrioformas, Corning, Verallia and Vidreria Santos. Moreover there were nearly 100 global and local glass manufacturing equipment suppliers, including Interglass, FIC, MGFS, BASF and of course Glass Service Italy.

"Glass Service's knowledgeable representative for Latin America, Anna D'Orazio was there to answer questions, deliver updates on our latest and most popular technologies..."

GLASS SERVICE ITALY AT GLASSMAN LATIN AMERICA

Glass Service Italy was truly excited to take part in this event for the Latin American sector. The company was poised to work with regional partners on delivering the most innovative, economical and environmentally-minded glass manufacturing equipment and services, building on relationships already established with local businesses.

Glass Service's knowledgeable representative for Latin America, Anna D'Orazio was there to answer questions, deliver updates on our latest and most popular technologies and to demonstrate how Glass Service can help clients begin, or to scale up their glass manufacturing operations, efficiently, economically and reliably.



GLASS SERVICE ITALY SOLUTIONS FOR THE HOLLOW GLASS MARKET

Glass Service Italy has substantial experience in delivering glass manufacturing equipment around the world. In Latin America, Glass Service Italy has regularly provided and installed combustion systems and control boards to glass manufacturers - and now that customers are demanding ever more environmentally focused solutions - Glass Service Italy has proven time and again that it is ready to work together with clients on improving their carbon footprint, including the growing usage of oxy-gas combustion which can enable reductions in CO_2 emissions of -15%.

Glass Service Italy works with clients all over the world from its headquarters in the Pisa province of Italy. The Glass Service Italy team is highly skilled and the company revolves around sector-leading engineering and innovative solutions for several types of glasses such as: container, tableware, mineral-wools, neutral-borosilicate and sodium silicate amongst others. They can deliver turn-key solutions for single ancillaries like slitting or batch chargers or bespoke, comprehensive manufacturing services and products to fit the precise needs of clients. As a preferred distributor for Honeywell and Comau in Italy its credibility and reputation as a sector-leading company is deserved. Glass Service Italy's key differentiators are agility, a good balance of quality and economy and its broad expertise and experience in combustion systems, borosilicate glass, colouring feeders and stirring machinery.

GLASS SERVICE'S KEY OFFERINGS:

- Glass furnace design and installation capabilities for making electrical, glass tile, sodium silicate, artistic, container, neutral and borosilicate and tableware products.
- Cutting edge design and supply of these furnaces and other bespoke or turnkey equipment, including their production and installation.
- An equipment catalogue that incorporates all glass manufacturing needs from forehearths and furnaces, to radar glass level machines, heat recuperators, batch charges, control boards, distributors, forehearths and much more - and in many cases solutions can be turnkey or bespoke.
- The latest in heating technology including Oxy Gas and Air-Gas burners.
- Advanced innovation including robotics and automatic/semi-automatic batch plant technology.

GLASS SERVICE BY NAME...

The company prides itself on putting customer service at the heart of the business and as such, customers will benefit from consultation on their needs and specifications throughout the process of working with Glass Service Italy. Whether it is raw materials analysis, furnace preheating, startup and servicing, glass defects analysis and troubleshooting, batch studies or the primary installation phase. Glass Services works hard to ensure that customers are kept appraised and supported throughout the process and to deliver both products and services that result in happy and long lasting relationships with our clients.

We were happy to be a part of the Glassman Latin America industry event. In case you missed it and you want to find out more on how Glass Service Italy can help you and your business to grow faster and more efficiently, contact Anne D'Orazio today!

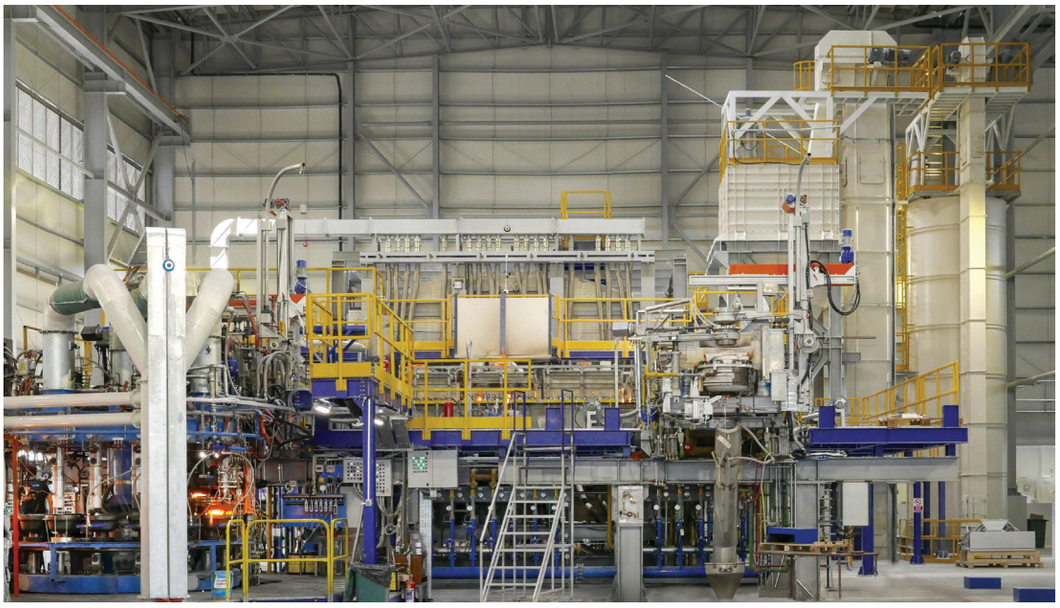
Case Study
Yorglass, Turkey

THE CLIENT

Yorglass, founded in 1974, is an industry leader in industrial glass processing. A Turkish company with over half a century of experience, they pride themselves on being on the cutting edge, pioneering glass technology with fast and creative production serving a global market. Yorglass's wide-ranging portfolio includes the home appliance sector, with plants in five different cities across Turkey.

CHALLENGE

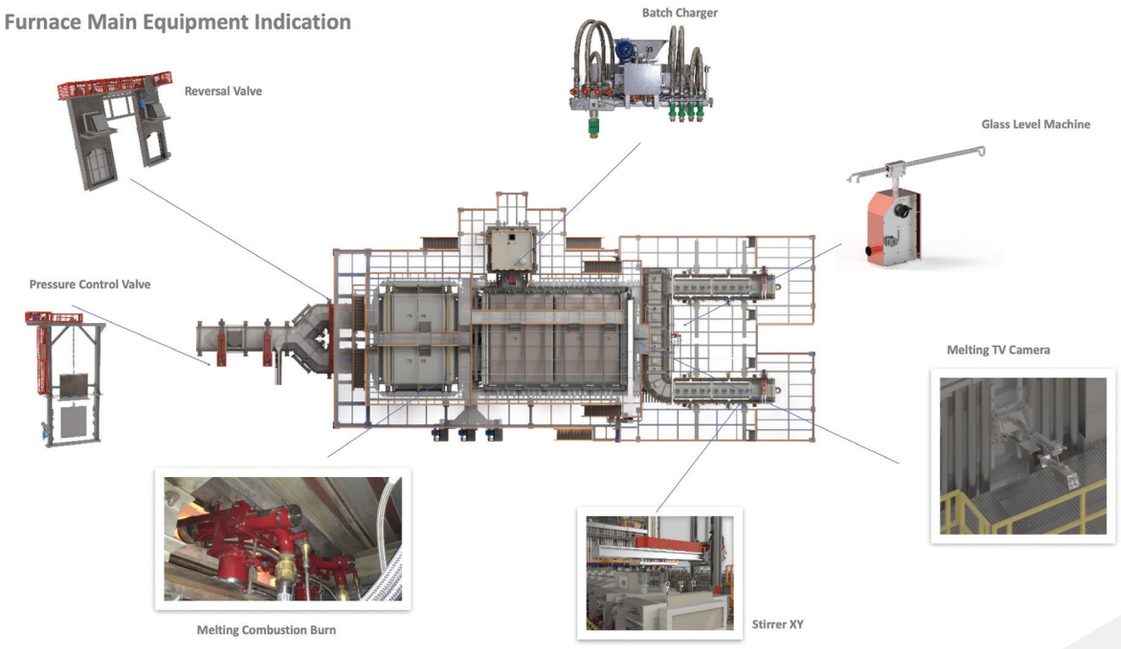
As a leading-edge manufacturer, Yorglass's requirements and specifications were suitably challenging. Yorglass required a facility capable of producing 120 TPD of high-quality tempered glass, using a regenerative port furnace powered by natural gas with barrier booster and throat booster. Yorglass also requires high flexibility in its production, with low emissions and energy consumption.

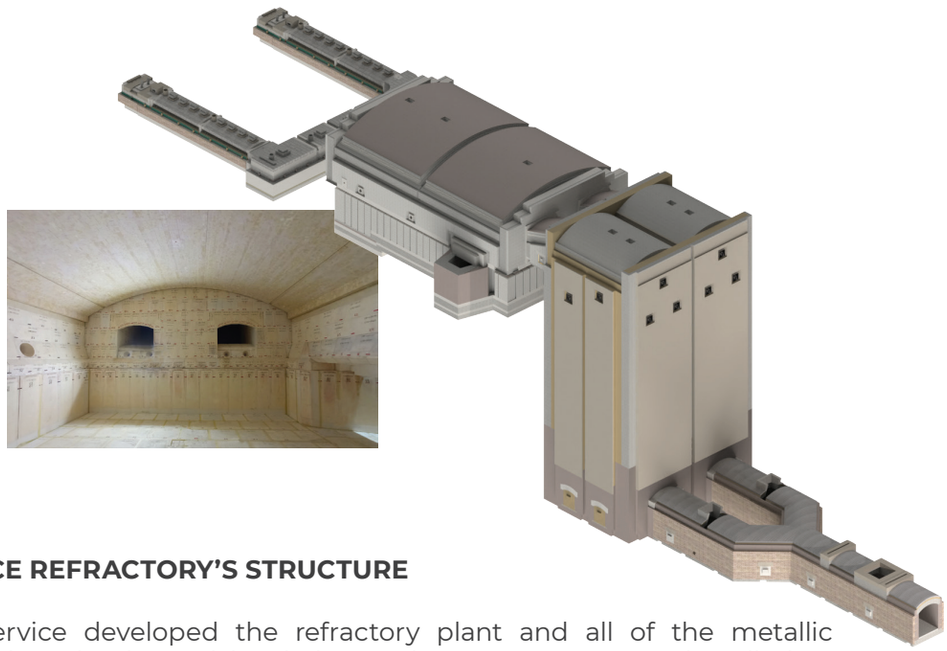


SOLUTION

Glass Service has fulfilled its brief by designing, building and installing a state-of-the-art facility for Yorglass that produces tempered soda lime glass for washing machines. GS was able to incorporate the latest technological developments to ensure that Yorglass can provide the highest quality product while also meeting the stringent energy constraints they required. The following review details the construction method and equipment utilised to meet Yorglass's requirements.

OVERVIEW OF FURNACE DESIGN AND MAIN COMPONENTS





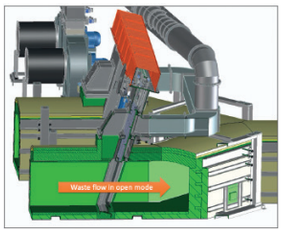
FURNACE REFRACTORY'S STRUCTURE

Glass Service developed the refractory plant and all of the metallic structural work. Thermal insulation and regenerators were installed to improve efficiency and maintain heat, along with an advanced method of using the chimneys to provide further insulation. In addition, a camera has been installed providing visual observation inside the crown of the furnace. The camera has been designed to operate at 1550 °C.

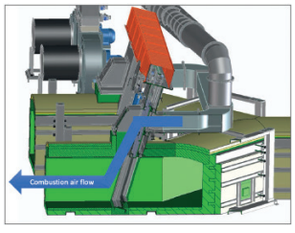
REVERSAL VALVE

A reversal valve was installed to allow waste air to directly connect to the chimney or feed the combustion fan flow in the regenerator when closed.

The Batch Plant is another design innovation which meets the client's current production of 120 TPD and also allows for the seamless addition of a second symmetrical line in the future. The total capacity of the batch plant is 280 TPD.

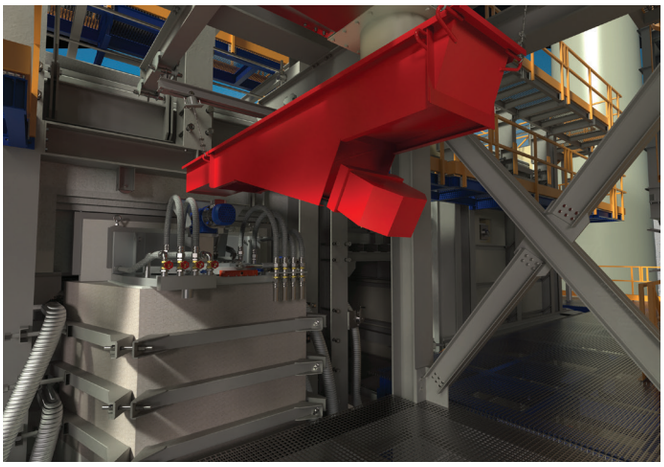


WITH THE GATE OPEN, EXHAUST FUMES FLOW DIRECTLY TO THE CHIMNEY



WITH THE GATE CLOSED, COMBUSTION AIR, FED BY THE COMBUSTION FAN, FLOWS INTO THE REGENERATOR

BATCH CHARGER



An oscillating close batch charger was installed on top of the dog house sidewall blocks; Glass Service's batch chargers have been designed to increase the control of the furnace pressure, reduce energy losses and NOx formation. The installation at Yorglass included a bucket elevator for ease of loading, with a vibrating feeding channel. Both the crane and vibration feeding channel have been designed to allow easy access for maintenance with removable panels, ensuring that production runs as smoothly as possible.

GLASS LEVEL MACHINE

Measuring the glass level is paramount in any production, particularly with continual operations and high pull loads. This equipment was designed to reduce fluctuations in the batch charger speed, reducing carryover and stabilising the gas flow.

GLASS LEVEL SIDE WALL INSTALLATION

A technologically advanced glass level machine such as this will stabilise the furnace temperature leading to reduced energy consumption and higher quality end product. The level of the glass is detected by a platinum tip, using an electrical current to break any tail produced by contact with the glass. Including the platinum tip ensures that electrolysis does not occur, causing bubbles to form.

MELTING COMBUSTION MACHINE

Melting area burners are equipped with individual flow control and solenoid gas safety shut off valves (SSOV) for safety precautions and to control the gas flow. The control board regulates the flow, enabling a quick set-up speed when switching to a different process without recalibrating.

GAS FLOW AND REVERSAL VALVE

Each port has two burners; the gas passes through a vortex metre, pressure transmitter, flow control valve then through a reverse valve with micro position switches and a visual position indicator.

The cooling compressed air is filtered before passing through a pressure regulator and flow metre and passing through a reverse valve, and fed to cool the burner during the inversion.

GAS FLOW AND REVERSAL VALVE TECHNICAL INFORMATION

Electrical motor	power 380 Vac, 3ph, power 1,5 Kw
Emergency compressed air suppliedat a pressure of 4 bar	clean and dry
Maximum operating temperature	600 °C
Reversal time	12 sec for motor at 50Hz frequency

FOREHEARTH AND VENTURI MIXER

Glass Service installed a Venturi mixer, a reliable and robust component that provides the precise mixture of air and gas to the burner, with a built-in adjustment valve. Glass Service produces a very precise and customisable Venturi mixer to correctly manage the air/gas ratio in glass industry applications.

The mixer is composed of a cast aluminium shell with a tailor-made Venturi insert inside, calibrated according to custom design specifications. Taking advantage of the Venturi Principle and a regulator needle, the correct amount of gas is sucked in utilising the energy of air flow and the mixture is sent to the burners. The proper air/fuel ratio is set initially by the valve built into the mixer.

ELECTRIC BOOSTER

Yorglass's furnace is fitted with electric boosters to save on energy costs; the boosters are managed by the control board that sends power to the thyristor power board, and the barrier booster provides 750 kVA to six 63mm electrodes. Electric boosters are also installed in the throat through two electrodes providing 50 kVA. The throat booster only operates during heating and emergency glass flow standby, preventing a drop in temperature. **Each electrode holder has a double cooling unit designed by Glass Furnace for the use of molybdenum electrodes.**

The new innovative design provides double protection; the primary circuit is water-cooled, with a backup secondary emergency circuit that uses air for cooling. The air cooling element acts as a safeguard in the event of a water cooling fault, and allows for installation when the furnace is hot. The new design is machined from a single piece of a special alloy resistant to high temperatures, ensuring reliability and robustness.

FOREHEARTH COOLING

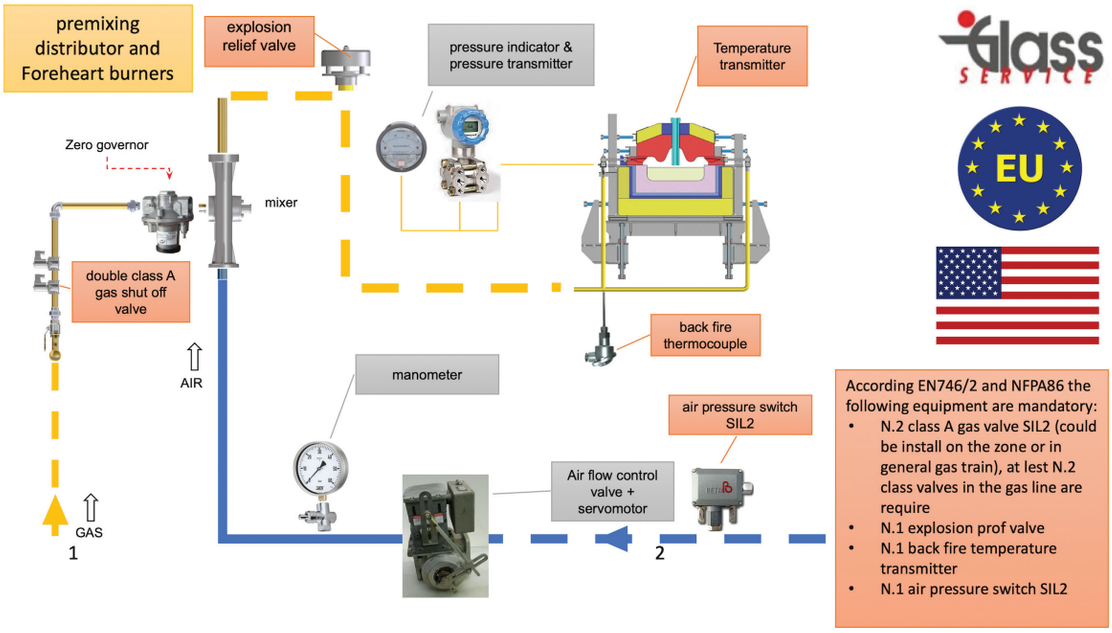
Glass Service has developed a cooling system that provides a constant, low-speed air circulation over the length of the forehearth and from a lateral manifold, flowing air to the centre of the forehearth. Several chimney holes exhaust the cooling air and combustion smoke along the length of the forehearth that are adjusted by a mechanical damper to control the flow. The effect of this design is to ensure that cool air is distributed evenly, avoiding any cold spots. Likewise, the chimney system prevents hotspots when smoke and hot air are evacuated.

SAFETY FEATURES

Glass Service has incorporated many safety features into the premixing distributor and forehearth combustion burners. The SIL2 certified control system provides an air pressure switch, explosion-proof valves, a backfire temperature transmitter and thermocouple.

Before the gas reaches the mixer, it goes through a class A gas shut-off valve and then a zero governor, ensuring that even in the event of a varied flow, the pressure remains at zero downstream of the regulator. These elements combine to produce the safest working environment possible for the operators, and meet the high safety standards required by regulators.

COMBUSTION SAFETY STANDARDS DIAGRAM



CONTROL SYSTEM

The plant is equipped with a Honeywell HC900, this system incorporates both the safety and operating applications, with early warning systems for sensor failure, allowing operators to respond promptly and safely for maintenance. Honeywell has designed its interface to be as user friendly as possible, with touch screen controls and a single PLC for the glass level control and batch charger.

The proposed process control includes a redundant CPU Honeywell HC900, a SIL2 safety control function according to EN746/2 by PLC REER, a single PLC for batch charger and level control integrated with a local touch screen. Complete the architecture with a double redundancy Ethernet control link TCP/IP Modbus and a main HMI by N°2 PC unit SCADA.

As well as providing safety features, the control system increases throughout, reduces scrap, and minimises energy costs. Another key benefit is that the control system does not need to be replaced when scaling up production. An important consideration, as Glass Service looks forward to working with Yorglass in the near future, as they are looking to expand production with a third forehearth and also a second furnace, to increase production and use at the maximum capacity the batch plant.

Excerpts from a conversation with Mr. Oleksandr Kudatsky from Poltava Medical Glass Plant, Ukraine

ABOUT THE COMPANY:

I have been the director at the Poltava Medical Glass Plant for 26 years. We complete the full production cycle from furnace through to glass tubing - manufacturing medical ampoules for both consumer products and pharmaceutical plants. 50% of our products remain in Ukraine with 50% exported. Our customers are large pharmaceutical companies such as Darnitsa, Farmak and Kharkiv Health. We already export to Belarus, Georgia, Kazakhstan and Romania and we're starting exports to Turkey. At present we operate two gas-oxygen furnaces for borosilicate glass, and we process it completely. We also sell a small amount as semi-finished products in the form of glass tubes.

ON POLTAVA MEDICAL GLASS PLANT HISTORICAL GLASS PRODUCTION:

Our plant has been in existence for 90 years! Different methods of glass melting were used at different times and in the Soviet era there was a recuperative gas-air furnace. Then, 27 years ago, we tried the KTG Open Electro technology, which is an English furnace, with pure electric melting. Why an electric melting? Because in Soviet times, everyone switched to electricity. It was cheaper. And so electricity was chosen when our energy industry was developing at a rapid pace and nuclear power plants, hydro, and gas production went deeper and deeper into the Tyumen region. There was also a Soviet leadership decree to switch to electricity consumption as much as possible, meaning electric stoves in the private sector and electric cookers in homes—an environmentally friendly option, removing the need for chimneys.

The method of melting was the so-called “Shuba”—a batch coating—but the power utilisation was high. We continued to try other routes, and ten years ago, we switched to gas-oxygen / gas-air electric melting technology because by then we had oxygen production. Two additional oxygen stations were built and we now produce 36 tons of liquid oxygen per day, 24/7, of which 8 tons are consumed by the furnace, 8 tons for our own ampoule production. But 16 tons, which were being kept as a reserve for the furnace, are all being sold as medicine because of the COVID pandemic. Because our oxygen has 99.9% content of O2 as the main substance, it is medical grade.

ON CHOOSING A SERVICE PARTNERSHIP:

When you are choosing between these furnace options you are considering the net cost of the different ways of production—electric melting has a high efficiency for sure. At that time, the net cost was lower, plus it removed the risk of volatility in the raw materials during the melting process, but gas-oxygen furnaces are also interesting. When we were choosing who to work with, we first of all looked at who had already worked with and knew the subject, because not all glass is the same.

For starters there is container glass, then there's bottle glass, float glass and window glass—each has a different way of production and a different chemical composition. In addition, furnaces for each of these products differ and each product produced has equally specific requirements. If, for example, you use the float method of production for window glass, it must be clear, transparent glass, without waves—there are specific nuances. For container or bottle glass, on the other hand, there are different nuances. But there are even more nuances in medical glass.

Medical glass requires both chemical and water resistance as medicine is an aggressive substance that can leach the walls. We need to guarantee a preservation period of five years for pharmacists during which the substance dispensed won't leach, opacity should not occur, and the chemical composition of drugs should not change. So, there are high standards and you must be careful about its fabrication—let's put it this way—the refractory materials, the platinum, burners, and everything else comes from materials that are not cheap—it translates to a very expensive production cycle.

The operating life of the furnace is 3 years, and it costs around 3 million euros to repair the furnace, so you can imagine how much it costs per kg of glass. Therefore, the selection of the supplier—the developer of the project—is a key event for us. That is why we work with Glass Service Italy.

ON WORKING WITH GLASS SERVICE:

So why Glass Service? There were offers from other companies, but our primary consideration was how much they have done in the borosilicate glass field, how many had already built furnaces and how long these furnaces were used. For example, if a potential supplier had only installed 5-7 furnaces, we would need to see a period of operation for these furnaces of 5-10 years, as the longer the furnaces are in operation, the more advantage the firm gets because every repair is a change, small changes or adjustments that have been carefully worked out and that will bring improvements. Otherwise, if you don't upgrade, you end up slipping a little behind competitors.

Because Glass Service Italy has worked in Pakistan, India, China, Russia, Belarus etc. we took this experience and what they already know into account and as a result chose this partner to work with. Moreover we maintain a live and direct link to Glass Service Italy which is also very necessary because of the different nuances of production. If our specialists cannot make the necessary adjustments in the process on their own, there is a new issue we can contact them quickly. It is the nature of production and machinery to be evolving and there are different tasks and changes that occur there during operation—but we always get answers and a quick reaction from Glass Service.

We chose Glass Service Italy as mentioned, because they already had experience in construction and maintenance of these furnaces, melting borosilicate glass. So, by these same parameters of experience, they were chosen. The decision is similar to that if you are looking for a driver to hire, you want to see if the driver has just graduated, or is a driver with a history of accident-free work for 10-12 years, I think you would probably choose the second option.

We have excellent communication with Glass Service Italy and their company office—we can contact them directly at any time, out of the office hours and by mobile, or with other means of communication. The reaction is quick and there is always a representative available lightning-fast. I am also grateful to the company for opening an office in Lviv, and I know there is one in Belarus. In Lviv's office the company's representative is a very competent representative, Roman Kotselko, a former technologist who deeply understands the technology of glass production.

We have been melting glass for the past 55 years and have gone through all the steps and seen many different ways. Or rather, it's been different grades of glass: there's been third grade neutral glass and first grade neutral glass and we even tried melting the simplest AB glass. So [our experience] is definitely broad, and by and large we can say that we have a lot of knowledge and operating experience and can choose the service provider clearly and specifically as a result. The fact that we knew the target is due to the fact that we didn't start working only yesterday—we had already tried and tested different ways.

When you know what your goal is and what you want to get at the finish line, you can clearly communicate and set goals for your service provider. We knew that Glass Service Italy was, and still is, in the borosilicate glass business and we needed borosilicate glass. The competition was increasing all the time, and to compete with world leaders like Schott and Corning, we had to step up to the level of quality and produce decent quality glass. We carefully selected the company and it all came together by combining the knowledge and experience we had, with the knowledge and experience they had.

We are thankful for the strong team...they achieve the goals that are set before them and align themselves with our knowledge, to what we do, and to what our consumer wants—because the most important thing is the end consumer. One might say that you can run a 100m in 9 seconds, but if it is at home, if you run in your garden, or on the street, then only you will know it. In our case, our success is only known when the final product is consumed by pharmaceutical plants

and if it is sold, and sold for a decade there—that is the minimum benchmark. And our product has been sold there for the last 50 years.

These are indicators of whether we are going the right way or not...it speaks about the quality of your product. The important thing isn't marketing or sales therefore, it doesn't matter if you are Glass Service, nor Poltava medical glass factories - these are only brands and that is why our progress and the right direction is always determined by the end consumer.

ON INVESTING IN A SERVICE PARTNERSHIP:

A good way to look at it is that there are many different car makes and models but everyone chooses a car according to the requirements he has for the car, and the finances. If you have good finances, I would recommend Glass Service. Yes it can be more expensive, but in this business, if it's inexpensive, that is not promising.

You have to be prepared to invest money, resources and a good business plan that calculates for a long period of time, and the fact that Glass Service will provide key materials and support. I would say look at the logic itself, we have been in partnership together for the past 10 years, so we can say we like them and we encourage you to like them too!

I will say that development should always be a joint endeavour and if the developer and the furnace operator develop together, then it benefits both of them and there is movement forward! If the developer, the furnace designer who built the furnace, has no operating experience but builds and accompanies the process in tandem with the operator then both sides get to develop and live in this market. I can say that the more Glass Service builds furnaces, the more information everyone gains, the more comparisons will be made...Basically all theory is one thing, and experience and operation is quite another. God bless them for mastering more furnaces. Well, I think then the services will be cheaper and the overheads. I believe they are going the right way!

Meet the team: Fulvio Puccioni

I am Fulvio Puccioni and I am the president of this company. Glass Service works in the glass market mainly producing industrial furnaces. The market has two types of evolution. The first, that of the containers, evolves towards a high product quality, a lowering of consumption, and research on extremely high safety standards and therefore I speak of ATEX, SIL, etc. Moreover it needs to be able to emit less CO_2 in the future to achieve the EU 2050 targets and zero CO_2 emissions in Europe. So Glass Service is evolving as the market evolves. And how does it do it? It takes expertise.

Therefore Glass Service is introducing new proficiencies within its corporate structure. Young people, engineers, graduates who have the ability, the desire to produce by introducing a whole series of technologies in the area of oxy-combustion, in the area of electric boosting and the increase in quality to be able to comply with this market trend.

Furthermore, the market is always evolving, like all products, even the furnace market demands higher quality at the same price. So how do you do it? We're certified in standards, ISO9001 and this means quality manuals, safety procedures, quality procedures and therefore also to be able to guarantee the customer a better product at the same cost.

It is a complicated mechanism because it means personnel, it means structures, it means buildings, it means machinery and also investments in software mainly, so we introduced a management system several years ago. We are introducing CAD / CAM technologies to be able to work with local mechanical subcontractors, without the need for operator intervention, thus reducing costs and also production errors. So it is a system that follows a process of continuous evolution, starting with the sale of the product and finishing with the design–now done entirely in 3-D with CAD / CAM–systems, production, assembly, installation and even assistance.

That is, Glass Service has strengthened the assistance structure in recent years to close the "quality" circle by going back to the product and seeing its defects, problems, solutions, improvements, and closing the quality circuit within ISO9001. ISO9001 is a beautiful word, but if it is not perfected and followed and made in a continuous circularity that starts from the sale, design, construction, installation and after-sales assistance it is an empty word, so it must be filled through concrete actions done by people, and Glass Service is following this trend, this is what we do today.

Those who want to work, those who want to learn are welcome here and they'll find that everyone is supportive, which is something that is not found very often. The ability to access all available information and the company's willingness to finance individual growth. This means training courses paid for by the company, it also means experimentation, it means every year putting 5% of the company's profit into research and development. And not all companies do; we do. ■

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