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BI-MONTHLY INTERNATIONAL MAGAZINE FOR GLASS MANUFACTURING

YEAR 34 • ISSUE NO. 1/2021

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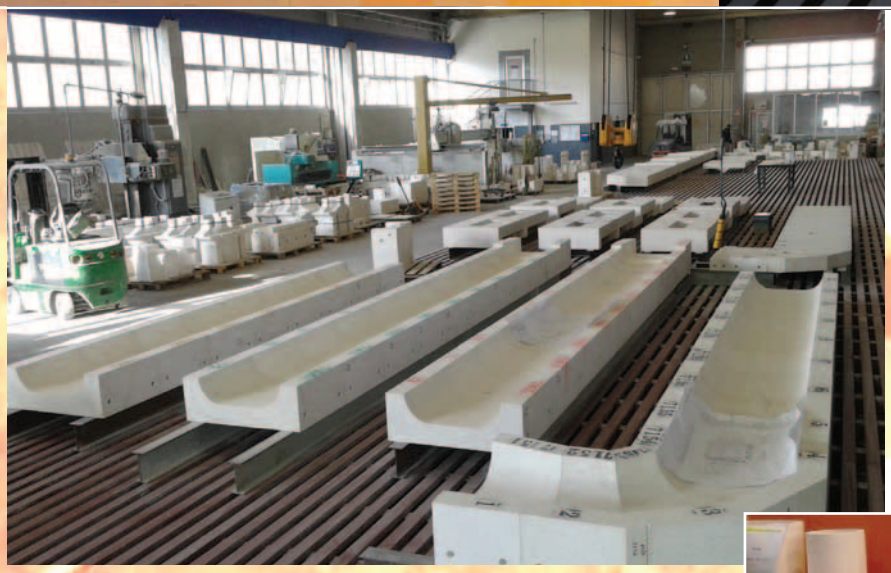

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Successful completion of the first fully remote-controlled and monitored commissioning of a production line for glass manufacturing

WALTEC REALIZED ***GAME-CHANGING REMOTE COMMISSIONING***

WALTEC successfully realized the first remote controlled commissioning and start-up of a new production line in China. The reason for this worldwide premiere in the glass producing industry was the unforeseeable entry restrictions of the Covid-19 pandemic.

Mr. Herman Green, commercial director, stated: "*The Covid-19 crisis forced us to think and act out of the box and using technology to eliminate traditional business boundaries. Thanks to the major steps forward in digitalization that WALTEC has already taken in recent years, we were able to apply now our newest digital solutions to carry out the commissioning in China. The first fully remote-controlled commissioning and start-up of represents a major milestone to WALTEC and underlines our innovation driven footprint to realize process optimization.*"

WALTEC´s operations Director Mr. Rainer Wagner commented: „*The remote collaboration between our HQ in Germany and our chinese customer over thousands of kilometers was accompanied by communication via video-capable end devices such as body cams, smartphones and laptops with headsets. In this way, the experts at the remote center of WALTEC were able to take the customer's view without having to be physically on site and so contributing to a lower carbon footprint in general. The components of the production line are equipped with digital hardware that enables remote access to the machine control system and sensors collecting operating data almost in real time. A first step to go beyond Industry 4.0!*"

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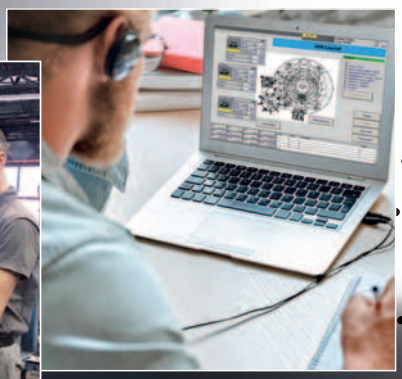

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BI-MONTHLY INTERNATIONAL MAGAZINE FOR GLASS MANUFACTURING

2021 FAIR CALENDAR

The magazine will be distributed at the following Trade Fairs

issue	exhibition/conference	date	venue	deadlines
2021 1	GLASSMAN ASIA	Postponed to 18-19 February 2022	SEOUL South Korea	Editorial files: 18-12-2020
	INTERPACK	Postponed	DÜSSELDORF Germany	Deadline Adv files: 20-01-2021
2021 2	COSMOPACK	Postponed to 27-31 May 2021	BOLOGNA Italy	Editorial files: 12-02-2021
	MIR STEKLA	22-25 March	MOSCOW Russia	Deadline Adv files: 19-02-2021
2021 3	CHINA GLASS	6-9 May	SHANGHAI China	Editorial files: 26-03-2021
	XXXIV INT'L ATIV CONFERENCE	12-14 May	PARMA italy	Deadline Adv files: 02-04-2021
2021 4	GLASSTEC	15-18 June	DUSSELDORF Germany	
	ALL GLASSTEC EXHIBITORS ADVERTISING IN THIS ISSUE ALSO RECEIVE A FREE GLASSTEC PREVIEW			Editorial files: 30-04-2021
	GLASSTECH MEXICO	4-6 August	GUADALAJARA Mexico	Deadline Adv files: 07-05-2021
2021	Glass Industry Directory NEW CONTENTS 			Editorial files: 11-06-2021 Deadline Adv files: 25-06-2021
2021 5	GLASSMAN LATIN AMERICA	8-9 September	MONTERREY Mexico	
	GULF GLASS	12-15 September	DUBAI UAE	Editorial files: 23-07-2021
	GLASSPEX INDIA	23-25 September	MUMBAI India	Deadline Adv files: 30-07-2021
2021 6	CONFERENCE ON GLASS PROBLEMS	1-4 November	COLUMBUS (OH) USA	Editorial files: 01-10-2021
	GLASSTECH ASIA	16-18 November	BANGKOK Thailand	Deadline Adv files: 8-10-2021

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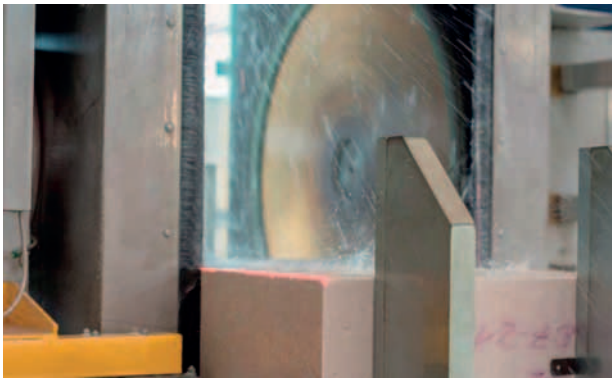


SIGMA Group has recently installed two double-disc grinding machines, one in Plovdiv, Bulgaria, the other one in Locate Varesino, Italy.

The company's plants are now equipped with:

- 5 five double-disc laser centring grinding machines (3 in Plovdiv and 2 in Locate)
- 5 five-axis numerical control workstations (3 in Locate and 2 in Plovdiv)
- 6 cutting machines (3 in Plovdiv and 3 in Locate)

Additionally, there are now 3 dedicated areas (2 in Locate and 1 in Plovdiv) for pre-assembly and inspection.

SIGMAREF, Plovdiv – Bulgaria

S.I.G.MA., Locate Varesino (CO)

This state-of-the-art equipment allows SIGMA to expedite grinding and pre-assembly operations both for forehearths, working ends and bottom paving, both on an emergency basis as well as for new orders.

WWW.SIGMAREF.IT

EME

Encirc batch plant upgraded

EME has successfully upgraded **Encirc's** batch plant at Elton, UK, to feed the increased capacity of the new furnace.

After performing an audit on site to define the needs of the customer, EME identified the opportunities to improve the cycle time and determined the new equipment that was critical for the upgrade. The batch plant was modernized with the installation of this critical equipment and by modifying the control system to reduce the cycle time in order to guarantee the increased feed to the new furnace.

Another challenge overcome was feeding batch to the second furnace continuously during the batch plant upgrade.

In addition EME extended the cullet return system and now at the Elton facility a total of 12 EME scrapers are in operation.

WWW.EME.DE - WWW.ENCIRC360.COM

BERLIN PACKAGING

Acquisition of Newpack, expansion continues in Europe

Berlin Packaging, the world's largest hybrid packaging supplier, has announced the acquisition of **Newpack,** a leading glass packaging company based in Italy.

Newpack was founded by a team of entrepreneurs experienced in glass packaging and the food and beverage markets, particularly the Italian wine sector. Newpack has a strong distribution network throughout Northern Italy, including the Liguria, Piedmont, and Veneto regions.

Newpack is Berlin Packaging's tenth European acquisition since 2016, confirming its commitment to supplying packaging across all geographies, substrates, and market verticals in Europe.

"The acquisition of Newpack allows us to increase our offering in the wine sector, an important market in Europe," explained Paolo Recrosio, CEO of Berlin Packaging Europe. "We expect our European sales force to help accelerate Newpack's growth in the wine sector. *Bruni Glass*, our premium brand for speciality glass, also has a renowned innovation centre headquartered in Milan, enabling us to bring our expertise in wine bottle design to Newpack."

"We are excited that our company will join with Berlin Packaging," said Newpack executives Damiano Cavedon and Giorgio Pirotti. "Our customers will benefit by having access to Berlin Packaging's product portfolio, distribution network, and design capabilities."

"Newpack is a great strategic fit for our European business," added Bill Hayes, CEO and President of Berlin Packaging. "We remain committed to building out our European presence through both organic means and strategic acquisitions."

WWW.BERLINPACKAGING.COM

HORN

Stoelzle Oberglas GmbH furnace order

In November 2010, **HORN** received the order for the cold repair of furnace 2 for the **Stoelzle Oberglas** plant in Koeflach. This is a 93.75 m² end fired furnace with six forehearths for the production of container glass. In the future the plant will produce 270 tonnes of flint glass per day. The existing furnace will be enlarged by HORN and equipped with new heating equipment and safety control. Furthermore, it will be equipped with a new melting boosting system, a new HVR 700F-2P batch charger and further furnace equipment.

Stoelzle manufactures moulded glass containers for the pharmaceutical, spirits, food, perfumery and cosmetic industry in a huge variety of different designs and sizes. The product range is complemented by the Medical Laboratory division, offering laboratory equipment, instruments, closures and packaging solutions in small batches.

WWW.HORNGLASS.COM/ - WWW.STOELZLE.COM/

STEVANATO GROUP

Partnering with Microsoft

Stevanato Group strengthens its collaboration with Microsoft Italy in support of its growth programme through the use of new technologies to meet the challenges the pharmaceutical industry is currently experiencing as a result of the pandemic.

The Group, which has over 4,200 employees and 14 production facilities in nine countries, is playing a key role in the production of plastic components for diagnostic tests and glass primary packaging for drugs. It provides packaging and syringes for the major international anti-COVID-19 vaccine programmes being developed, as well as pharmaceutical inspection equipment. Cloud Computing is, thus, strategic for business continuity during this delicate phase in which Stevanato Group has never ceased production, with the goal of providing support to the pharmaceutical industry.

Stevanato Group's constant growth is sustained by an extensive digital transformation plan which also includes the development of a series of applications which, leveraging Microsoft Mixed Reality technologies, are designed to respond to the current needs of the pharmaceutical sector.

For example, a Virtual Audit plan was launched, thanks to which the Stevanato Group quality teams wear the Microsoft HoloLens2 holographic headset with integrated Dynamics Remote Assist. This allows them to move throughout the installation to show customers in remote connection all processes, including production phases and lab testing. This also makes it possible to perform a remote quality system audit to ascertain that the installation complies with required standards and customer needs without requiring an interruption in the pharmaceutical supply chain, which is even more strategic during the pandemic.

In addition, the HoloLens headset also makes it possible to perform the Virtual FAT (Factory Acceptance Test) — the final pre-delivery inspection that assures the remotely connected customer that the equipment is functioning properly. While wearing the headset, a technician can demonstrate machine components, start it up and share documentation.

Remote acceptance of equipment for the inspection of drugs and vaccines being developed makes it possible to accelerate delivery to pharmaceutical companies, a factor that is critical in this period when the company has to manage large volumes on a short time frame.

The new frontier of Stevanato Group digital transformation process also includes the development of Artificial Intelligence to improve the performance of inspection systems and detection of defective glass containers filled with a range of drugs. In fact, a project designed to make inspection equipment supplied by the Group even more intelligent was launched in recent months, and it will be completed by 2021.

Artificial Intelligence will be an additional ally of Stevanato Group in guaranteeing maximum quality to the pharmaceutical industry, by reducing potential errors and quickly detecting defective products along the production line. The integrity of these containers is essential and, thanks to Microsoft AI integrated into Stevanato Group inspection equipment, pharmaceutical companies will be able to make use of reliable algorithms to identify any defects even more easily and guarantee the highest standards of drug and vaccine conformity. False positives can be reduced by 10-fold, also decreasing container production waste and detection rate can be improved by 5%.

These projects are part of the broader Digital Transformation plan of Stevanato Group, which is aimed to the completion of the New Digital Ecosystem by 2022. Within this context, the Group has worked side-by-side with Microsoft, focusing on a 360° Cloud approach.

Over the last two years, Microsoft 365 cloud platform for productivity and security was adopted, utilizing Teams for collaboration, the New Digital Architecture on Microsoft Azure cloud was extended with advantages in terms of scalability and computing capacity, and Microsoft Dy-

namics 365 cloud platform was implemented to provide a unified picture of customers and sales processes across all business lines.

An integral part of the new digital ecosystem will also be the Data Strategy focused on Azure Synapse platform, the analysis service that combines data warehousing features with Big Data analysis, making it possible to carry out queries on a large scale, while providing analysis with unparalleled rapidity – up to 14 times faster – and detailed information for Business Intelligence and Machine Learning. All this with the guarantee of maximum security and privacy, which is a strategic factor when working with the pharmaceutical companies involved in drug patents and research projects, such as those for the new anti-COVID-19 vaccine.

WWW.STEVANATOGROUP.COM/EN/

PIRAMAL GLASS

Takeover by Blackstone

US-based private equity Blackstone Group Inc. has signed a deal to acquire **Piramal Enterprises Ltd.**'s (PEL) glass unit for USD 1 billion.

Piramal Glass manufactures container glass packaging solutions for perfumes, cosmetics, beverages, speciallty foods and pharma industries. The company has manufacturing facilities in India, US and Sri Lanka.

The transaction includes a down payment of USD 850 million to take over the management and ownership of Piramal Glass, while the Piramal Group will get about USD 150 million on reaching defined milestones, to be paid over the course of two years.

WWW.PIRAMALGLASS.COM

Piramal Glass

HORN

New combustion equipment for Pochet du Courval

After a revision and complete rebuild, **Pochet du Courval** put its brand new furnace 5 into operation in October. Ultra-modern techniques have been used to keep the environmental impact as low as possible. Energy consumption and CO2 emissions have been reduced by 20%.

The new **HORN** design and the corresponding combustion equipment made it possible to achieve these excellent results. During the cold repair, the control lines were modernised in order to optimise the product quality.

Pochet du Courval continued to rebuild this furnace despite the difficulties associated with COVID-19, in particular thanks to the exceptional mobilisation of internal teams. With this brand new, optimised furnace, Pochet du Courval can supply its customers with the best possible quality to help them resume production.

During the cold repair of furnace 5, Pochet du Courval installed new HORN combustion equipment which includes new HORN Dualflame AC burners, gas reversing, measuring and control skid as well as gas measuring and safety skid. This modernisation, combined with the complete furnace technology, enabled Pochet du Courval to reduce its nitrogen oxide emissions by 25%, thus continuing its plan to reduce its environmental impact.

WWW.HORNGLASS.COM/ - WWW.GROUPE-POCHET.FR/EN/

STOELZLE

Type II – new technology for inner surface treatment

Due to its numerous positive characteristics, glass can be defined as the first choice of packaging material for many products, either for food, beverages or pharmaceuticals. Glass containers are chemically inert, can easily be heated and sterilized and are suitable to protect the content from contamination. The most common types of glass used in the pharmaceutical industry are Type I, Type II and Type III which are determined by their degree of hydrolytic resistance.

Over the past year **Stoelzle** R&D Team worked on the development of an innovative, resource-efficient, safe and stable process for Type II glass´ production used for acidic and neutral aqueous preparations be it parenteral or non-parenteral.

"Our intention was to develop a new process for inner treatment of soda silica glass to reduce the main weakness of the current two existing processes regarding stability and safety and to develop a process which also fits smaller bottles by

enabling optimal dosing of the treatment," said Mr. Alexander Stern, CSCO Stoelzle Glass Group & Head of BU Pharma.

"In line with our goal of being the first-choice partner for the global pharmaceutical industry we have been working on broadening our range of pharma primary packaging to better serve our clients' needs. Adhering to our overall Group's sustainability goals, we developed a process, which ensures a consistent high quality, guarantees a high level of work safety in production with a minimum impact on the environment," explained Mrs. Antonia Karamat, Deputy. Global Sales Director BU Pharma & Sales Director Medical & Laboratory.

Dr. Niklas Zwettler, Head of R&D at Stoelzle Glass Group added, "With our process, we also aimed to overcome difficulties that other treatment technologies face with small containers sizes. Extensive laboratory analysis and inline samplings of container sizes ranging from 6 to 250 ml showed a good stability of our process over a wide range of filling volumes and adherence to all requirements of US and European Pharmacopoeias for Type II Glass.

Close cooperation between company's engineers and production specialists during the development process allows Stoelzle to set a date for industrial production start-up by mid-2021. With already produced industrial samples, full production of Stoelzle Type II is aimed to start June 2021 in one of Stoelzle pharma dedicated plants in Köflach, Austria. The plant has two furnaces with a daily capacity of 270 tons of glass. Currently, around 1.5 billion pieces of white, amber and green packaging glass are produced annually on eleven fully automated production lines.

WWW.STOELZLE.COM

GLASS SERVICE

Expert System III rollout continues

Glass Service (GS) Expert System III (ES III™) has become the leading Supervisory Model Based Predictive Control for furnaces and forehearths. It brings Industry 4.0 to life.

Most major float, container and fibre glass producers have implemented ES III™ as their standard for improved furnace control. It provides stability and improved quality, aiming for 2-3% energy cost savings, plus CO2 and NOx emissions reduction, with a Return on Investment (ROI) of about six months.

Especially during COVID-19, with low operator and engineering personnel in attendance, the ES III™ has contributed to keep all systems running in optimal automatic mode without risk of exposure to the virus.

The GS-ASENS NIR furnace camera can monitor a glass furnace with specialized Artificial Intelligent software analysing what is going on in your furnace and inform ES III™ to take actions if needed.

Even with this past year's travel restrictions GS was able to realize about 40 new installations worldwide, reaching now a total of 290 installations. The rollout is supported by embedded installation partners from many leading engineering and control firms.

WWW.GSL.CZ

SIALON CERAMICS

Ultrasonic degassing in molten glass

Sialon Ceramics Ltd and *Akve Arc Últrasonics Sarl* announced a breakthrough in ultrasonic molten gas technology that can reduce energy costs, and lower the environmental impact of glass manufacturing.

Glass manufacture is a highly energy-intensive process. It involves two primary processes, glass melting and glass refining. In the glass melting process, the raw materials are first mixed into a batch and then introduced into a furnace where they are heated to a high temperature (up to nearly 1600°C). The raw materials chemically react to form the glass.

Glass refining is then carried out to eliminate gas bubbles from the melt. This process is critically important to achieving good quality defect-free glass. The aim is to reduce the size and number of bubbles in the melt before forming the glass into containers. The process is lengthy and energy-intensive.

The two companies have developed an ultrasonic gas melt degassing technology which significantly increases the efficiency of this process, reducing the refining temperature and saving up to 20% of the energy cost.

Nico Van Dongen, Director of Sialon Ceramics, explained, "Removing gas bubbles from glass during its manufacture is an essential part of the glassmaking process. The gas bubbles form during the glass melting process, which involves several chemical reactions that create the glass."

The chemical reactions produce large amounts of carbon dioxide and other gasses. Degassing involves bubble agglomeration. Dissolved gasses diffuse from the melt to form bubbles that rise to the surface and are expelled. The time this takes depends on the bubble diameter and the viscosity of the melt, which is a function of the melt temperature.

Various methods can improve the efficiency of this process. These range from the addition of fining agents, vacuum fining and even the use of microgravity. However, the application of ultrasonic-assisted glass refining is highly promising.

Describing the process, Mario Plasencia, Director of Akve Arc Ultrasonics, said, "Our ultrasonic degassing process uses a new ultrasonic generator and a proprietary ceramic sonotrode which can treat large volumes of highly viscosity molten glass at temperatures of up to 1,600°C. We carry this out at the forehearth of the glass furnace, placing the sonotrodes directly into the melt. This process allows us to reduce refining temperatures from around 1,450°C to 1,300°C. This is massive, and provides a total energy saving of up to 20%."

The process is complicated. When ultrasonic energy at the right frequency is applied to a glass melt, acoustic cavitation occurs. Cavitation is a process in which rapid changes in pressure produce small vapour filled bubbles which collapse when subjected to high pressure generating a shock wave.

Gas dissolved in the melt diffuses into the cavitation bubbles. Gas bubbles form on the cavitation nuclei. These grow by diffusion from the melt into the bubble during ultrasonic oscillations. The tiny bubbles then coalesce under the influence of various forces and, when large enough, float to the surface of the melt releasing the gas within the bubble to the atmosphere.

Summarising this new development, Nico Van Dongen added, "Ultrasonic degassing of glass melts in the forehearth of a glass furnace is a breakthrough technology with the potential to considerably reduce the carbon footprint of the highly energy-intensive glass manufacturing industry.

The work is ongoing, and the current trial is 50% funded by Sialon Ceramics Ltd who are working in partnership with Akve Arc Ultrasonics Sarl.

WWW.HORNGLASS.COM/ - WWW.GROUPE-POCHET.FR/EN/

WIEGAND GLAS

Konrad Wiegand passes away

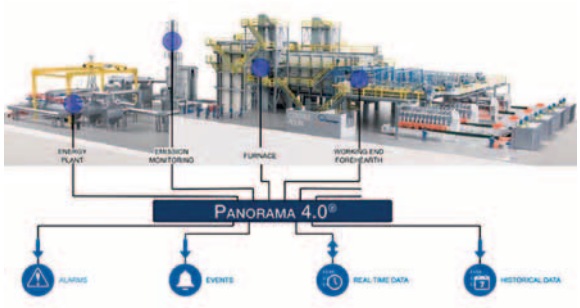
Wiegand Glas mourns the loss of Dr. Konrd Wiegand was a member of the management board from 1965 to 1997 and shareholder until 2008. Dr. Wiegans's, drive, outstanding entrepreneurial vision and humanity had a decisive impact on the development of the company.

For him "Life meant fulfilling a duty, and not a collection of pleasures". For his life´s work he was awarded the Order of Merit of the Federal Republic of Germany as well as honorary citizenship of the municipality of Steinbach am Wald and the town of Großbreitenbach.

WWW.WIEGAND-GLAS.DE/EN

BDF

Panorama 4.0 for state-of-the-art Industry 4.0 features



BDF's Panorama Suite 4.0 is a system platform which can operate with the standard operating systems across the plant, to provide the features of the state-of-the-art Industry 4.0.

Panorama Suite 4.0 is aligned with IoT (Internet of Things) philosophy of collecting real-time data from furnaces, forehearths, emission monitoring and recovered waste energy plant. Data storage history can be used to analyse statistics and create reports, which can also be accessed online from specific devices, by dedicated users with security permissions.

Panorama 4.0 has been developed following the latest best practices with simple and intuitive user interfaces, taking advantage of mobile media technologies such as tablet or smartphone. Its SQL database and the numerous communication protocols allow integration with other ERP business systems.

BDF Panorama 4.0 features:

- Unlimited web client access
- Use internal database powered by mySQL
- Data exporting to ERP system or company database
- Possibility of using physical or virtual server
- Use of local data loggers across geographically distributed multi-plant architectures
- User customizable dashboards
- User customizable reports
- The Suite has a number of different modules from which a customer can choose as required
- Multi driver suite to connect with different devices
- Alarm notification via email or SMS
- Strategic KPI calculation

WWW.BDFINDUSTRIESGROUP.COM

VETROPACK GROUP

Acquisition of glassworks in Chișinău, Moldova

Vetropack, leading Swiss corporate group in the European glass packaging industry, has reported that the acquisition of the Moldovan glassworks in Chișinău has been closed successfully after the necessary approvals were obtained from the responsible competition authorities.

WWW.VETROPACK.COM/EN/

ZIPPE

ZMART® Scraper Control boosts scraper efficiency

Reducing wear and minimizing the proportion of fine material – especially these two topics are considered as important reasons for improvement by **ZIPPE's** customers because the scraping conveyor runs longer than really needed, due to changing production conditions. This causes unnecessary energy costs and excessive wear.

That is why ZIPPE developed the innovative ZMART® Scraper Control System to face these problems.

Dependent on the gob weights and number of gobs, respectively hot bottles, this intelligent control module decides if and how fast the scraping conveyor operates. Furthermore, the required operation time is individually calculated and minimized.

The production data necessary for this calculation are provided automatically via simple standardized interfaces between the IS machines and the control system of the scraping conveyor.

If required, these parameters can also be entered and adapted manually, which allows a continuous and individual optimization of the process.

Thus, a high flexibility for the operation and use with the customer is achieved, the operation time is reduced to the necessary minimum and, above all, this cost-saving opportunity is permanently available.

The positive effects of the optimized scraper control system at a glance:

- longer lifespan of the scraping conveyor
- higher availability
- lower maintenance effort
- reduced wear and therefore fewer spare parts are required
- considerably lower energy consumption
- enormous savings in cost and CO2 emissions

The ZIPPE ZMART® scraper control was put into operation successfully at *O-I's* facility in Bernsdorf, Germany in August and shows a stable, safe and efficient operation with excellent results.

WWW.ZIPPE.DE/EN/

ARGLASS YAMAMURA

Furnace operations start up at Georgia plant

Arglass Yamamura started the furnace heat-up process at its Georgia, US, plant, at the end of November 2020.

The company looks forward to very soon providing its customers with the highest quality and service in the industry. All new bottles produced by Arglass will be made with proprietary glass composition Arglass Biogenic® with significantly enhanced sustainability attributes over traditional glass bottles.

The entire Arglass Yamamura team is ready and excited to bring a new reality to the US glass industry.

HTTPS://ARGLASS.US/

HEYE

Remote installation in Thailand completed

Heye International experts – in cooperation with a great customer's team on site – successfully installed and commissioned an IS-machine via remote access.

The 8 Sect. 5-inch DG IS-machine (overhauled), runs NNPB operation and produces lightweight juice bottles.

This project was accomplished remotely with Heye experts' knowledge in Germany and powerful performance of the *L. Lighting Glass* team in Thailand. Heye's local partner in Bangkok also supported the team on-site.

WWW.HEYE-INTERNATIONAL.COM/

ALLIED GLASS

Senior leadership team developed

New board level appointments have been made as **Allied Glass** develops its Senior Leadership Team with new board members for manufacturing, organisational development, and quality.

Richard Summers has been appointed Chief Operating Officer. With the business since 1988, Richard progresses from the role of Operations Director, a position he has held since 2002. Richard has been part of the senior team at Allied for over 20 years.

Robin Stanfield will now oversee the company's two factories as Manufacturing Director for Allied Glass. Having joined Allied in 1999, Robin he has been Factory Manager at Allied Leeds since 2015 and brings a strong understanding and considerable industry experience to the board.

In a further announcement, Sara Tucker has been appointed to the newly created role of Organisational Development Director. With operational human resources experience, Sara will be responsible for HR and business strategy development.

Martin Jones has become the company's first Quality Director. Martin has over three decades of relevant glass container experience in design and quality assurance, he also brings considerable industry knowledge to the board.

To support these board appointments, Luke Baresh has taken on the role of Factory Manager for the Leeds site, Josie Woodward has been promoted to Human Resources Manager and Jason Hunton is the new Production Manager for Allied's Knottingley site.

WWW.ALLIED-GLASS.COM

AMETEK LAND

New furnace temperature monitoring borescope

AMETEK Land has launched an innovative, new mid-wavelength borescope, the MWIR-B-640, for furnace applications. The MWIR-Borescope-640 is suitable for use in hydrocarbon processing reformers; heat treatment; reheat, cement kiln, and annealing furnaces; biomass, waste and coal boilers; as well as incinerators. This innovative new borescope features advanced spectral filtering and a high thermal and spatial resolution to deliver clear live images of the furnace, boiler, and stock, with more than 300,000 accurate point temperatures measuring in the range of 300-1200°C (572-2192°F) and 500-1800°C (932-3272°F).

The high-resolution image of the MWIR-B-640, combined with a 90° wide-angle field of view, allows multiple areas to be imaged and measured simultaneously. With the wide-angle view into the furnace, image data can be viewed in real-time from the safety of the control room. With only a small opening in the wall, the MWIR-B-640 can accurately profile the temperature of the entire furnace without affecting the furnace atmosphere, the stock temperature, or energy consumption.

"The MWIR-B-640 is an invaluable tool that will prolong furnace and boiler lifetime, optimise production throughput, reduce energy consumption and improve stock temperatures," said David Primhak, Director of Development and Product Management for AMETEK Land. "It has a range

of innovative features that ensure it is user-friendly, extremely accurate, and offers a high level of asset protection."

The MWIR-B-640 uses proven thermal imaging technology to accurately and continuously profile the temperature of the furnace and the stock, resulting in improved data accuracy through automation and reduced risk to personnel by minimizing the need for an operator to be in the hazardous furnace/boiler area.

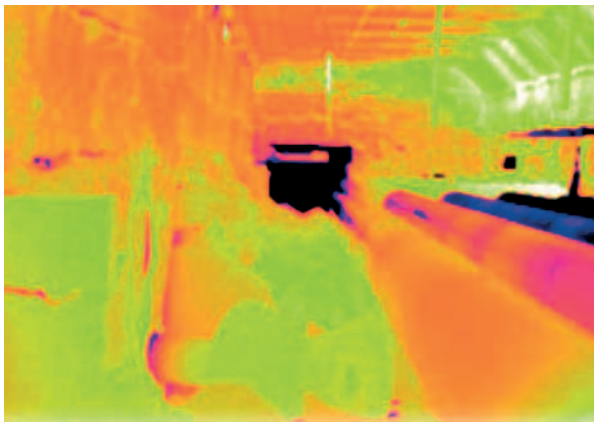
To protect the thermal imager from damage by overheating in the event of loss of water flow, air pressure, electricity supply, or a high borescope tip temperature alarm, the MWIR-B-640 is also available with AMETEK Land's innovative auto retraction system.

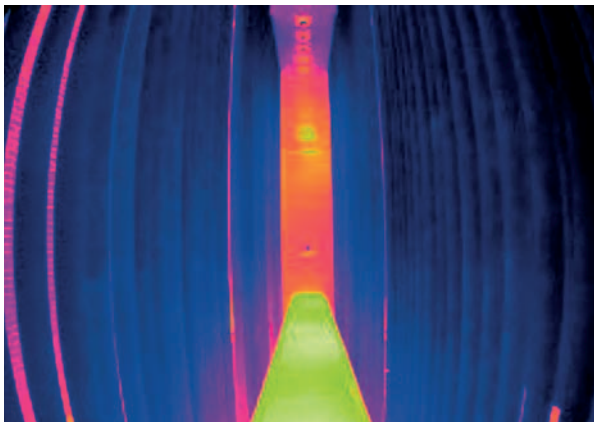
Features of the MWIR-B-640 include a high-performance water-cooling system, with low water flow requirements, even in the highest temperature furnaces. The borescope has a thermocouple at its tip, which sounds an alarm when removing the instrument, thus preventing damage if maximum temperatures are exceeded. It also features an integrated air purge to maintain a dust-free optical system while using minimal instrument air.

In addition, the MWIR-B-640 has a range of mounting options to ensure simple installation and is available with a range of probe lengths to suit every application.

The MWIR-B-640 is available with advanced IMAGEPro thermal imaging and data processing software, which supports long-term data trending to enable the early detection of leaks and temperature variations and achieve process optimisation.

WWW.AMETEK-LAND.COM





SCHOTT sets the course for the future

Successfully established business segment: Ultrathin glass from SCHOTT is extremely flexible and robust - Photo: SCHOTT

SCHOTT has set itself ambitious goals with its new Group Strategy. The internationally active Group is an expert on the development and manufacturing of specialty glass, a material with which nearly everyone comes into contact on a daily basis and that offers virtually infinite application potential for a wide variety of markets.

"It is our clear goal to leverage this potential," said Chairman of the Board of Management Dr. Frank Heinricht at the presentation of the new SCHOTT Strategy in Mainz. "We will concentrate on four fields of action: we intend to enter into neighbouring business fields and significantly expand our involvement in our two focus markets, the USA and China. At the same time, we will focus on the current challenges of climate protection, diversity and digitalization and want to actively convert these into an advantage for us."

REVIEW 2014-2020: SUCCESSFUL PORTFOLIO CONSOLIDATION

SCHOTT has set the course for these efforts within the framework of its previous strategy. Dr. Heinricht emphasized the good development over the past six years, he said, "We have achieved the goal of setting a clear course for profitability with our strategy program initiated in 2014, much faster than we had planned." For example, the equity ratio has been increased to currently 32 per cent in recent years. Operating profit has risen steadily since 2014, most recently to EUR 275 million.

GOOD STABILITY THANKS TO WORLDWIDE INVESTMENTS

"This shows that our approach of initially streamlining the portfolio at that time was the right move," Heinricht added. At the same time, the Group has laid the foundations for further growth alongside its successful consolidation. During the aforementioned period, SCHOTT invested over

Ambitious goals for Schott, an international group manufacturing speciality glass. Schott will focus on four defined projects across the whole group expanding into the Chinese and USA markets whilst also tackling digitalization, climate protection and diversity aiming to become a climate neutral company by 2030.

EUR 1 billion worldwide and expanded its innovation pipeline even further. This preparatory work is particularly effective in the current economically fragile situation: thanks to its broad portfolio, the company has good stability despite COVID-19. As in the past, SCHOTT will announce further details and its results for fiscal year 2020 at its Annual Results Press Conference in January.

Dr. Frank Heinricht, Chairman of the Board of Management, presents the new SCHOTT strategy - Photo: SCHOTT

A NEW LEVEL

"We have established a good foundation over the past few years. Now is the time to take our ambitions to a new level," Dr. Heinricht explained. "This project is ambitious, but that has always been SCHOTT's strength." It is for this very reason that the company culture and the guiding principle of "Pioneering Responsibly Together" are fixed components of the new strategy. Based on this, the company has defined four projects across all units by 2026:

FOCUS ON NEW BUSINESS FIELDS

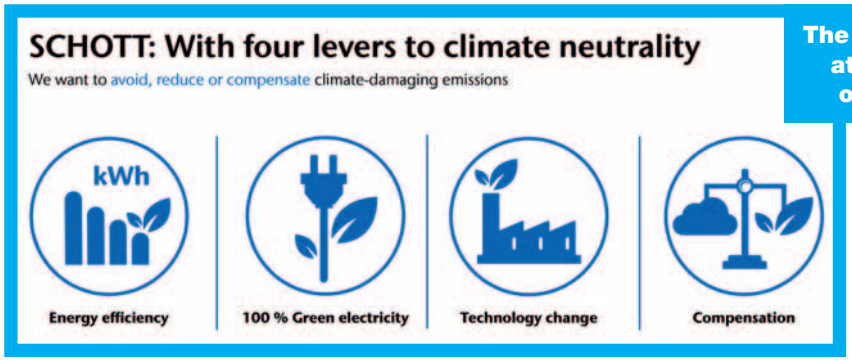
SCHOTT has set itself the goal of increasingly developing adjacent markets and applications. Successful examples include the augmented reality or ultra-thin glass business: glass types that have already been developed are being used for new applications such as foldable smartphone displays or data glasses. Another goal is to expand the range of products by adding new products and thus make a strong impression in markets the Group is already active in. For example, the company has made use of its expertise in the pharmaceutical market and successfully opened up a new product segment with its polymer syringes. The company is already expanding this expertise by incrementing the capacity of its site in St. Gallen (Switzerland) and by building a new plant in Müllheim (Germany).

FOCUS ON CHINA AND THE US

The expansion of business in the US and China represents an important focus of the new strategy. As the world's largest economies and centres of innovation with an international scope, both regions hold great potential for a wide range of specialty glass applications. SCHOTT expects positive impulses from these two regions for pharmaceutical packaging, semiconductors and data communication as well as in medical technology and consumer electronics, among other fields. Expanding regional research and production activities in cross-functional and transnational teams should significantly advance growth in these dynamic markets. SCHOTT has set an initial milestone for this goal with the start of production at the new Chinese pharmaceutical tubing plant at the beginning of 2021.

CLIMATE NEUTRAL BY 2030

At the same time, SCHOTT is focusing on sustainable devel-



The action plan for climate neutrality at SCHOTT comprises four fields of action – Illustration: SCHOTT

opment in pursuing its growth targets and therefore intends to become even more involved in climate protection than before. "We want to make SCHOTT a climate neutral company by 2030 and thus make an active contribution to climate protection," Dr. Heinricht explained. No other company in the specialty glass industry has ever set itself such an ambitious goal and firmly anchored it in its strategy.

The Group is seeking to avoid, reduce or compensate for climate-damaging emissions and is focusing on four fields of action: Further savings potential will be identified within its proven energy management system. SCHOTT will be switching completely to green electricity for its electrical power. Over the long term, the company wants to completely dispense with the use of fossil fuels, as far as this is technologically feasible. The company sees a promising approach to solving this problem in hydrogen technology, for example. SCHOTT wants to compensate for technologically unavoidable emissions by investing in climate protection projects.

DRIVING FORWARD TRANSFORMATION IN TERMS OF DIGITALIZATION AND DIVERSITY

People determine the success of any company. "Organizations are demonstrably more successful when they live diversity in their culture and rely on diverse teams," said Dr. Heinricht. As a traditional industrial Group, SCHOTT's first priority is to attend to the basics. The goal is to send a "Best Team" to the starting line for each task that combines the right professional skills with a culture of acceptance and openness. Target images and roadmaps are currently being developed in consultation with the Business Units. In addition, the HR department is developing a process to ensure greater diversity in new hires and succession planning. SCHOTT wants to take into account all dimensions of diversity, such as different values and perspectives, and place an emphasis on nationality, gender and interdisciplinary professional experience.

EFFICIENT DIGITAL PRODUCTION

In order for the "Best Teams" to reach top form, the right conditions need to be in place. In the area of digital transformation, SCHOTT therefore wants to gain speed, impact and reach and thus play a leading role in the specialty glass industry. The development and manufacturing of specialty glass is a complex process for which digitalization definitely offers potential for optimization. Manufacturing processes at SCHOTT have been optimized for quite some time now using Industry 4.0 approaches and Artificial Intelligence. "We want to provide SCHOTT employees with even better support when it comes to their daily work and raise awareness within the Group of the opportunities that digitalization offers," Heinricht explained. The goal is to make glass production more efficient, to learn even more about glass and to enable further product innovations and business models.

TRANSLATING THE SPIRIT OF THE FOUNDING FATHERS INTO THE FUTURE

"More than 130 years ago, our company founders made it their mission to improve life, promote the sciences and spur progress in many areas with innovative specialty glass. As pioneers, they developed this company with curiosity, focus and a clear vision. Exactly the same spirit serves as a model for our new strategy. In the coming years, we will consistently take the necessary steps to achieve this," concluded Chairman of the Board of Management Dr. Heinricht.

SCHOTT is one of the world's leading suppliers of pharmaceutical packaging. The company produces more than 11 billion pharma containers for life-saving drugs annually – Photo: SCHOTT

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OPTIMELT

Operating data from an OPTIMELT™ Thermo-Chemical Regenerator system on a tableware glass furnace at Libbey Leerdam

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INTRODUCTION

The OPTIMELT™ Thermo-chemical Regenerator (TCR) process is an advanced heat recovery technology for oxy fuel fired glass furnaces. The technology is based on a unique waste heat recovery concept called thermo-chemical regeneration in which heat stored in a regenerator checker during the flue gas exhausting cycle is recovered during the reforming cycle by preheating and reforming a mixture of natural gas and recycled flue gas.

Figure 1 shows this cyclic heat recovery process.

The flue gas cycle in regenerator 1 is similar to the conventional regenerator heating cycle in which flue gas waste heat is transferred to and stored in the checker. The unique feature of the TCR process occurs during the reforming cycle where a portion of the cooled flue gas is recycled back (Recycled Flue Gas, RFG) to the bottom of the already preheated regenerator (regenerator 2) and mixed with natural gas fuel (e.g., CH4). The RFG/CH4 mixture is heated by the hot checker. When the gas mixture is heated above a certain temperature various endothermic chemical reactions occur. For example, CH4 is reformed by CO2 and H2O in the RFG to form CO and H2.

The reformed gas or "syngas", Figure 2, is combusted with oxygen in the glass furnace, Figure 3, thus providing thermal energy for glass melting. When the regenerator in reforming mode is getting colder, the regenerators are switched and the regenerator that was previously in reforming mode is heated with flue gas.

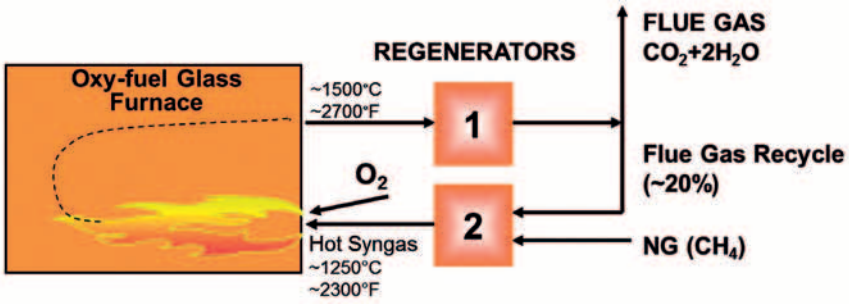

Figure 1: OPTIMELT™ TCR Process

OPTIMELT INSTALLATION ON THE TABLEWARE FURNACE AT LIBBEY LEERDAM

In support of Libbey's sustainability strategy and alignment with the European Carbon

The OPTIMELT™ Thermo-Chemical Regenerator (TCR) system stores waste heat from the hot oxy-fuel flue gas in regenerator beds and uses this energy to reform a mixture of natural gas and recirculated flue gas to hot syngas which is combusted with oxygen in the furnace. This technology significantly reduces the natural gas consumption of the oxy-fuel furnace. Following successful commercialization on a 50 tpd container glass furnace in Mexico, the OPTIMELT™ system has been in commercial operation on a 110 tpd oxy-fuel fired tableware glass furnace at Libbey Leerdam in The Netherlands since November 2017.

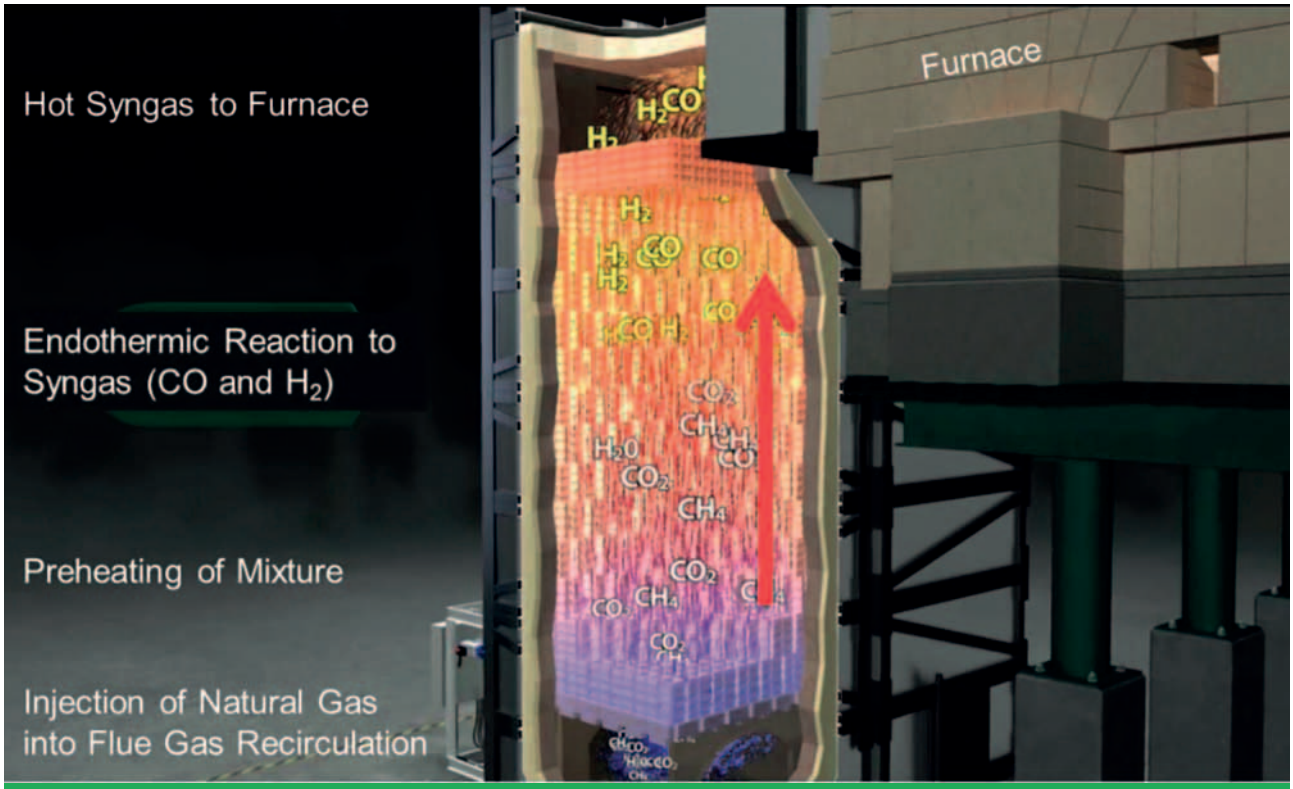

Figure 2. OPTIMELT™ Reforming Process

Reduction Roadmap the project's goals were to utilize best-in-class furnace technology for improved productivity, reduce energy consumption and lower emissions.

The new furnace started production with oxy-fuel combustion in the spring 2017 and the TCR startup followed in November 2017. The OPTIMELT part of the project was awarded funding by the European Union under LIFE grant LIFE15 CCM-NL-000121 – LIFE OPTIMELT.

Figure 4 shows the typical end-fired arrangement of the furnace with the TCR regenerators, flue gas piping and the downcomer with the flue gas damper at Leerdam. The flue gas recirculation piping is arranged under the port necks. Between the downcomer and the furnace a cooled refractory damper is used to close the flue gas opening dur-

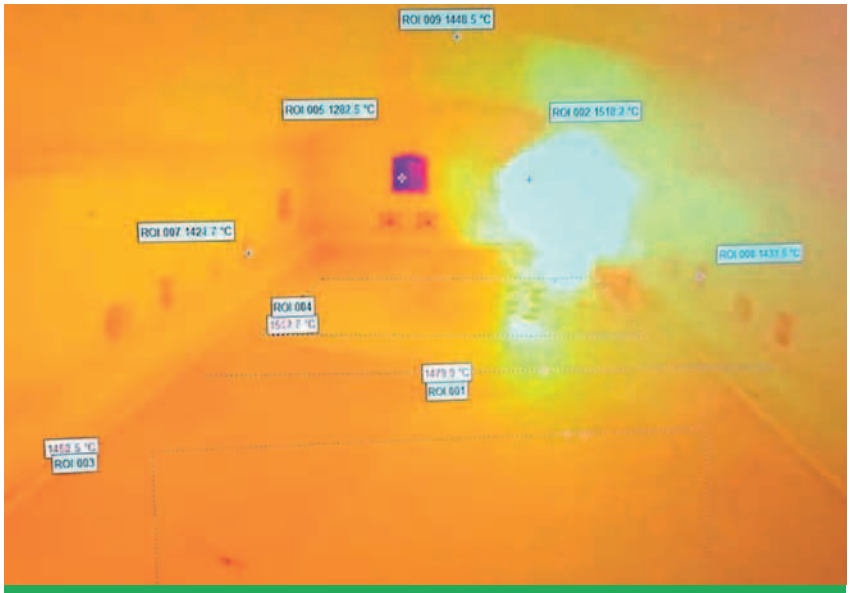

Figure 3. OPTIMELT Oxy-syngas flame

ing TCR operation when all flue gas passes through the regenerators. When the furnace operates on oxy-fuel, this flue gas damper is opened, and air dilution cooling is used in the downcomer to quench the flue gas to the baghouse inlet temperature. The oxy-fuel combustion system is a completely redundant back-up to the TCR system.

During OPTIMELT operation, the flue gas leaves the furnace through the regenerator that is in heating mode. A small high temperature fan is used to move most of the flue gas to the downcomer where it is diluted with air to a temperature suitable for the downstream flue gas treatment system where a main fan after a baghouse moves the flue gas to the stack. Approximately 20 per cent of flue gas is recirculated after the fan to the opposite regenerator, where it is mixed for reforming with natural gas at the entry to the regenerator. This mixture is then reformed to syngas and directed through the port neck into the furnace where oxygen jets below the port provide oxygen for combustion. During this TCR operation the hot flue gas damper inside the downcomer is closed and all flue gas is directed through the TCR system.

A significant part of the project was a comprehensive approach to process and system

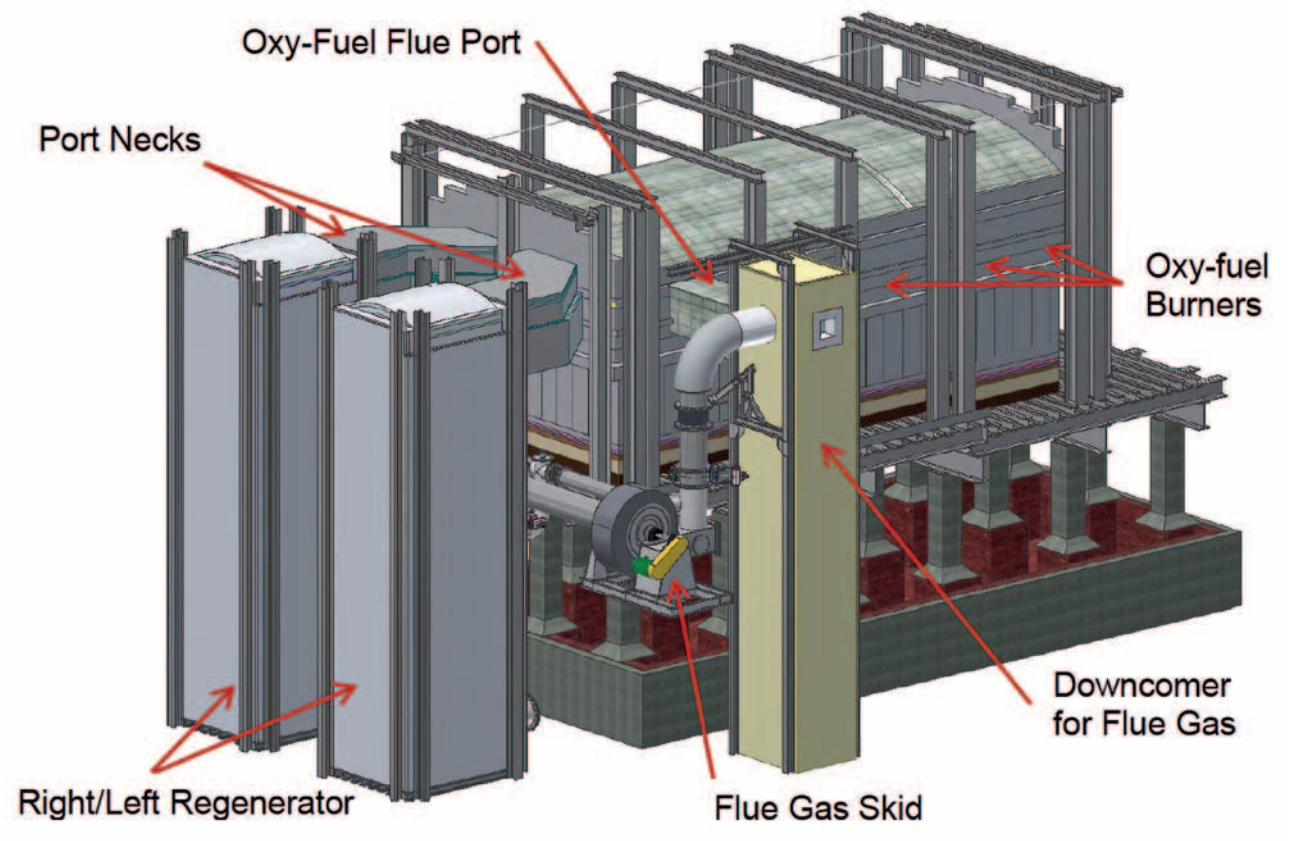

Figure 4: OPTIMELT System and L1 Furnace at Libbey Leerdam

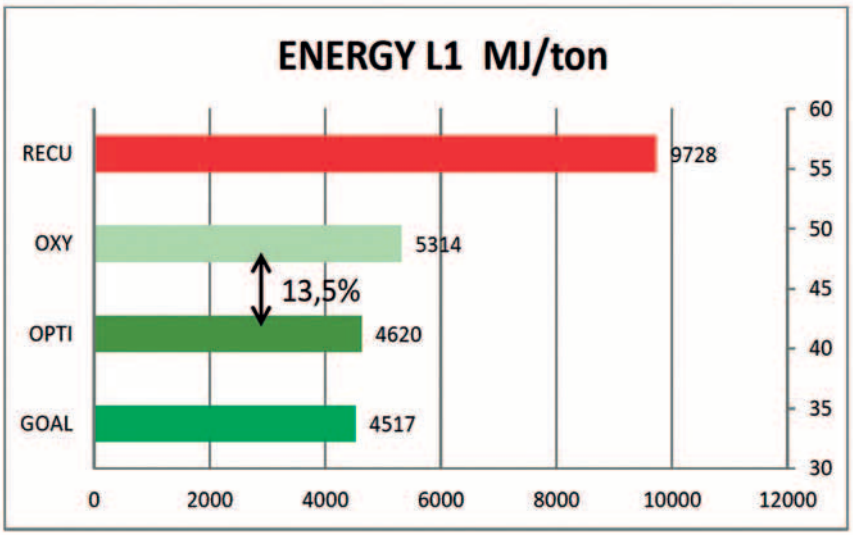

Figure 5: Specific Energy Consumption

design safety. This was followed by a safe and successful implementation of the technology at Leerdam and the startup. The process and implementation safety steps were reported in[1].

GENERAL PROJECT EXPERIENCE

The OPTIMELT execution was integrated into the overall project and careful planning resulted in a successful startup and optimization without lost production[2]. Early and comprehensive training of the engineering and operation staff on the new OPTIMELT technology resulted in good project acceptance and ownership. The switching between oxy-fuel and TCR operation is seamless and is either initiated by operator demand or automatically if there is a system fault.

The previous operational experience with generating large TCR syngas flames as needed for melting high quality glass has been confirmed at Leerdam. The oxygen jets can be directed in such a way that the syngas flame in the furnace has the appropriate length and width and is not touching walls or crown. There are no signs of overheating furnace refractory. The same glass quality at the required pull rates can be achieved and the required differences in operational settings in comparison to oxy-fuel operation have been identified for the OPTIMELT technology.

HEAT RECOVERY PERFORMANCE

The OPTIMELT technology recovers energy contained in the flue gas. The TCR system basically works as a heat exchanger. If the flue gas temperature of the gas entering the regenerators is lower, the available total amount of heat to be recoverable by reforming is limited as well. Any heat lost from the flue gas through the insulation in the high temperature parts of the port necks or direct furnace flue gas leaks cannot be utilized for the syngas generation process and reduces the energy reduction potential of the TCR system. Also important for the recovery are the pull rate of the furnace and the throat temperature which influence the total required heat input and the furnace flue gas temperature level. Batch composition and moisture, cullet ratio, air infiltration, excess oxygen level and even oxygen supply purity are related to the amount of flue gas available and influence the flue gas enthalpy and energy savings potential.

The first results of the energy consumption are shown in Figure 5 which shows the specific fuel consumption for oxy-fuel and TCR operation in MJ/t normalized to 50 per cent cullet rate and 25°C ambient temperature (to eliminate summer/winter influence) versus the pull rate of the furnace. Each point represents a daily average of the energy consumption. Due to daily variation of the furnace production rate at Leerdam and process optimization settings the data scatter is quite large.

Most of the data points fall into a production range of approximately 75 per cent of the furnace capacity. At this pull level the reduction in heat consumption is 13.5 per cent which falls short of the expected performance. At a low furnace production rate, the furnace temperatures are lower and the recoverable heat in flue gas by TCR is reduced. Thus, the heat recovery rate is expected to increase with the furnace production rate. Although the available data at higher pull of 85 per cent capacity is limited, it shows approximately 15 per cent fuel reduction.

EMISSION PERFORMANCE

The L1 project has significantly reduced the emission of NOx, SOx and dust at Leerdam. Table 1 shows preliminary and non-official emission measurements.

By replacing the two old air recuperative furnaces at the site with a single oxy-fuel furnace the NOx emissions were reduced from 1.63 kg/t (3.2 lb/ton (US)) to 0.39 kg/t (0.8 lb/ton) or by 76 per cent. Similar reduction percentages were achieved for SOx and dust. The OPTIMELT emission performance goes beyond that of the oxy-fuel combustion system. NOx, SOx and dust were reduced in these first

TABLE 1

EMISSION PERFORMANCE OF THE L1 FURNACE AT LEERDAM

	Old Recup. Furnaces at full pull,kg/t	Oxy-fuel L1 at 75% pull,kg/t	OPTIMELT L1 at 75% pull, kg/t	Oxy-fuel vs. old furnaces	OPTIMELT vs. old	OPTIMELT vs. Oxyfuel
Date of measurement	Oct 16/ Apr 17	30 May 18	4-5 Apr 18			
NOx	1.625	0.390	0.230	-76%	-86%	-41%
SOx	0.930	0.240	0.190	-74%	-80%	-21%
Dust	0.013	0.003	0.001	-77%	-92%	-67%

preliminary measurements by approximately 80-90 per cent compared to the old furnaces. The unique forming of the large TCR flame with oxygen jets in the furnace leads to a deeply staged flame where most of the fuel and oxygen can be diluted with furnace gases before they react with each other.

The excellent results for SOx and dust show that the OPTIMELT flame is properly placed in the furnace and that glass volatilization is low. CFD models of the two combustion systems have confirmed the lower volatilization rates and that the furnace temperatures are generally lower with the TCR flame.

Initial data from 2017 without burner optimization show higher NOx emissions in a range of 0.59 to 0.85 kg/t. However, with a well optimized combustion NOx emission of approximately 0.40 kg/t (0.80 lb/ton) are possible with oxy-fuel operation and 10 per cent flue gas nitrogen content. The data points for OPTIMELT operation were collected at a slightly higher range of nitrogen concentrations in the furnace but are all below a NOx emission of 0.3 kg/t (0.6 lb/ton). NOx emissions with OPTIMELT operation of 0.2 kg/t are remarkable since Dutch natural gas contains about 14 per cent nitrogen. It is our expectation that by working closely with glass plant operators and managing air infiltration, the OPTIMELT technology can meet future emissions requirements while recovering flue gas energy from oxy fuel furnaces.

CONCLUSION

The implementation of the OPTIMELT technology into the furnace at Libbey Leerdam has been successful and the system is now in commercial operation using a fully automated control system. The project commissioning and startup phase were completed without encountering major issues or glass production problems. A few design issues had to be addressed, but no fundamental technology or scale-up issues were encountered. The operational results show that the projected energy savings can currently not be achieved due to unexpected heat losses in the regenerators which especially penalize smaller systems as the recoverable energy is limited. The shortcomings of the insulation will be addressed in the future. The emission results of the L1 TCR system are significantly lower than the already low emissions of the oxy-fuel combustion system. Future optimization progress and operational experience will be available as part of the reporting requirements under the LIFE grant.

The support of the European Union for the implementation of OPTIMELT at Libbey Holland is gratefully acknowledged.

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BUCHER EMHART GLASS

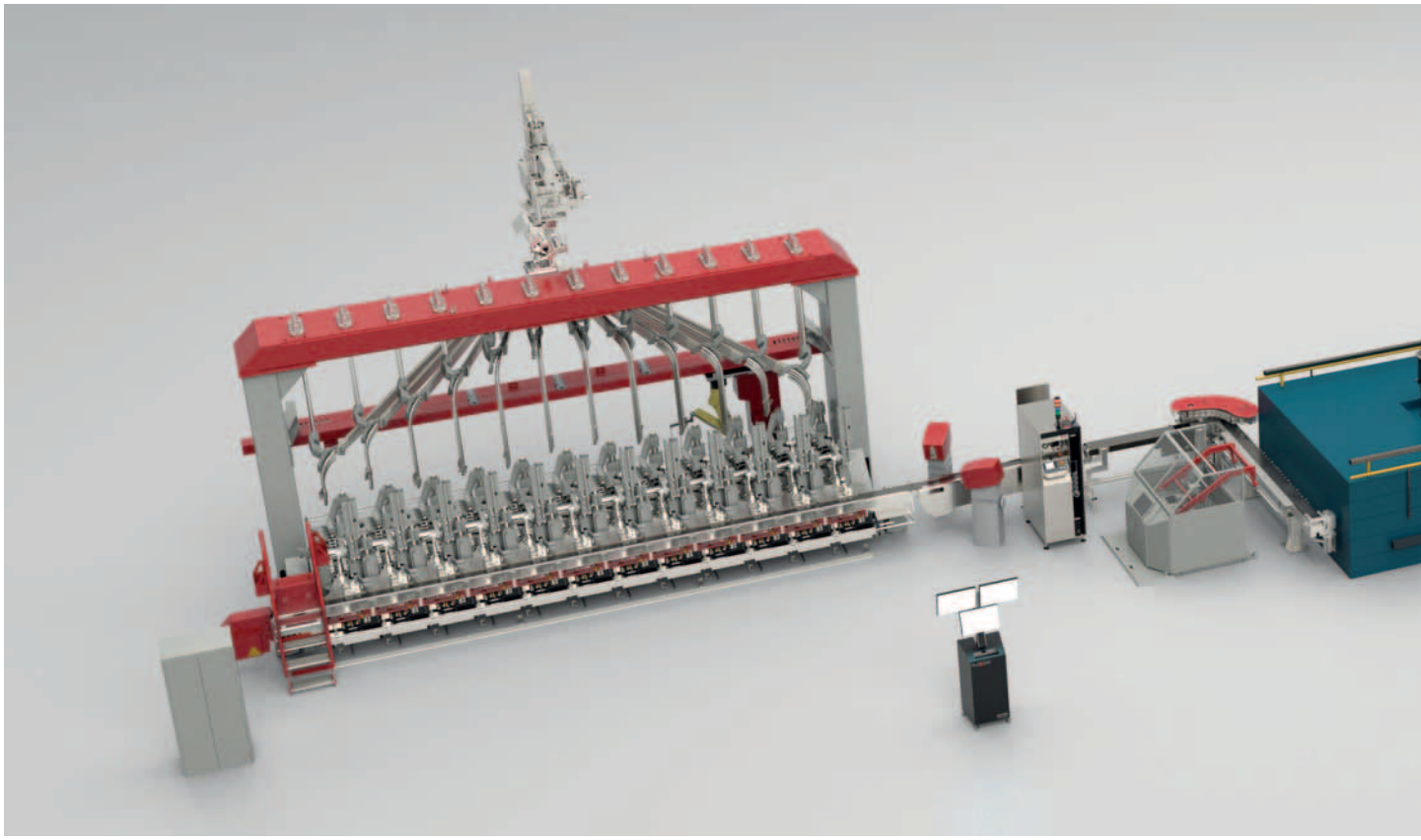
container marking traceability

Bucher Emhart Glass secures major order from CP Glass, Poland, for seven ID Mark units. This laser marking unit inscribes a unique code allowing to track each glass container through its lifetime with 150 units already installed worldwide.

TRACEABILITY

ID Mark addresses a long-standing problem in glass-container manufacturing: traceability. Because production lines are so long, and wares take a great deal of time to make the journey along them, matching up inspection data from the Cold End with forming data from the Hot End is a major challenge.

Emhart's ID Mark solves this by using a CO2 laser to inscribe a unique ID code on each container shortly after forming. The marking process is carried out on the conveyor or cross-conveyor



at high speed, allowing for mass beer container production and even for tandem machines. The position and angle of the laser can be easily adjusted to compensate for container shape and conveyor position. Job changes where the same code is used take less than a minute.

UNIQUE CODE

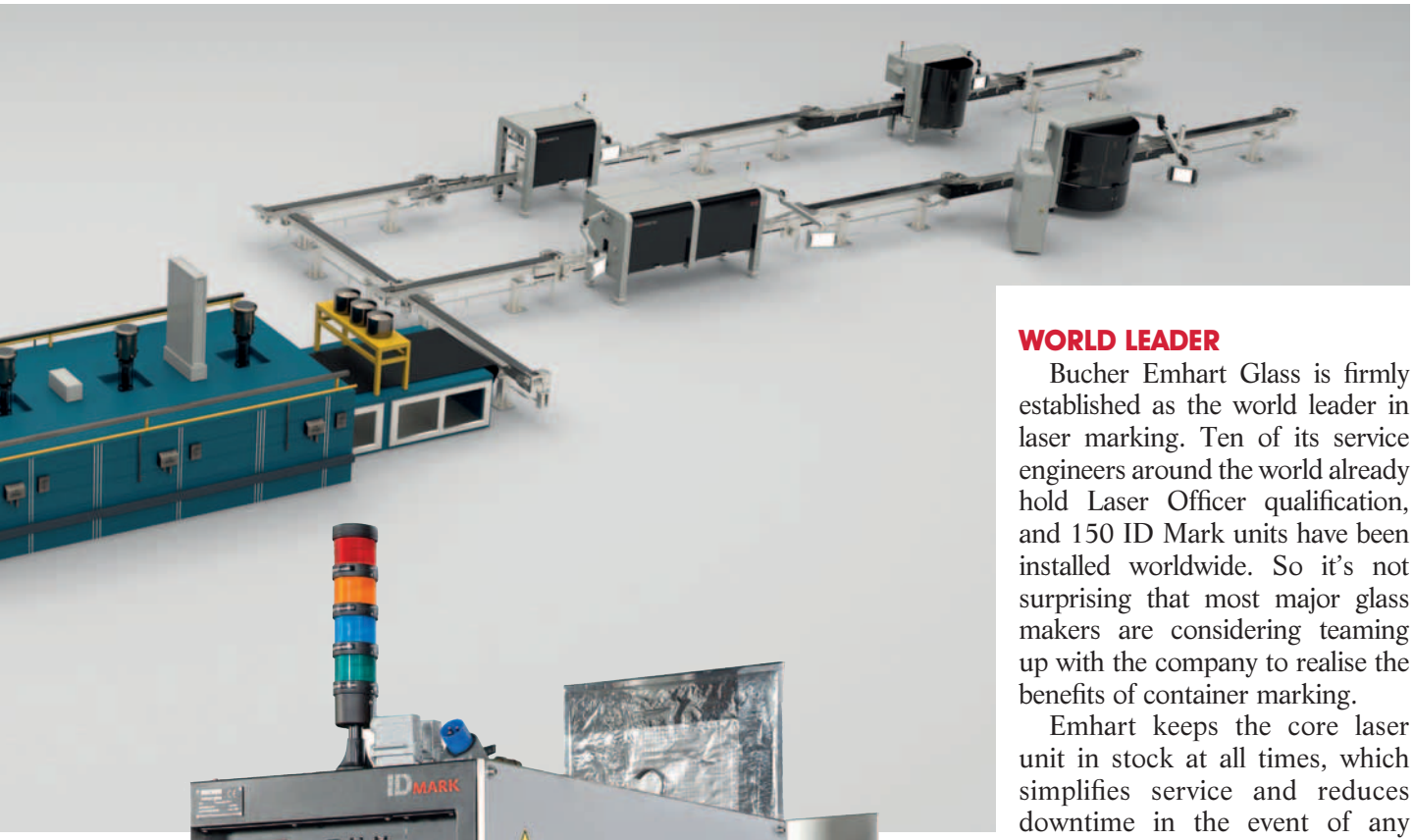
As the marked container makes its way along the production line, every measurement taken can be associated with its unique code, allowing the operator to view the 'life story' of any container at a glance. As more data is gathered, manufacturers can gain deep insights into their production, allowing for process and quality improvements.

The code can be read automatically – for example, by Emhart's own ID Read technology. This also offers the possibility to store all the inspection results to the individual bottle ID. ID Mark can also help brand owners to guard against counterfeiting, and improve the management of returnable bottles.

CP GLASS

The latest manufacturer to adopt the technology is CP Glass of Poland, who make bottles for beer, spirits and soft drinks. The company was very satisfied with the two previously installed systems and has now decided to purchase seven ID Mark systems from Bucher Emhart Glass. For CP, a key concern is to track all containers without exception.

On Emhart's side, the project has been handled by a dedicated team consisting of a Sales Account Manager Jakub Ciosmak, a Product Manager and a Project Manager. The machines were scheduled to arrive at the CP plant before 31 December 2020.



WORLD LEADER

Bucher Emhart Glass is firmly established as the world leader in laser marking. Ten of its service engineers around the world already hold Laser Officer qualification, and 150 ID Mark units have been installed worldwide. So it's not surprising that most major glass makers are considering teaming up with the company to realise the benefits of container marking.

Emhart keeps the core laser unit in stock at all times, which simplifies service and reduces downtime in the event of any issues. The design of the unit is constantly being refined: just this year, Emhart has switched to stainless steel for the height set-up belt and added a new trigger sensor that is unaffected by dust in the environment.

"We're delighted that CP Glass have put so much confidence in ID Mark by placing such a significant order," says Jakub. "We're looking forward to getting the machines delivered and set up, and helping them achieve the quality gains they're looking for." ■

BUCHER
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FALORNI TECH

Maintaining air and gas ratio constant with AQRatio

Thanks to AQRatio technology, the air/gas ratio is kept constant during the regulation output driven by the temperature profile demand and is independent from the pressure losses in the air/gas mixture line downstream the regulation skid due to any cause (fouling in the pipe or in the burners).

To meet the objectives of evolution and innovation in combustion technology, the system requires stable, uniform, and complete combustion. The combustion plays a crucial role in the right concept and a rigorous design path of FLEXCOND, which embeds integrated solutions that contribute to the overall performance of the glass conditioning system.

In forehearth temperature control processes, the key elements to be kept under full control are basically two:

- The ratio between the air and the gas during the whole working range of each combustion zone;

• The temperature stability duration time.

AQRATIO TECHNOLOGY

AQRatio technology is based on the Differential Pressure Governor principle. A membrane device continuously receives the differential pressure signal taken before and after an orifice, in both air and gas lines. The purpose of the membrane device is to keep a constant preset balancing of the air and gas differential pressure values at variable flow of combustion air. Being assumed that the differential pressure measured before and after an orifice plate inside a single duct with a gaseous fluid in motion is directly proportional to square of the mass flow of the same fluid, the fact to keep these differential pressures in constant relationship consequently means to keep the flow ratio constant. It is important to highlight that the measurement of the differential pressure value is not qualitative but quantitative, so there is no reading of flow but only the physical correlation inside the system (See Chart 1).

Another characteristic of AQRatio technology is the integration of a linear flow control valve to accurately and repeatedly modulate the flow of air at any servomotor angle. The valve controls Air/Gas ratios up to 25:1 and is suitable for regulating flow rates for modulating or, also, stage-controlled combustion processes.

This type of control valve uses the rotary valve principle in which a control cylinder, with a specially designed opening to determine a linear flow, is installed in the flow body. The rotation of the cylinder around its main axle, sets the desired flow rate in the air pipeline. In addition, the maximum flow can be limited in broad ranges by means of a flow restricting cylinder which allows optimum adaptation to the capacity required, without limiting control quality.

In conclusion, the AQRatio is a modular integration of air and gas flow control technologies aimed to modulate the temperature of the forehearth zones providing:

• Constant Air/Gas ratio at any admittable flow of the line;
• Easy adjustment of Air/Gas ratio;
• Linear air flow adjustment;
• Suitable working conditions of air and gas flow control devices.

THE ADVANTAGES OF AQRATIO

The main advantages of Falorni Tech AQRatio combustion system technology can be resumed as follows:

- Tailor-made system to fit the FLEX-COND glass conditioning technology by Falorni Tech;
- Steadiness of the Air/Gas ratio regulation during operation and during the time;
- Regulation not influenced by the downstream mix line characteristics and/or by eventual decay of the pressure losses in the same due to ageing, clogging or fouling;

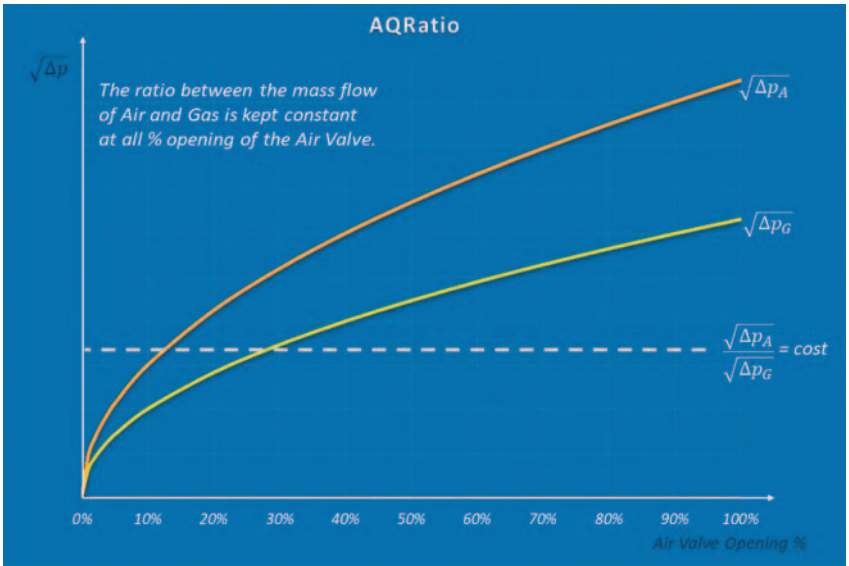


Chart 1 - Qualitative view of the mass flow of air and gas ratio related to differential pressure measurement in the lines.

- Quick response of the temperature regulation loop to the temperature variations of the zone thanks to a fast tuning of the gas flow (slave) to the air flow adjustment (master);
- Linear response of the air flow modulation to the servomotor angle in all working range;
- A number of adjusting parameters that allow engineers and the furnace personnel to fix the air and gas working conditions fitting with the field line requirements and to keep these figures constant for the whole firing range. No need of further adjustments once the system is commissioned up to the time of forehearth maintenance;
- Wide range of temperature setting in the same zone by keeping combustion values constant
- Capability to maintain the optimal combustion atmosphere in case of glass types sensible to oxidation (all reduced glass such as amber or dead leaf, etc.).

AQRATIO AND FLEX-COND: PERFECT INTEGRATION

Falorni Tech has developed his AQRAtio system by means of the experience gained operating the FLEX-COND glass conditioning technology in the field. FLEX-COND has been conceived bearing in mind the most accurate glass temperature homogeneity regulation in a forehearth in order to produce NNPB container glass with no compromise to the operating flexibility of the same forehearth. So far, AQRatio has been expressively developed thinking to its integration with these strict requirements, not only for NNPB in container glass process but for any other high performance forming process including multi-gob press systems or Press-Blow systems for tableware production.

As a matter of this, it can be said that AQRatio and FLEX-COND are two sides of the same coin as they are so strictly connected that they cannot stand one without the other.

FUTURE DEVELOPMENTS FOR AQRATIO AND FLEX-COND

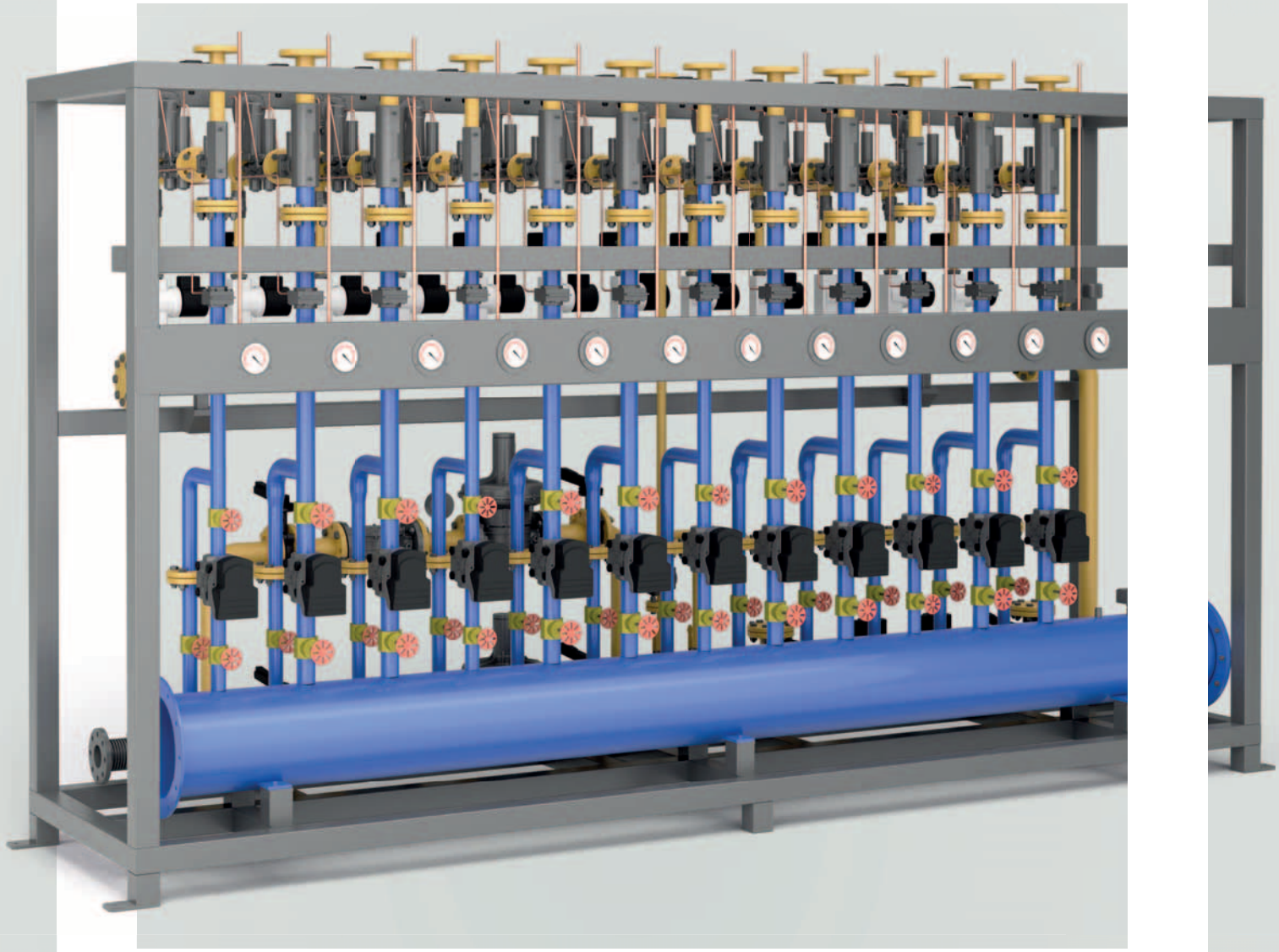
The next important target of all the industry kinds will be the achievement of Industry 4.0 standards or the Fourth Industrial Revolution standards currently ongoing and aimed to support the traditional manufacturing and industrial processes with smart technologies, in particular communication and Internet, that will make possible the management of complex processes in full automation and without or with the most limited human intervention.

The next step to complete the evolution of FLEX-COND and AQRatio, will be the ICS or Interactive Control System a new kind of controller philosophy. This will be based on advanced technology developed by glass makers for glass makers to support the whole conditioning phase (and not only).

Interactive Control System by Falorni Tech will generate a database of experience directly from the daily field operation. This database will be the platform to enhance the process efficiency by providing quick response for problem solving, fast setting, sharing of experience.

This controller philosophy, still under improvement, is able to provide the standard control capabilities but with additional features:

- Mathematical and Physical analysis of the process data;
- Support to Operator on process status and data reading;
- Storage of analysis, reports and experience;
- Reporting/interface and sharing of all operators' experience. ■



KEEP CONSTANT AIR AND GAS RATIO AT ANY HEATING RANGE WITH AQRATIO.

AQRatio is a modular integration of air and gas flow control technologies aimed to modulate the temperature of the forehearth zones.

AQRatio combustion system technology has been conceived not only for NNPB and multigob process but for any other high performance forming process including high speed press systems or Press-Blow systems for tableware production.

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DISCOVER THE BENEFITS OF AQRATIO
Scan the QR code or go to **flexcond.falornitech.com** to learn more about our glass conditioning system for NNPB.

falornitech
glass melting technology

HEYE INTERNATIONAL

Simotion® servo drive maximises processes at Ardagh Group

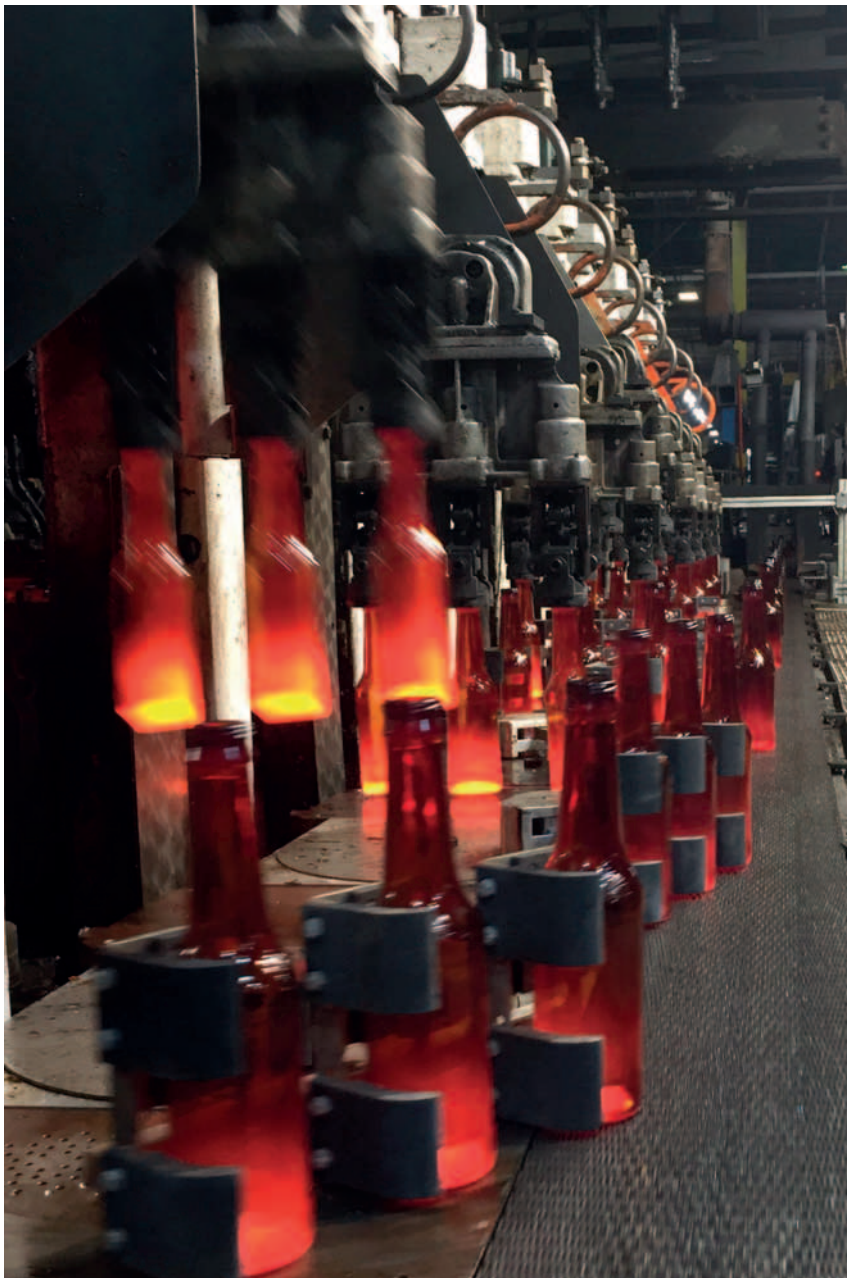
Ardagh Group's Knottingley glass container facility in the UK is benefitting from the recent conversion of an existing production line to Simotion® servo drive and FMT control technology.

Installed and commissioned by production machinery specialist Heye International GmbH, the highly flexible control system is based on the future-proof, multi axis Simotion® drive system from Siemens. Independently oper-

Ardagh's glass container facility based in Knottingley, UK, looks forward to maximising the benefits of using process visualisation within its production process thanks to the combination of the Simotion® servo drive and advanced glass container production technologies.

RESILIENT, NON-STOP OPERATION, MINIMISED TIMES AND REDUCED STAFF TRAINING

Enhanced reliability of the electronic components in combination with the application of a compact servo motor with robust resolver, guarantee resilient, non-stop operation. If control components need to be changed, complicated programming is not necessary because the configuration data



ating visualisation and real-time control has enabled delivering simplified access to all production data parameters and system error reports.

is stored on a memory board. When control is initiated, the data is automatically transferred. Hence, commissioning times and downtimes during servicing are minimised, whilst the staff training requirements are reduced.

FURTHER ENHANCING ADDITIONS

Retrofitting the Simotion® and FMT control equipment at the Knottingley glass plant was combined with Heye's expert technicians installing a series of advanced glass container production technologies as part of the project. This included the installation of a 3-inch triple gob feeder mechanism, Heye servo dual motor shears (type 2323, 3-inch triple gob) and a 'futronic' FMT VDM electronic timing system.

Along with 10-section crane rail equipment, the installation features replacement blank side valve blocks, the Heye 2157 servo pusher system, a Heye three axis servo lehr loader (type 4206), hot end reject equipment and Heye process control.

HEYE INTERNATIONAL

Based at Obernkirchen, Germany, Heye International GmbH is one of the international glass container industry's foremost suppliers of production technology, high performance equipment and production knowhow. Its mechanical engineering has set industry standards for more than five decades. Extensive industry expertise, combined with the positive attitude and enthusiasm of Heye International employees is mirrored by the company motto 'We are Glass People'. Its three sub-brands HiPERFORM, HiSHIELD and HiTRUST form the Heye Smart Plant portfolio, addressing the glass industry's hot end, cold end and service requirements respectively.

A Simotion® IS conveyor and ware transfer conversion kit was supplied, together with a Simotion® cross conveyor conversion kit. The Heye Simotion® Servodrive System is designed for nine drives and features two control cabinets.

GOOD TEAMWORK

Julie Watson, Director of Operations at Ardagh Glass Knottingley, confirms successful commissioning of the project in close co-operation with Heye personnel, both before and during installation: "We are delighted with the good teamwork between Ardagh and Heye staff. The upgrade of our IS machine and equipment will lead us to the next level of high-end technology". Now, the glassmaker is looking forward to maximising the benefits of using process visualisation within the production process. ■

heye international

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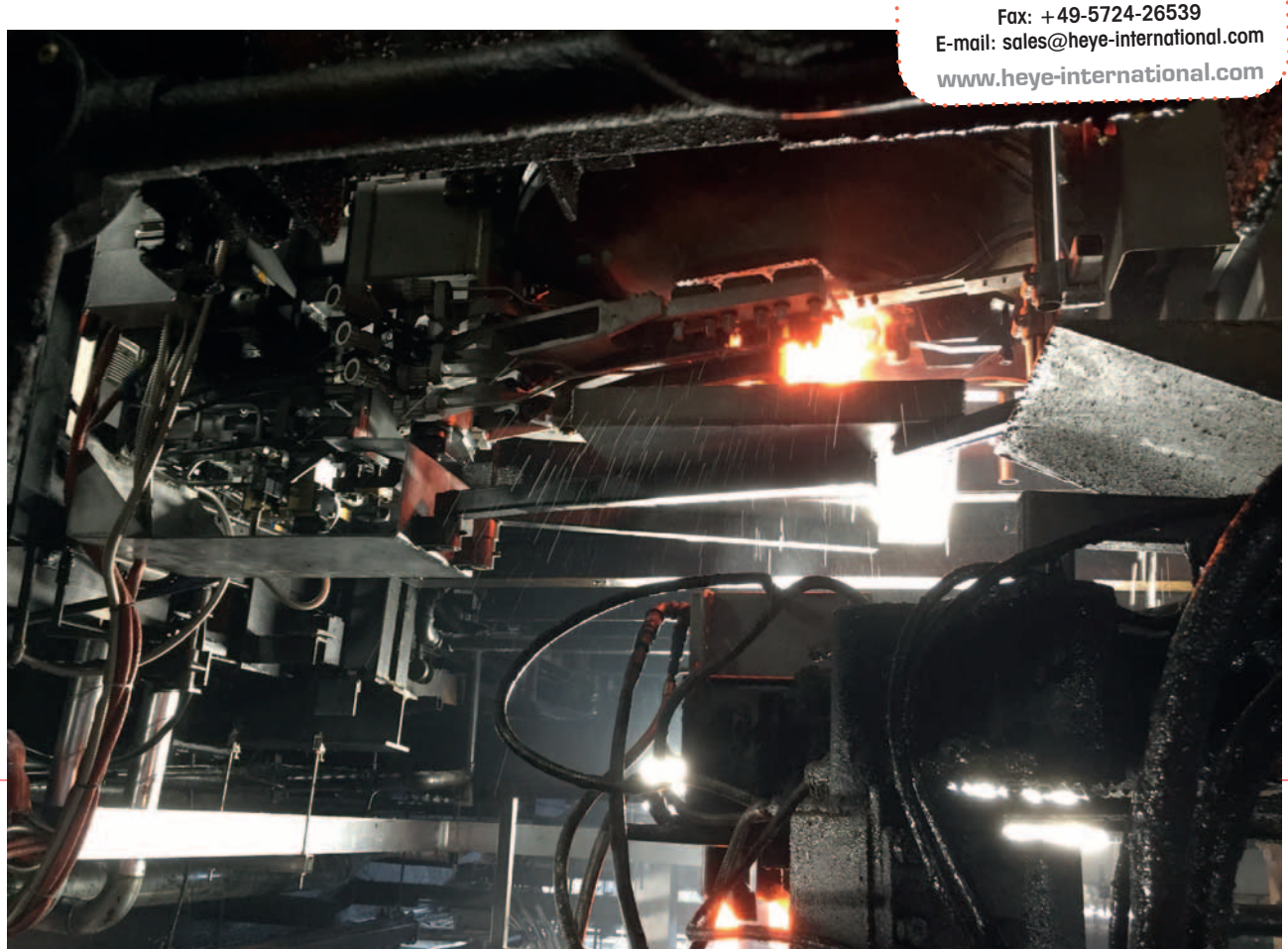

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IRIS INSPECTION MACHINES

Long-term partnership supports pharmaceutical glassware investment in Thailand

As the pursuit of successful vaccines to control the spread of the global Covid-19 pandemic intensifies, demand for specialist pharmaceutical glassware to package these critical vaccines has required glass manufacturers throughout the world to create or boost their manufacturing capacities accordingly.

Mr Udomsak Tangsaksathit, General Manager of Wellgrow Glass and Mr Jean-Luc Logel, CEO of IRIS Inspection machines

Few industrial sectors have such stringent quality requirements as the pharmaceutical industry and to meet these exacting specifications, IRIS Inspection machines and its innovative ware inspection technologies are available to support the world's specialist pharmaceutical glassmakers to meet these challenges.

ACCEPTING THE PHARMA INDUSTRY'S CHALLENGE

Among the companies to have accepted this challenge is Thailand's Wellgrow Glass Industry Co Ltd (WGI), an established independent producer of high quality glass bottles for the pharmaceutical and cosmetics sectors.

Located in Chacheongsao Province, some 50km east of Bangkok, WGI has more than 18 years' experience in the international glass container market, having successfully created extensive capabilities to make an established portfolio of products in flint, high flint and colour glass on its 12 production lines,

Evolution Dim NEO machine installed at Wellgrow Glass

primarily to satisfy the needs of local customers.

Just 15 years ago, WGI's manufacturing capabilities comprised a single melting furnace and five production lines but as local demand for its specialist output has steadily increased in the intervening period, the need for additional manufacturing capacity has also grown gradually.

In support of the glassmaker's business expansion initiatives, close working relationships have been established with many leading international technology suppliers. This includes a mutually beneficial long-term partnership with the non-contact inspection solutions specialist, IRIS Inspection machines.

WORKING CLOSELY WITH IRIS

Since ordering its first two Evolution 16 inspection machines in 2005, Wellgrow has worked closely with the IRIS team to improve and maintain the quality of its output. Today, the glassworks features three furnaces and 12 production lines and the factory's IRIS inspection equipment has been the subject of extensive investment and modernisation to support these investment initiatives.

The hardware and software for all machines has been upgraded and converted to the latest Evolution NEO technology, making it capable of operating like brand new, smart inspection equipment. All production lines now feature the IRIS body inspection solution, with some lines also benefiting from the Evolution DIM dimensional inspection machine.

CONTINUING TO SUPPORT PHARMA GLASSMAKERS

The innovative ware inspection technologies available from IRIS Inspection machines are continuing to support the world's specialist pharmaceutical glassmakers to meet the challenges posed by the Covid-19 crisis. In Thailand, for example, the long-standing partnership between WGI and IRIS Inspection machines has benefited both parties. Based on mutual trust and a belief in the advantages of business cooperation, this successful relationship is expected to continue long into the foreseeable future.

IRIS INSPECTION MACHINES

A subsidiary of the Wisetec Group, IRIS Inspection machines was established to provide turnkey inspection solutions for mass-produced glass containers of any shape or colour, including wine, beer, liquor and Champagne bottles, pharmaceuticals and food containers. A team of dedicated Research and Development engineers has evolved a range of equipment to match the industry's demanding requirements and satisfy the inspection needs of key international customers.

The company has based its development on a long-term partnership with glassmakers in the field of glass defects detection, as well as on an exceptional know-how in the most innovative vision technologies. The success of IRIS is due not only to the exceptional efficiency of its Evolution machines range but also to the excellent support provided by engineers worldwide. Thanks to a network of international agents and technical support service centres, IRIS is able to support customers throughout Asia, Europe, the Americas, Africa and Australia.

IRIS Inspection machines

IRIS INSPECTION MACHINES

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COMPANY PROFILE

WALTEC

Tailor-made technology and innovative machine solutions for sustainable glass production

With over 250 pressing, blowing, spinning, handling, and fire polishing solutions up and running all over the world, Waltec works closely with its customers, taking business to the next level, challenging clients to build together better manufacturing processes which, in turn, contribute to a more sustainable industry footprint.

Waltec is a leading manufacturer of fully automated and electronically controlled production lines – from feeder up to annealing lehr. Over time, Waltec has successfully migrated its in-house designed and manufactured state-of-the-art pressing, blowing, spinning, handling, and fire polishing solutions into more than 250 manufacturing locations around the globe.

Transforming hot-end operations through improved resource efficiency and reduced energy consumption is their key challenge. Waltec's team of dedicated industry experts is there to make this happen.

WALTEC'S VALUES: RELIABLE BY TRADITION AND DRIVEN BY INNOVATION

Waltec practices the highest standards for health and safety and integrates this into their innovative production lines, components, and services. The company fully recognizes their broader responsibility towards its employees and society and even better, acts accordingly. Long term relationships based on trust and performance form the backbone of its successful long-lasting business model.

Waltec stated: "Sharing our ongoing and exciting innovation path with you and go together the extra mile to create a better forming process is our passion. Our company offers continuous learning and improvement. Apprenticeship and permanent education is part of our DNA. Young people get the chance to develop themselves through an integrated, practical on the job training concept. We believe that only motivated and skilled employees are capable of delivering top performance to our customers."

"We are creators of innovative glass manufacturing technology, we design sustainable production processes, we build cost-effective production lines and components

targeting the optimization of your hot-end process." Dipl-Ing. Britta Höfer, Waltec owner and managing director.

"Our decisions are guided by the principle that we should empower our people so that they can transfer our world-class technology knowledge into solutions that help our friends in the glass industry to cope with today's complex challenges."

The family tradition and heritage safeguards these values across the globe and that's why Waltec is proudly saying: "reliable by tradition and driven by innovation".

TOWARDS A BETTER HOT-END FORMING PROCESS – SHARING TECHNOLOGY AND EXPERIENCE

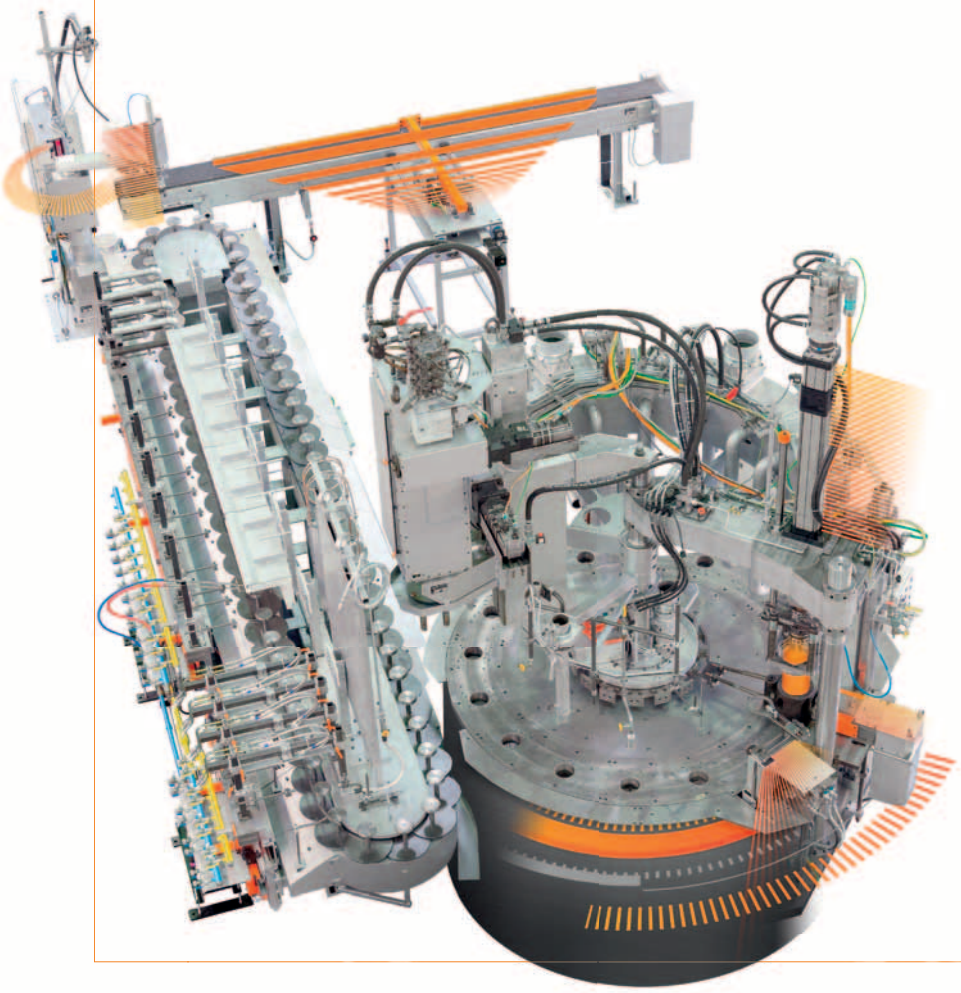
Creating a better hot-end press-process empowered by the latest available machine, process, and software data technology has inspired the Waltec team to develop a new range of so-called E-SERVO performance components. Transforming and upgrading the sustainability footprint of older in-market press machines is now possible:

1. Lower energy consumption
2. Less cost
3. Higher output
4. Sustainability inside

Waltec presented this innovation to the global glass industry via a special webinar during glasstec virtual.

PROCESS DESIGN AND MACHINE DEVELOPMENT

"Each customer inquiry is, for Waltec, unique and will always be handled by a multi-disciplinary project team of Waltec specialists looking for the best possible solution. Teamplay guarantees the best possible customer satisfaction," confirms Waltec's commercial director, Herman Green.



INDUSTRY 4.0 - BIG DATA ANALYTICS

Process optimization and the use of data analytics is nowadays a must to stay ahead of competition. Contemporary software solutions analyzing and optimizing data and efficiencies are embedded in self-engineered artificial intelligence. Waltec delivers tailor-made processes and machine designs to comply with Industry 4.0 standards and even far beyond.

QUALITY THROUGH IN-HOUSE MANUFACTURING

All activities, from design to manufacturing, up to customer delivery, and the start of operations, are executed by a qualified team of experts and specialists. Waltec offers a one-stop customer approach. The risk of third-party failure is eliminated and the highest quality is guaranteed according to the companies management team.

WALTEC CARRIES OUT GAME-CHANGING REMOTE COMMISSIONING

Waltec has successfully carried out the first remote controlled commissioning and start-up of a new production line in China. The reason for this worldwide premiere in the glass producing industry was the unforeseeable entry restrictions of the Covid-19 pandemic.
Mr. Herman Green, commercial director, stated: "The Covid-19 crisis forced us to think and act out of the box and using technology to eliminate traditional business boundaries. Thanks to the major steps forward in digitalization that Waltec has already taken in recent years, we were able to apply now our newest digital solutions to carry out the commissioning in China. The first fully remote-controlled commissioning and start-up of represents a major milestone to Waltec and underlines our innovation driven footprint to realize process optimization."
Waltec's operations Director Mr. Rainer Wagner commented: "The remote collaboration between our HQ in Germany and our Chinese customer over thousands of kilometres away was accompanied by communication via video-capable end devices such as body cams, smartphones and laptops with headsets. In this way, the experts at the remote centre of Waltec were able to take the customer's view without having to be physically on site and so contributing to a lower carbon footprint in general.
The components of the production line are equipped with digital hardware that enables remote access to the machine control system and sensors collecting operating data almost in real time. A first step to go beyond Industry 4.0!"

24/7 AFTER-SALES SERVICE AND PRODUCTION SUPPORT

Once in operation, the service team is always there to help. The team operates a 24/7 service model and herewith helping customers around the clock to increase output, reduce downtime and ensure continuity in operations. Recently Waltec successfully started a new innovative service named remote commissioning. This service made it possible to start up a brand new production line in China without the service team had to be on site. Waltec's operations director, Mr. Rainer Wagner: "Online troubleshooting, as well as direct communication with our service experts, is highly appreciated by all of our customers." ■

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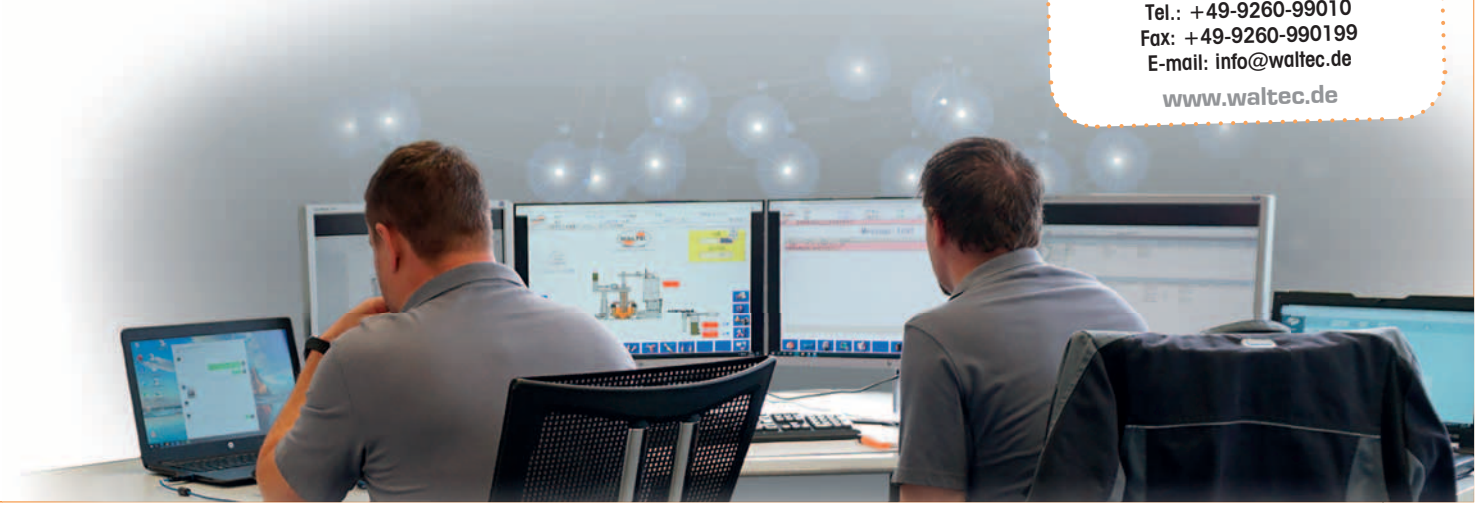


VRMT

Groundbreaking virtual reality training tool for the worldwide glass container industry

VRMT from the United Kingdom have developed a 'state of the art' virtual reality tool for helping glass plants to train IS personnel on the complexity of glass container manufacturing. In this article, Glass Machinery Plants & Accessories speaks to the two founders of the company to find out about the functions available in the virtual hot-end developed by VRMT, and how these functions can assist glassmakers in training their personnel.

Image 1: The virtual hot end

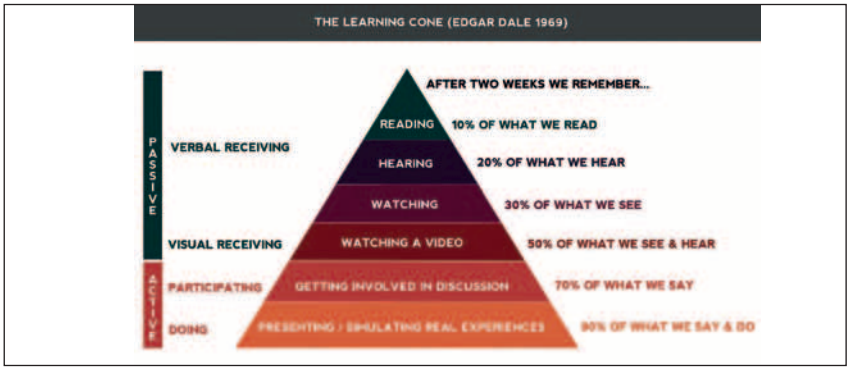


Image 2: Learning Cone

VRMT was set up two years ago in February 2019 by Tony Pawinski and Mark Henshaw. Tony Pawinski has 31 years of experience working at Allied Glass as well as consultancy for other glass companies such as Beatson Clark. Tony started work in the glass industry in 1981 and worked in several roles during his career at Allied. Tony recalls "I started as a general maintenance engineer, then transferred to the first ever cold-end department. Through the following years, I worked as Senior Project Manager and Head of Engineering."

Tony gained a lot of experience ranging from designing cold-end layouts to organising major furnace rebuilds to being charge of every aspect of engineering that is expected at a major glass container manufacturer.

His VRMT co-founder, Mark Henshaw, has decades of expe-

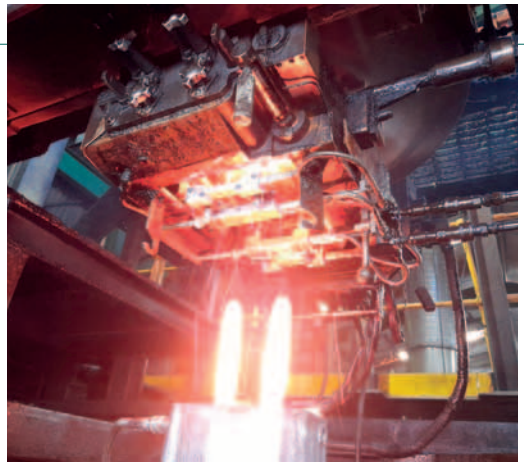
rience in designing bespoke machinery, including cold-end conveyor configurations with Tony. Mark has been using 3D modelling for many years and has frequently produced working animations to demonstrate a process and has a real love of technology.

Mark first introduced virtual reality to Tony when he built a small promotional program for a conveyor system. The success of virtual reality has a medium for displaying a product was evident. For the first time, a person could go inside the guard of a moving product and view/understand how it works without danger.

Tony states. "It was evident that virtual reality was an enormously powerful tool for training in a way I had never seen before. Glass container manufacturing was the obvious choice for this technology. Even though I was Head of Engineering for a big glass company, I did not fully understand the complexity of glass container manufacturing because it is the type of process where in-depth knowledge can only really be built over many years of 'on the job' involvement. Virtual Reality technology could clearly be developed to de-mystify and digitise Glass bottle manufacturing."

VIRTUAL REALITY USED FOR TRAINING

"I then researched learning methods in general and found a raft of information that supported the use of virtual reality as a Bonafede training medium. The learning pyramid in Image 2 is a conclusion by Edgar Dale



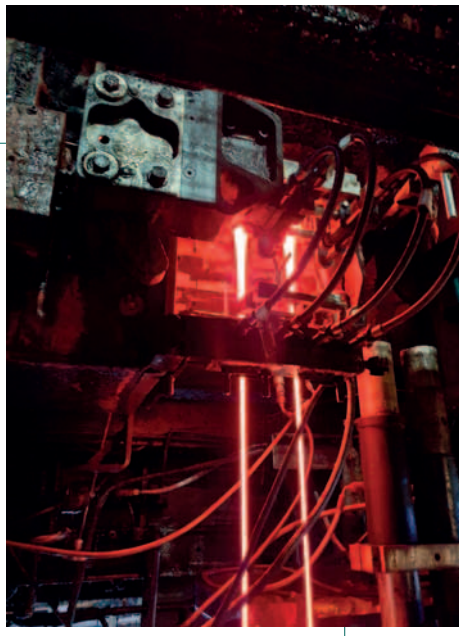


Image 3: VR can bridge the huge step between theory and the real thing

Image 4: Feeder training with a trainer and trainee in the same environment (even though they are in different geographical locations)

Image 5: Propriety PDF or Video documents can be imported into the environment. The VRMT application can be used in conjunction with a company's previous training material. Any PDF;'s or videos used are stored directly on the user's PC so they cannot be accidentally sent to a third party

Image 6: The user must be wearing PPE before entering the factory. This is mandatory every time a trainee enters the glass plant. It is also recorded against a person's profile

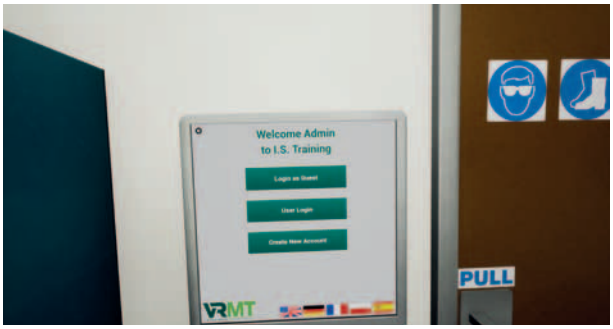


Image 7: The VRMT training tool is mainly Icon based but text is multilingual if required. VRMT can also cater for other languages not yet covered

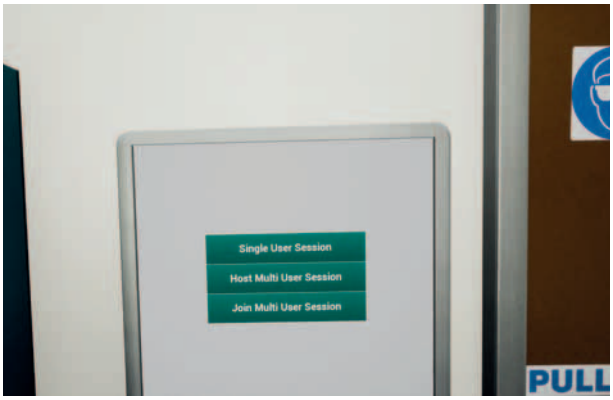


Image 8: Four people can connect and work together, regardless of worldwide location. With a stable, high speed internet connection people can immerse and communicate orally using all functions of the IS machine

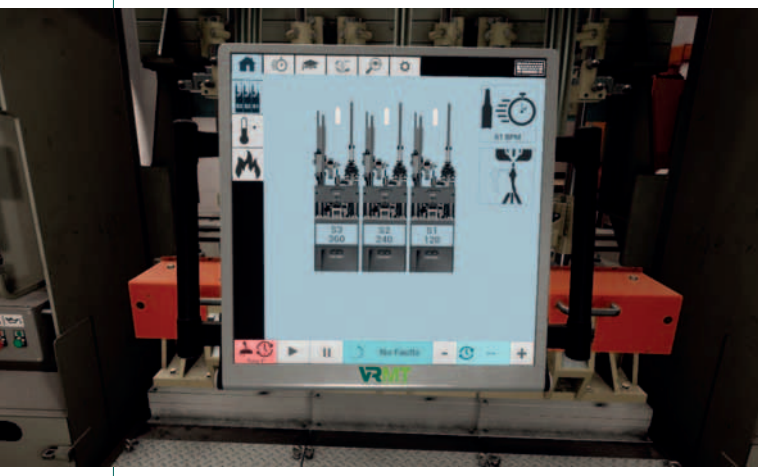


Image 9: The system is based on the industry standard of 360° drum event timing. The system runs all machine and training sections based on the 360° drum count, allowing events to be timed in the same manner as all IS machines regardless of make and brand

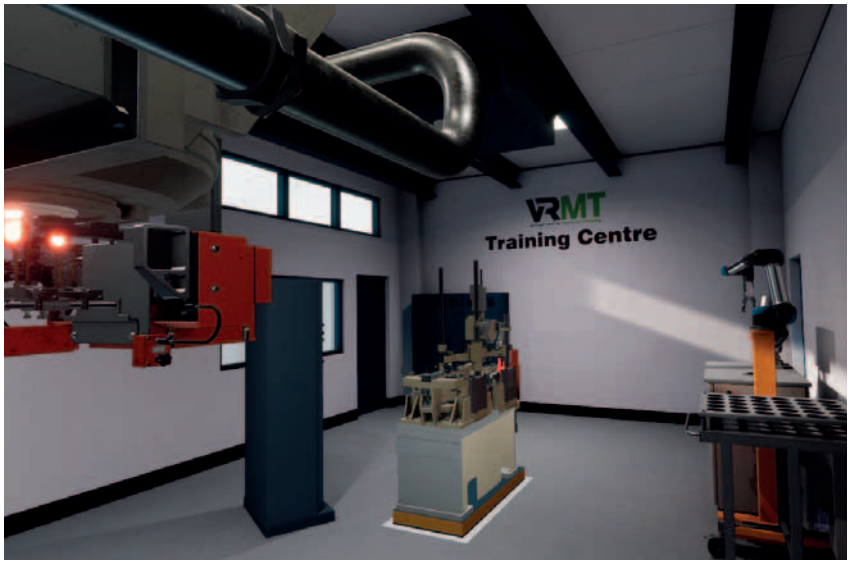


Image 10: The training room with single section and feeder. The single section and feeder are linked to the main virtual glass plant, so any modification carried out on the main machine also modifies the training equipment and vice versa

that he produced over 49 years ago but it clearly demonstrates that the best way to learn and remember something is 'doing or simulating the real thing', virtual reality gives you that experience."

IS TRAINING IMPROVED BY THE USE OF VIRTUAL REALITY

"In my role as Head of Engineering at Allied, I was responsible for the IS maintenance department and one of the things that stood out for me was the massive step from classroom training to undertaking the real task. However good the training, the step from watching a trainer modifying gob defectors to doing it yourself is a daunting one. It was clear that through virtual reality, we could create a safe environment for people to learn and even make mistakes that do not have the same severe consequences that may occur when working on a live machine. In VR, a mistake becomes a recordable learning outcome."

DESIGN CONSIDERATIONS

"When we began to develop the code for a virtual training section, the first challenge was to understand our intended audience. It was clear from the start that we could not develop an exact copy of each IS machine in the world. Even new machines from the same manufacturer can be different i.e. valves, pipes in different positions etc. The second challenge is that we did not have any drawings of the individual components. We knew from the

start that we could not commercially develop a different machine for each company and to be honest I think our product is, first and foremost, all about learning the concepts behind glass manufacturing in a safe learning environment, and not recreating individual factories."

"Other major design considerations were that it had to be an environment where people from around the world can join and work together, which can mitigate the need to travel. We also had to ensure that all PDF and video training material previously used by a company, can be used within the environment but be very secure to the company and cannot be accidentally leaked to a third party. Therefore, all documents lie on the individual computers and not in a cloud, etc."

"The vision of the VRMT virtual training tool training is to encompass all the realistic functions of a typical IS machine so it was obvious we had to develop it on the 360° drum event timing that is the industry standard. The virtual reality IS machine events can be changed by altering drum timing like the real task. Health and Safety is another core value, which is why you cannot even get into the factory without PPE. Encroachment into dangerous areas is identified by a red barrier and there is even an IS machine fire module."

DEVELOPMENT STEPS

"We knew we would not be able to obtain any drawings from machine suppliers because naturally they would not release proprietary drawings to a third party.

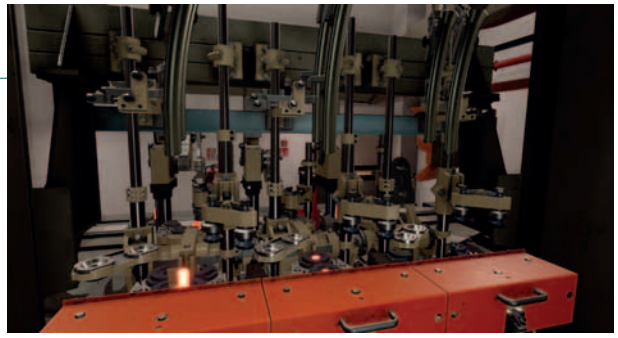


Image 11: Blow/Blow process on the IS machine. The system can alternate between Blow/Blow and NNPB at the touch of a button

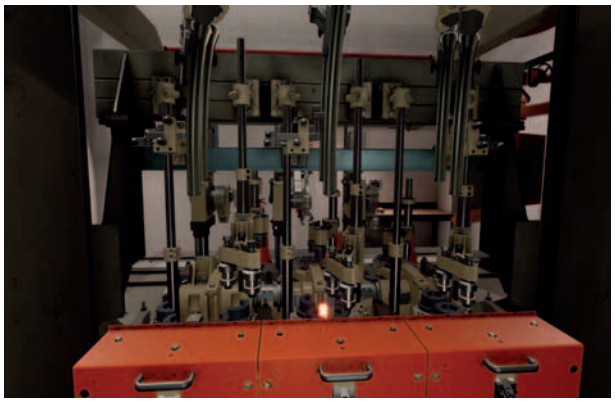


Image 12: NNPB process on the IS machine

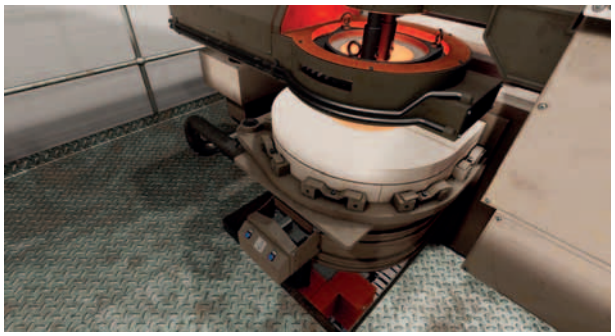


Image 13: A working Feeder can be modified whether this is rotation, tube hight, speed etc. The resultant modification directly changes gob geometry on the machine and training section

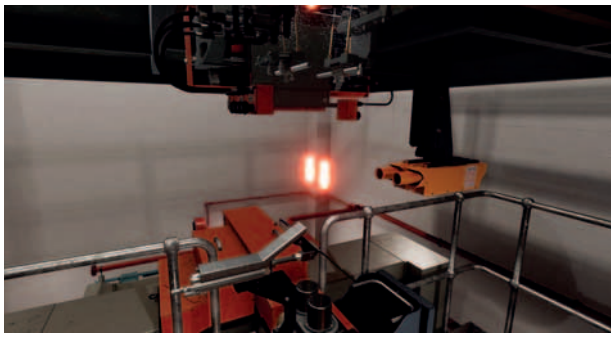


Image 14: Orifice platform, the gob shape is directly linked to parameter setting on the feeder such as temperature, needle height, shear mechanism height, cam change, etc.

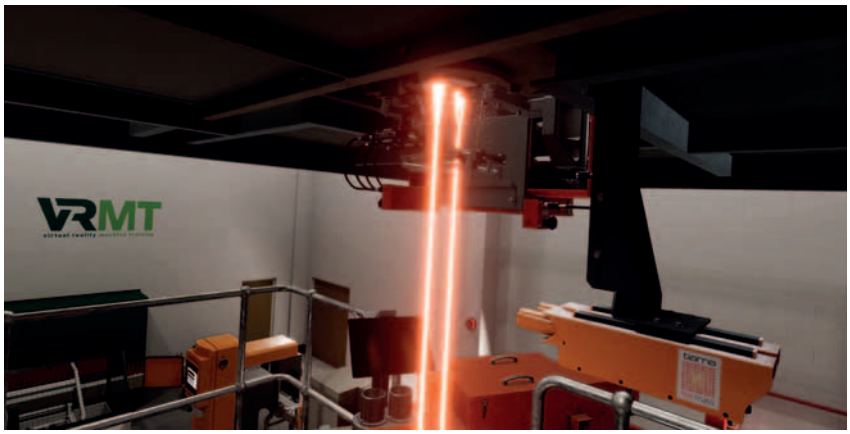


Image 15: Glass streaming, fully functioning control panels on the orifice platform can stop the scoops, distributor, needle plunging and shear cut

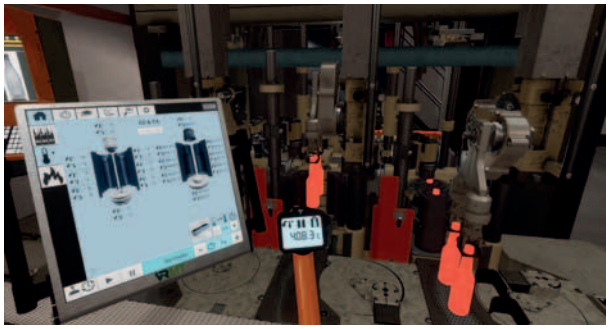


Image 16: Optical mould and auxiliary temperature measurement can easily be taken from three places on the inner, outer and left/right blanks as can baffles blow heads, etc.

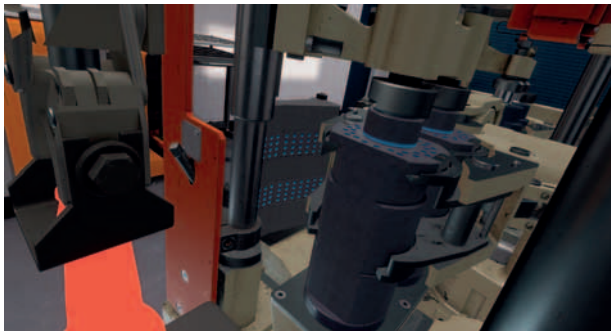


Image 17: Stack/side, Vertiflow and Finish cooling (Blue when on). If this drum timed duration is changed, the blanks and mould temperatures change accordingly

We therefore had no choice but to painstakingly design it from photographs that are readily available and use fixed measurements for scaling our drawings. Also our beta testing company Beatson Clark, kindly offered some oral explanation of the process and I utilised my contacts from the industry to make sure what we were developing was accurate."

A SELECTION OF SOME OF THE VIRTUAL REALITY FUNCTIONS

The photos in this article show just some of the functions available in the Virtual hot-end developed by VRMT. These include the main factory with a 3-section

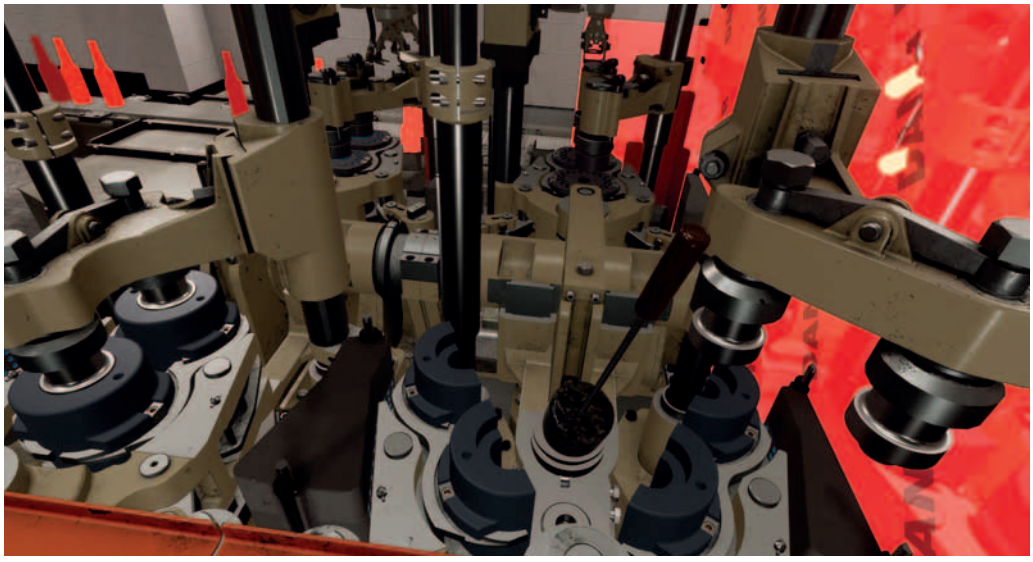


Image 18: Swab training is recorded against an individual's records, in this image the trainer has encroached on the adjacent section so a red warning barrier was activated to inform the user

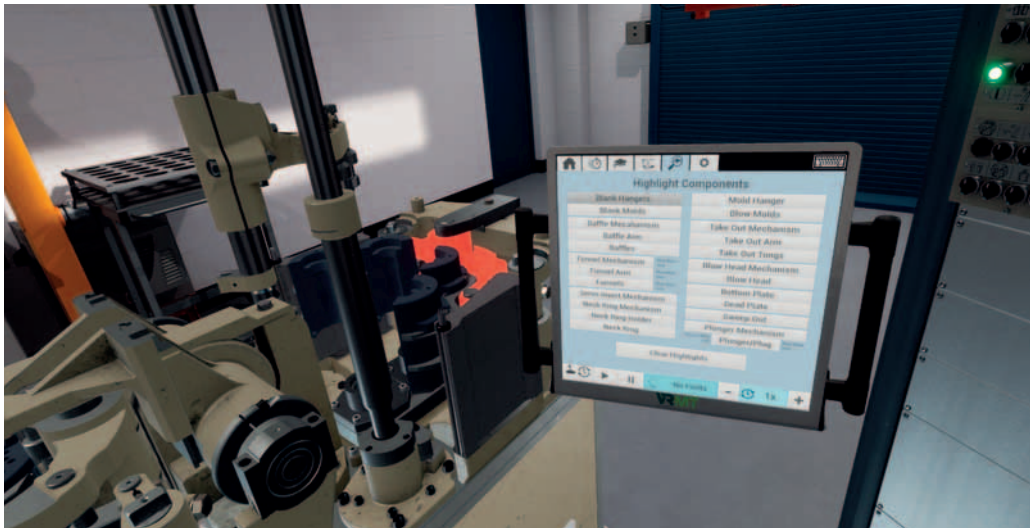


Image 19: Key components of an IS machine can be identified to help trainees learn names, such as blank hanger etc. This is automatically translated into the local language of the user

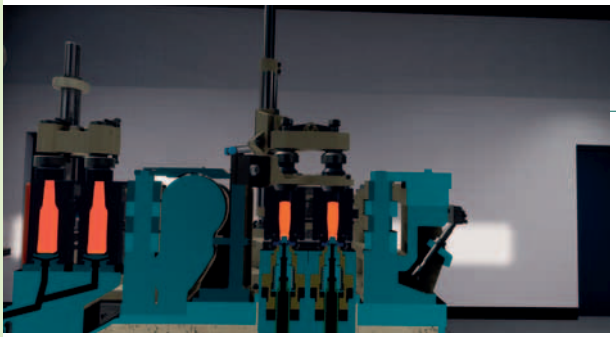


Image 20: Training section cut in half on Blow/Blow process. The single section in the training room has many additional features, such as being able to cut the section in half to better understand how it works. In this case the Blow/Blow process

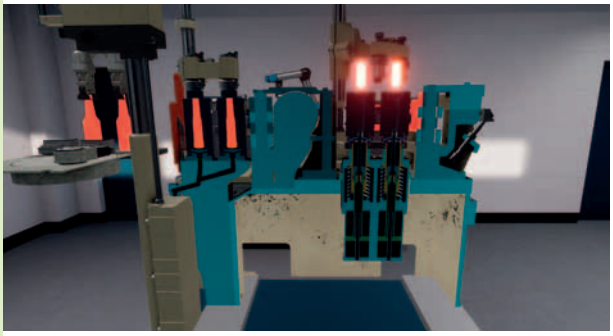


Image 21: Training section cut in half on NNPB process

Image 22: Bottle weight is dependent on how the feeder is set. The feeder weight is connected to the training feeder and any changes will be noted on the mould side weigh scales

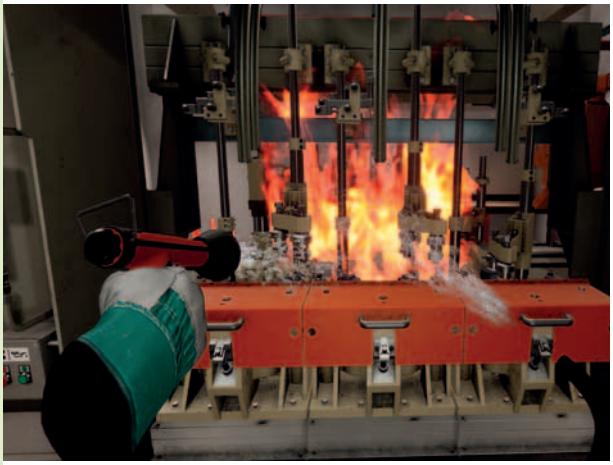


Image 23: Two people learning how to fight an IS machine fire. VRMT have developed a firefighting module, which can be tailored to suit most factories. This allows companies to develop and train their staff on how to mitigate a small fire becoming a large fire

Image 24: The fire is out of control and forces the use of a deluge system and because Fuel and Oxygen is still powering the fire, it still requires personnel to help bring the fire under control

IS machine and a training centre with a single section and feeder, both of which can be cut in half to aid understanding.

THE FUTURE FOR VRMT AND OUR CUSTOMERS

"The VRMT system is continually being developed and we are currently working on gob retardation and delivery adjustment. Fault creation as a function of how the operator sets the IS machine and feeder, is the next project before we begin work on developing a regenerative, end fired furnace. All upgrades are downloaded remotely as and when they become available throughout the duration of the subscription-based contract." ■

Image 25: VRMT are working with worldwide brands such as Tiama for their Hot Mass, Hot Eye, Hot Move, Hot Move and Total Trace products

SORG

Remote commissioning at global level

This article gives us some examples of how SORG has been dealing with the COVID pandemic, and how its work and projects are continuing to be carried out despite restrictions and quarantine periods.

During 2019, and despite the coronavirus pandemic, SORG continued to provide emergency support to its customers around the world.

CHINA

This includes two major projects in China where despite many adversities and restrictions, the innovative furnace specialist was able to carry out essential work for Qixia Changyu Glass and Huifeng Glass.

Engineers from SORG had to go through 14 days of quarantine under strict conditions and with various tests, before they were even allowed on-site. At Qixia, they started the assembly and tempering work on Furnace 6 in October.

Thanks to the high quality of the assembly, they were able to offer top-level remote support service, right up until the successful glass flow at the end of the month.

Following its completion, the team from SORG then travelled immediately to the construction site in Huifeng, to take care of the tempering there in November.

SLOVENIA

Based in Slovenia, Steklarna Hrastnik is a premium and super premium glassmaker for spirits and perfumery packaging.

Wishing to increase the melting capacity of Furnace G to 120 tons per day of high-quality soda lime flint glass, the manufacturer called upon Germany's SORG

Group for its world-renowned support in glass melting and conditioning technologies.

Existing space at the plant is very limited, so to meet the requirements for glass quality and production capacity, SORG's new calculated design strategically enlarged the melting surface from 39.5m² to 57m².

In addition, the melting burners have also been increased from two to three on each side, while an air-cooled barrier wall has been included to separate the melting area from the refining area. By installing this wall, the refining process will be greatly improved as the glass is forced to flow upwards, towards the glass bath surface.

Although Slovenia was classified as high-risk and had a strict lock-down, three dedicated specialists from SORG were prepared to travel there to master the challenges of reconstructing and commissioning the furnace on-site.

The project was successfully completed on schedule to the total satisfaction of Steklarna Hrastnik, and the first glass was produced recently.

SOUTH AFRICA

Due to the different coronavirus restrictions in South Africa, SORG Group had no choice but to offer commissioning and tempering at Consol Glass (Pty.) Ltd via remote support.

With a world-class reputation for innovative glass melting and conditioning technologies, SORG supplied a 175 tpd 340S+® tandem forehearth to Africa's largest glass container manufacturer, as well as a SCADA system for its Furnace C1 and two forehearths. Keeping up to date with the individual rules of respective countries has been a real challenge, especially when they can often change on a daily basis.

Having supervised the installation of equipment and initial heating up of the furnace on-site, SORG's specialists had to come and go on a daily basis when lockdown started, before the furnace was eventually cooled down due to a total alcohol ban and all work related to it. As soon as lockdown was lifted there was a high demand for glass bottles, however with international travel still not allowed the specialist team was able to offer very good remote assistance. Combined with the excellent work of Consol Glass personnel, it was possible to successfully and safely put the forehearth and SCADA system into full operation.

SPEAKING TO SORG

Glass Machinery Plants & Accessories (GMP&A): The two most recent projects undertaken by SORG were in Slovenia and in China – both countries with a high level of risk for your technicians. How did you organize this work?

SORG: Despite the critical circumstances, all our specialists were willing to do the necessary work in those high-risk areas. After we had their agreements, we started working out a safety plan and instructions for performing occupational health and safety measures especially for this site in Slovenia. This was realised in cooperation with Steklarna Hrastnik.

Luckily, during that time it was not mandatory to go into quarantine when travelling from Germany to Slovenia and our specialists could start working directly the day after their arrival. During the entire installation and commission period everyone at the site considered the hygienic measures, ensuring that everyone stayed healthy and no one got infected.

During the installation, the Slovenian government decided to go into a straight lockdown. Since that time our staff had to live with a lot of restrictions. However, thanks to the support of Steklarna Hrastnik it was even possible to stay in the hotel and our specialists (the only guests) were served well the whole time.

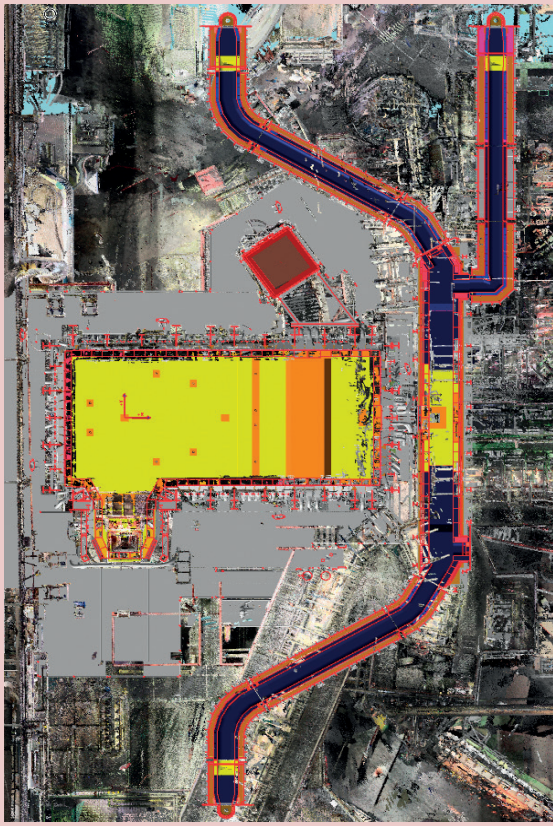
After completion of the works our specialists did a COVID-19 test right after their arriv-

al in Germany. Luckily no one tested positive.

GMP&A: Let's speak about the increase in melting capacity carried out in Slovenia at Steklarna Hrastnik first of all. What were the difficulties involved in enlarging the melting surface in the limited available space?

SORG: The enlargement of glass melting plants and the reuse of existing structures and infrastructures is very complex and we are confronted with respective challenges. Therefore, a detailed visualization of the existing plant complex is crucial. Due to its big range of vision, reliability and high accuracy, 3D laser scanning has proven itself in the glass industry as a useful, efficient, and time-saving measurement method. Thanks to our expertise in 3D laser scanning, our company had the necessary tools and internal experts at hand to tackle these challenges appropriately, to get the best basis for the design, and of course to offer our customer the best solution.

At the beginning of the project phase, a SORG expert was sent to the customer site, who executed the 3D laser scanning of the melting furnace, the batch charging system, and the batch house. For that, a special scanner was set up at different positions (normally up to 400 locations or more) in the building. It is important to select the correct spacing between the individual installation positions of the scanner so that a complete scan of the inventory is available for further planning. Three-dimensional images are created, which are later combined to form a coherent point cloud. The point cloud



for this project includes all levels and areas from the basement to the roof that were required for the planning of the furnace, the forehearth and the equipment.

The new furnace had to have a larger melting surface than the existing one. Therefore, special attention had to be paid to the rear wall of the building, the existing foundations, and pipes. In the scan, the distances between existing objects such as the furnace wall or the rear wall of the building or even floor heights can be measured.

One important point was the new quenching chamber, which had to be built on the existing foundation. Due to the enlargement, the connection to the furnace had to be installed further in the front (in the direction of the glass flow) for technological reasons. Thanks to measurements in the scan, the chamber could be rotated and placed appropriately on the foundation to fit through the existing ceiling breakthrough.

During the planning phase, the 3D data of the refractory material, steel, stages and cooling were assembled and inserted into the scan, which made it possible to check if there were collisions with existing and reusable equipment or the building.

At the end of the planning, a 3D file of the new overall system was created considering the old building and system structures as well as the position of the new quenching chamber.

To increase the melting capacity, it was necessary to adjust several parts and parameters of the old furnace:

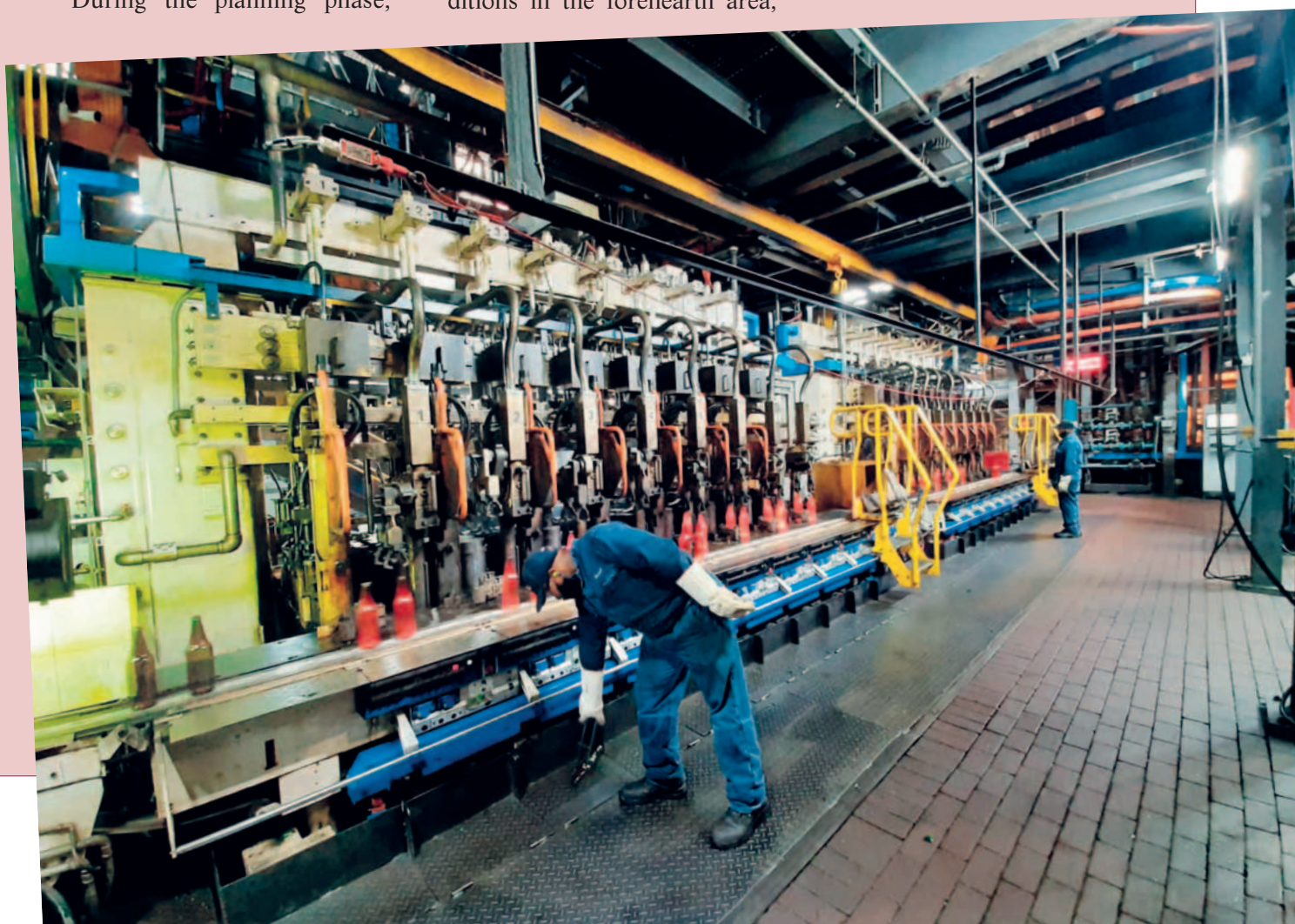
- The metal line was increased.
- The machine layout was changed.
- The melting area was increased from 39,5m² to 57m². This enlargement was realised by prolonging the furnace width and the furnace length towards the working end.
- The centre line of the working end was moved towards the cold end.
- Due to the confined space conditions in the forehearth area, also the forehearths were relocated.
- Furthermore, the glass bath depth was increased slightly in order to optimise the residence time of the glass in the melting area, which is one further step for an improved glass quality.
- The steel work had to be adapted and complemented according to these new conditions under reuse of most of the existing steel.

GMP&A: What will the benefits be with three melting burners?

SORG: As the furnace got bigger it was necessary to have a third burner per side to get an improved covering of the melting surface. This enables the client to increase production capacity with higher efficiency.

GMP&A: How was the air-cooled barrier built? Were there any logistic difficulties during construction?

SORG: By installing the air-



cooled barrier wall, the refining process is improved as the glass is forced to flow upwards, towards the glass bath surface, i.e. into a high temperature area.

Logistically there were no special difficulties. Of course, a good design – SORG has in-depth experience with this type of air-cooled barrier – and perfect work planning are essential.

GMP&A: Moving on to China, and the two projects carried out there, what did the 'essential' work for the two companies - Qixia Changyu Glass and Huifeng Glass – involve?

SORG: For both projects we had a scope with planning, delivery of equipment, supervision, training, and commissioning.

The Huifeng Glass project installation started before the COVID pandemic. So, most of the work has been done at Huifeng in 2019 under the site supervision of SORG specialists before Christmas. Then, the COVID-19 outbreak took place in China during the Chinese New Year in February 2020 and the cosmetic glass market dropped dramatically. Huifeng kept running their 'old' furnace until SORG specialists could go to the site in November 2020.

Due to the pandemic, commissioning and training needed to be postponed to a suitable new schedule.

For Qixia Changyu, remote supervision played a very important role. Most of the installation and pre-commissioning was done by the local team from the headquarters of SORG in Germany via remote service with excellent results. We appreciated very much the great support from the Qixia team, including excellent electricians, equipment specialists and translators. SORG installed a permanent remote service via VPN with a key access to all relevant technical experts.

In the meantime, SORG, Qixia Changyu and Huifeng Glass worked very hard to get visas for several SORG specialists to get them on-site. Subsequently, our specialists went through a very hard quarantine period and several tests before they started to work on site.

For the final commissioning on site, the efforts for the two projects were bundled. That means the company SORG send a team of specialists which first trained and commissioned the Qixia project and directly after that they took care of the Huifeng project. So, the 14-day quarantine period for the SORG team in China with very restrictive limitations could be shared between the two projects.

Both projects were expected be finished, with acceptance of the clients by end of 2020.

GMP&A: How did the remote assistance proceed and how many technicians were working with the companies?

SORG: As mentioned before, SORG installed a fixed service expert with a daily fixed availability. This expert coordinated the service, involving all relevant technical experts of the SORG team (about 10 different departments) in case of necessity. It was an excellent interaction between the SORG and Qixia teams.

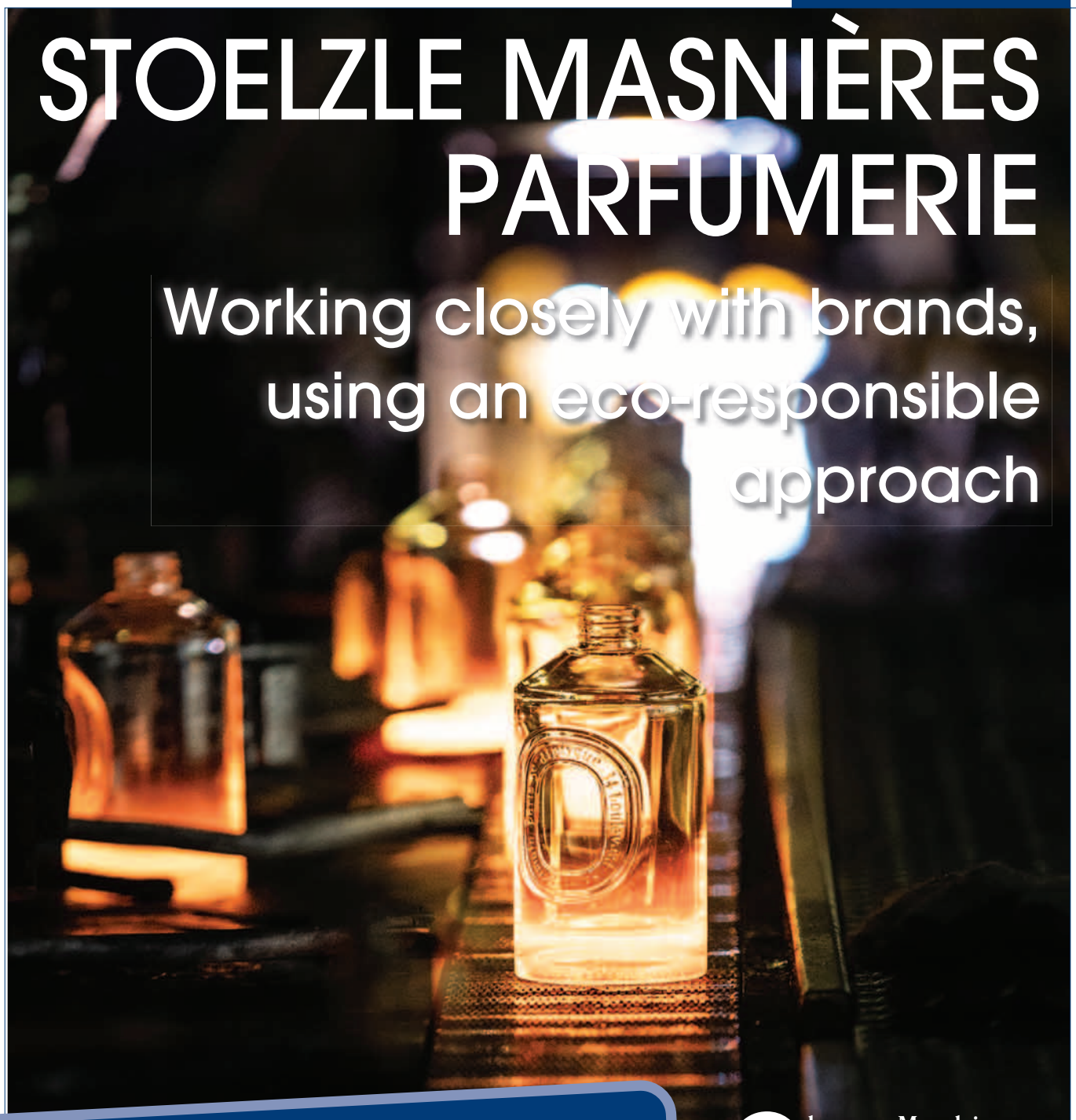
Due to the positive experiences Sorg will establish this remote service for the future.

GMP&A: What will be the next projects for SORG, and where?

SORG: We have several rebuilding projects running, for example in Germany with a 200 tpd regenerative end-fired furnace for flint container glass, in Spain with a 360 tpd end-fired furnace for container glass in all colours, and in Egypt where we are rebuilding a S-Melter for flint tableware with 140 tpd. In China, a Green Field project with a regenerative end-fired furnace for flint container glass is planned.

STOELZLE MASNIÈRES PARFUMERIE

Working closely with brands, using an eco-responsible approach



In this article, we speak to Etienne Gruyez, the Président Directeur Général of Stoelzle Masnières Parfumerie, about one of the company's recent products for the hand care sector – using glass for the containers that become decorative elements for bathrooms.

Glass Machinery Plants & Accessories (GMP&A): The present global situation is continuing to create difficulties for the majority of industrial sectors – but not specialist glass bottle and flacon manufacturers. Your recent press release speaks about the DIPTYQUE Hand Care bottles. Please tell us how this idea came about, and how it will be developed further in the near future.

Etienne Gruyez, Président

Directeur Général, Stoelzle Masnières Parfumerie: The 350 ml bottle for the ART DES SOINS NS POUR LES MAINS DIPTYQUE range is a great sales success for the brand.

The Stoelzle Masnières Parfumerie team has worked closely with this brand, which has long been committed to an eco-responsible approach, making these containers decorative objects for the bathroom. This means that they become long-lasting and familiar decorative objects, conveying meaning and emotions. Their design beautifies everyday gestures and marks the first steps in the brand's long-term eco-responsible approach.

Today, all Stoelzle's developments are considered 100 per cent in a sustainable development approach, in response to the demand of all our customers. Whether it is for this type of large-format containers or for all other formats, glass is obviously benefiting from a craze that is growing year after year.

GMP&A: Were any changes required in machinery or the design of the containers, as their use is quite different from perfume and cosmetics?

Stoelzle Masnières Parfumerie: No, the tooling is no different. We adapt it to every bottle or jar design.

GMP&A: How does the 350 ml size bottle fit in with the diverse usages: personal, public and mass public?

Stoelzle Masnières Parfumerie: We adapt to all requests, each customer has his specificity.

GMP&A: You have also taken into consideration the decorative aspect – quite a nice feature in these times …

Stoelzle Masnières Parfumerie: In Masnières we have a factory specially dedicated to DECOR, which allows us to answer ...and to propose many decorations for bottles or jars. This work of personalization on the spot is a big asset for us.

GMP&A: Does this devel-

opment mean that Stoelzle Masnières Parfumerie may be branching out to other sectors? If yes, which sectors do you think could be of major interest?

Stoelzle Masnières Parfumerie: We want to continue focusing on perfumery and cosmetics products. Yet, we are also always interested in new projects that are 'unusual' that utilizes our expertise and pushes our limits.

GMP&A: How is Stoelzle facing up to the recent 'second' surge of Covid? What are the safety requirements that you have been obliged to put into practice?

Stoelzle Masnières Parfumerie: Overall, the second surge of Covid did not impact us further than the first one. Actually, like I believe everybody else, we were more prepared than the first one. We have been able to keep contact with our staff and customers through online tools. Also we managed to keep the operations running thanks to the respect of sanitary measures. Everybody inside the company understood the necessity to respect them.

The first Covid-19 crisis pushed us to decide to renew faster the furnace rebuilt to be ready for 2021. I strongly believe we took the right decision as with the second surge, the business did not restart as expected and we therefore had the time to rebuild our furnace. We will be ready in 2021 and 2022 to answer the market needs and also offer new solutions for our customers.

GMP&A: What kind of differences has your market sector been subject to this year, and how are you working to maintain your market position?

Stoelzle Masnières Parfumerie: The perfumery segment has been the most hit. Sales have dropped between 30 per cent to 50 per cent on the market. On top of that, many customers have decided to closely monitor and reduce their stock level so that did not help in maintaining the line running. Again, thanks to the furnace rebuilt, we tried to take advantage of the situation. We hope the market will restart in 2021 but nobody knows. Nobody was expecting a second wave as intense as it is. We have to accept to work on a weekly if not daily basis.

On the cosmetic segment, the drop has not been so dramatic. This is why we are now going to strengthen our position on that segment, thanks to the addition of our new production line which will be capable of answering high quality jar for the premium market.

GMP&A: What do you think will happen next year – trade shows and events? Will you be attending, or have you decided to hold virtual meetings and Open Houses like a lot of other

companies and shows?

Stoelzle Masnières Parfumerie: Who knows…. I really don't know. I hope we will be able to have trade shows in 2021 but it will be different still even if they take place. We will have to maintain social distance and/or sanitary procedures. I think there will be more and more online events to allow companies to introduce their products and innovations.

In our case, we are working on offering an online tour of the factory of Masnières so that customers can discover all the work we have achieved and what we have to offer.

Again, as always, we will thrive on our flexibility and agility to be on top of the market. ■

CHINA GLASS 2021

31st China International Glass Industrial Technical Exhibition

Shanghai New International Expo Centre

May 6-9, 2021

Organizer: The Chinese Ceramic Society
Supporter: Shanghai Ceramic Society
Contractor: Beijing Zhonggui Exhibition Co., Ltd.

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PHARMACEUTICAL GLASS IN PAKISTAN

Rajeev Jetley

With an estimated population of 220 million towards the end of the year 2020, Pakistan is the world's fifth most populous country. More than average economic growth rates in last two decades, rising disposable income and increasing awareness about healthcare has been a boom for the country's pharmaceutical industry, which in turn has translated into huge gains for domestic pharmaceutical glass producers. Glass Machinery Plants & Accessories gives a detailed outlook of the country's pharmaceutical glass market and major producers of these products.

THE PHARMACEUTICAL MARKET IN PAKISTAN

Pakistan's pharmaceutical industry has emerged among the fastest-growing industries in the world. Pakistani pharmaceutical companies have shown a cumulative average growth rate or CAGR of 13.1 per cent in the last four years, as compared to a CAGR of 9.34 per cent of Multinational Companies (MNCs) operating in the country.

Overall pharmaceutical sales for the outgoing fiscal year ended 30 June 2020 clocked in at Rs 453.5 billion, posting a growth of 9 per cent. On a quarterly basis, overall sales for the quarter ended 30 June 2020 grew 4 per cent to clock in at Rs 111.12 billion. In overall sales during the aforementioned period, the share of national drug-makers was 68 per cent, up 10 per cent, while that of international ones stood at 32 per cent, a growth of 8 per cent.

The pharmaceutical sector recorded the highest sales in March, reaching USD 1.3 million

Foreign Direct Investment in April 2020. In a report commissioned by the Planning Commission of Pakistan and Asian Development Bank, Mckinsey & Company identified the pharmaceutical industry as a sunrise industry.

According to Chairman Pakistan Pharmaceutical Manufacturers Association (PPMA), Tauqeer Ul Haq, "Domestic pharmaceutical producers have a 70 per cent share of the overall PKR 400 billion Pakistani pharmaceutical market. It's one of the industries which is continuously growing in terms of quality standards and providing quality medicines to alleviate the cause of suffering due to different diseases. After gaining a 70 per cent market share, our next step is to improve export business for our country through the support of the Government of Pakistan. Currently, the Pakistan Pharmaceutical industry has USD 300 million export, however, this industry possesses huge potential to enhance export by up to USD 100-200 million in the next four to five years. The pharmaceutical export business is quite different compared to other industries because unlike other industries, each product of the pharmaceutical industry needs to be passed through the regulatory process first before it gains approval for export, which takes three to four years."

The pandemic has brought the healthcare sector to the fore in countries across the world and Pakistan's health sector is no different. The coronavirus has exposed strengths and weaknesses in the system, which has caught the attention of the government, pharmaceutical companies and suppliers to the pharmaceutical industry, including glass containers.

As many as 910 pharmaceutical companies have been issued licenses, out of which 620 are functional in the country, including 22 multinational companies.

Unfortunately, not even a single Pakistani company had acquired the Food and Drugs Association (FDA) certification from the USA and Europe's Good Manufacturing Practices (GMP).

Only three national companies, including Getz Pharma, have World Health Organization (WHO) certification, exporting medicines to 66 countries. The CCL Pharma also has approval of the WHO pre-qualification certification, exporting medicines to 35 countries, while Pacific Pharma already has European GMP, and is exporting medicines to 18 countries, including Germany and England.

According to the Economic Survey of Pakistan, the country's economy has been subjected to demand and supply shock and the 2020 fiscal year witnessed a contraction in economic activity. The Covid-19 pandemic, high inflation and a weakening Rupee posed significant challenges to the economy, resulting in a decline of 0.38 per cent in GDP (2019: growth of 1.9 per cent) for the year ended 30 June 2020. Large scale manufacturing contracted by 7.8 per cent (2019: 2.6 per cent), while the construction activity in the country also remained subdued due to slowdown in economy.

PAKISTAN'S PHARMACEUTICAL GLASS INDUSTRY AND MAJOR PRODUCERS

Pakistan has a total of three container glass producers, two of which produce glass containers for the pharmaceutical industry. Container glass used in the pharmaceutical industry has increased along with the total value of the overall pharmaceutical industry in the country. Both producers of pharmaceutical glass: Ghani Glass and Balochistan Glass, are considering expanding their installed capacities of pharmaceutical glass products in the coming years.

The spread of Covid-19 as a pandemic and, consequently, the imposition of lock down by Federal and Provincial Governments of Pakistan (Authorities) has slightly effected the sales volume of pharmaceutical glass in the first two months of lockdown (April and May 2020) due to non-availability of some customers during the lockdown period. However, being involved in medical supplies i.e. vial and ampoules, led to an increase in production, sales price and volume sold by container glass producers during the pandemic period.

GHANI GLASS

Ghani Glass is the leading glass producer for pharmaceutical glass in Pakistan. The company operates two container glass production plants. Located at Haripur, in Khyber Pukhtunkhwa province, and the Landhi Industrial area in the city of Karachi. These two plants have an aggregate installed capacity of 550 tonnes per day of container glass for food, beverage and pharmaceutical industries.

Ghani Glass supplies glass containers to leading pharmaceutical companies and food and beverage companies. Some of the company's well-known pharmaceutical clients include Gloxo Smith Kline (GSK), Getz Pharma, Reckitt Benckiser, Abbott, Pepsi, Coca Cola, Unilever and Nestle among many others. As per the company's claims, Ghani Glass Limited is the leader in the domestic market, dominating the pharmaceutical category by owning 86 per cent of the market share. On the international front, GHGL exports to about 29 countries including South Korea, UAE, India, Turkey, etc.

Ghani Global Glass Limited (GGGL) has setup a brand new hollow glass manufacturing plant imported from top companies of Italy, Germany and France. All the components have been installed by the best and world's renowned glass technologies. The project is located at 52 kilometres Multan Road near Phool Nagar.

To attain customers satisfaction and quality, GGGL has installed brand new machinery which is imported from European

renowned glass tubing manufacturers. Possessing enormous experience and patent name in the glass tubing sector, the design of plant and its technical infrastructure is based on the latest available European technology named 'Kimbel'. This plant has a capacity of producing 24 tons per day. Also the plant consists of two state-of-the-art glass tubing manufacturing lines producing high quality tubing glass.

In the 2020 financial year, the company added 20 more customers of ampoules and vials to its customer base. In total, the company supplies ampoules and vials to around 80 pharmaceutical companies. In the concluded financial year, pharmaceutical glass tube sales increased by 160 per cent, ampoules by 167 per cent and vials by 174 per cent thus aggregate sales increased by 164 per cent. The company also exported 357 tonnes of pharmaceutical glass tube to Bangladesh, Egypt, Argentina and Mexico. Samples in Italy, Uruguay and Paraguay are under approval stage. The company is also exploring to export pharmaceutical glass tubing in Africa, South America and the Middle East.

Ghani Glass is considering modernization, balancing and replacement to enhance its capacity and to set-up another melting furnace for glass tubes. The market for glass tubes and other value added products such as ampoules and vials is robust. Capacity enhancement will tap the unmet market demand and to diversify into new products and markets (including Bangladesh, MENA Countries etc.). After finalization of internal workings and formal approvals from the bank(s), the company will formally announce to set up another glass melting furnace for tubes in the year 2021.

BALOCHISTAN GLASS

Balochistan Glass is one of the two pharmaceutical glass producers in Pakistan. The company operates a total of three glass production units spread across the country. Balochistan Glass's first unit is located in the Lasbella Hub district of the Balochistan province over an area of 21.95 acre. The company's second production unit is located at Lahore - Sheikhupura Road, Sheikhupura over an area of 10.43 acres and the third production unit is located at Lahore - Sheikhupura Road in Sheikhupura district over an area of 4.65 acres.

Balochistan Glass also owns a 49.99 per cent stake in Paidar Hong Glass (Private) Limited (a joint venture between Balochistan Glass and Chinese investors) and a joint control with Chinese investors to set up a container glass production plant to produce USP Type-I Borosilicate glass tubes, vials and ampoules.

Some of the machinery items for the production plant have already reached the company premises, but have not been installed yet. However, the project could not be operative because of non-execution of contractual responsibilities by the Chinese partner with respect to establishing the project; but the management is addressing this issue and is confident the matter shall be resolved in due course of time. Balochistan Glass has made a total investment of PKR 125.631 million in this project. The project has, however, been stagnant since 2018 due to the non-execution of theese contractual responsibility by the joint venture partner.

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PALLETIZING/ DEPALLETIZING LINES

All Glass
EMS Group
Messersì Packaging
MSK Covertech
Olivotto Glass Technologies
OMS
Vetromeccanica
Zecchetti

PASTE MOULD MACHINES

Olivotto Glass Technologies

PLANT UTILITIES

GCG - Glass Consulting Group
Pneumofore

PLASTIC COATING

Zeca

PLATINUM FEEDER SYSTEMS

BDF Industries
Forma Glas
Glass Service
Olivotto Glass Technologies

PLUNGER HONING MACHINES

Bottero

PLUNGERS & MECHANISMS

BDF Industries
Bucher Emhart Glass
Olivotto Glass Technologies
Perego Giancarlo
Revimac-Bottero
UniMould
Waltec Maschinen

POLISHING/ GRINDING MACHINES

Forma Glas
Olivotto Glass Technologies

POWER REGULATION/ TRANSFORMERS

Bock Energietechnik

PREDICTIVE SOLUTIONS

Video Systems

PRESS MACHINES

Amig
Bucher Emhart Glass
Famor Engineering
Forma Glas
Olivotto Glass Technologies
Waltec Maschinen

PRESS & BLOW MACHINES

Amig
Bucher Emhart Glass
Famor Engineering
Heye International
Messersì Packaging
Olivotto Glass Technologies
Waltec Maschinen

PRESS RECONDITIONING

Famor Engineering
Olivotto Glass Technologies

PUSHERS

BDF Industries
Bottero
Car-Met
EME
Famor Engineering
Forma Glas
Heye International
Olivotto Glass Technologies
Waltec Maschinen

RAW MATERIALS

Bohemi Chemicals
Fonderie Bartalesi
GCG - Glass Consulting Group
Minerali Industriali

RECYCLING PROCESSES

EME

RECYCLING SYSTEMS

Falorni Tech
GCG - Glass Consulting Group
ZIPPE

REFRACTORIES

Bucher Emhart Glass
Falorni Tech
Forglass
Fusiontec-Revimac
Linco Baxo
Olivotto Glass Technologies
S.I.G.MA.
Stara Glass
Waltec Maschinen

REFRACTORIES INSTALLATION SERVICES

Bucher Emhart Glass
Falorni Tech
Fusiontec-Revimac
Horn
SKS - Sorg Karrena Service
Stara Glass
Teichmann, Henry F. / E.W. Bowman

REPLACEMENT PARTS

The TECO Group (KTG Engineering)
Olivotto Glass Technologies
Waltec Maschinen

ROBOTS: BALL GATHERERS

Falorni Tech
Glass Service
Olivotto Glass Technologies
Waltec Maschinen

ROBOTS: HANDLING & PACKAGING

All Glass
EMS Group
Falorni Tech
Famor Engineering
KYP Accesories
Messersì Packaging
MSK Covertech
Olivotto Glass Technologies
Spami-Optrel-Stevanato Group
Vetromeccanica
Waltec Maschinen

ROTATING TABLES

Messersì Packaging
Olivotto Glass Technologies
Vetromeccanica
Waltec Maschinen

SAW MACHINES

Olivotto Glass Technologies

SECOND-HAND EQUIPMENT

BDF Industries
Falorni Tech
Forma Glas
Heye International
KYP Accesories
Olivotto Glass Technologies
Vidromecanica

SERVICES

Bock Energietechnik
EME
Forglass
Forma Glas
Stara Glass
The TECO Group
Zeca

SERVICES IN HOT-DRILLING AND CHANGE OF ELECTRODE HOLDERS

Bock Energietechnik

SHEAR BLADES

BDF Industries
Heye International
Famor Engineering

SHEAR BLADES LUBRICANTS

Graphoidal Developments

SHEAR SYSTEMS

BDF Industries
Bottero
Falorni Tech
Famor Engineering
Forma Glas
Graphoidal Developments
Heye International
Olivotto Glass Technologies
Revimac-Bottero
Waltec Maschinen

SHUTTLE CARS

Zecchetti

STRETCH & SHRINK FILM WRAP MACHINES

All Glass
Messersì Packaging
MSK Covertech
Vetromeccanica
Zecchetti

SHRINK OVENS

Messersì Packaging

SILKSCREEN INKS

Fluorital

SILKSCREEN PRINTING LINES: HOLLOWARE & TABLEWARE

Fermac

SILKSCREEN PRINTING LINES: VIALS & AMPOULES

Moderne Mecanique
OCMI OTG

SOFTWARE

BDF Industries
Bottero
Bucher Emhart Glass
futronic
GS - Glass Service
Heye International
Olivotto Glass Technologies
Stara Glass
TIAMA
Vertech''
Vetromeccanica
VPInstruments
Waltec Maschinen

SPINNING MACHINES

Famor Engineering
Olivotto Glass Technologies
Waltec Maschinen

SPOUT ELECTRICAL HEATING ELEMENTS

Bock Energietechnik

STACKERS

All Glass
BDF Industries
Bottero
Bucher Emhart Glass
Car-Met
EMS Group
Famor Engineering
MT Forni Industriali
Olivotto Glass Technologies
Revimac-Bottero
Vidromecanica
Waltec Maschinen
Zecchetti

STEMWARE PRODUCTION LINES

Falorni Tech
Forma Glas
Olivotto Glass Technologies
Vidromecanica
Waltec Maschinen

STEMWARE SEALING MACHINES

Falorni Tech
Forma Glas
OCMI OTG
Olivotto Glass Technologies
Waltec Maschinen

STIRRERS

BDF Industries
Bottero
Falorni Tech
Forglass
Fusiontec-Revimac
GCG - Glass Consulting Group
Glass Service
Horn
MT Forni Industriali
Olivotto Glass Technologies
Revimac-Bottero
Stara Glass
Vidromecanica

SUCTION GATHERERS

Falorni Tech

suppliers guide
YELLOW PAGES

Olivotto Glass Technologies

SUPERVISORS MODEL BASED PREDICTIVE CONTROL

GS - Glass Service

TAKE-OUT DEVICES & EQUIPMENT

BDF Industries
Bottero
Bucher Emhart Glass
Falorni Tech
Famor Engineering
Forma Glas
Olivotto Glass Technologies
Ramsey Products
Renold
Vidromecanica
Waltec Maschinen

TEMPERATURE MEASUREMENT & CONTROL

BDF Industries
Bock Energietechnik
Bucher Emhart Glass
Falorni Tech
Forglass
Graphoidal Developments
GS - Glass Service
Horn
KYP Accesories
XPAR Vision

TEMPERING LINES

R.C.N. Solutions
Vidromecanica
Waltec Maschinen

THERMAL CLEANING SYSTEMS FOR FURNACES

Preriscaldo Forni

THERMAL SHOCK TEST MACHINES

Vidromecanica

THERMOCOUPLES & ASSEMBLIES

Bock Energietechnik
Falorni Tech
GCG - Glass Consulting Group
Stara Glass

THERMO SHOCK MACHINES

BDF Industries

TIN OXIDE ELECTRODES & CONNECTORS

Horn
The TECO Group (KTG Engineering)

TRAY FORMERS

Zecchetti

TOOLS & EQUIPMENT

Bottero
VPInstruments

TUBING LINES

Falorni Tech
Olivotto Glass Technologies

TURNKEY PLANTS ENGINEERING & CONSTRUCTION

Amig
BDF Industries
Falorni Tech
Forglass
EME
Glass Service
Horn
Olivotto Glass Technologies
Refractories Experience
Spami-Optrel-Stevanato Group
Stara Glass
Teichmann, Henry F. / E.W. Bowman
The TECO Group
Waltec Maschinen

UV LAMPS

Graphoidal Developments

VACUUM PLANTS & ACCESSORIES

Pneumofore

VACUUM PUMPS

Pneumofore

VIAL AFTER - FORMING MACHINES/LINES

KYP Accesories
Moderne Mecanique
OCMI OTG
Spami-Optrel-Stevanato Group

VIAL FORMING MACHINES/ LINES

Moderne Mecanique
OCMI OTG
Spami-Optrel-Stevanato Group

VIAL PACKAGING MACHINES

KYP Accesories
Moderne Mecanique
OCMI OTG
Spami-Optrel-Stevanato Group

VIBRATING EQUIPMENT

Forglass
Vetromeccanica
ZIPPE

WASTE GAS CLEANING SYSTEMS

BDF Industries
Stara Glass

WASTE GASES DUCT WORKS AND VALVES CLEANING SYSTEMS

BDF Industries

WATER CLEANING SYSTEMS

BDF Industries
Forglass
Graphoidal Developments
Stara Glass
ZIPPE

WATER COOLING SYSTEMS

Bock EnergietechniK

See you at

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