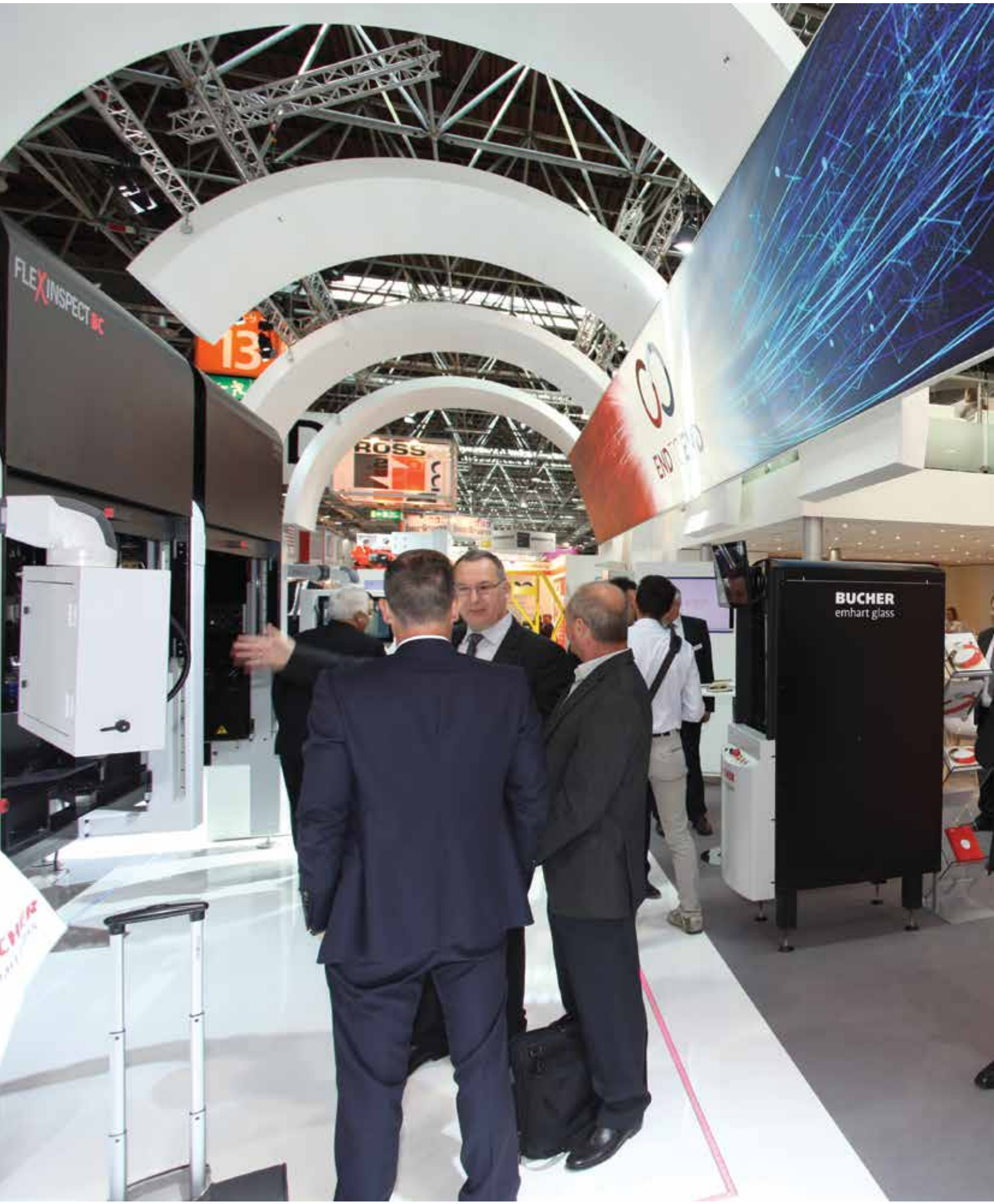
WE,
GLASS,
& YOU

BUCHER
emhart glass

End to End Strategy


FLEXINSPECT
BUCHER
emhart glass

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Welcome to Bucher Emhart Glass

As we look back on more than 100 years of growth and the success of our company, we recall many “firsts” - from the first glass gob forming and shearing device to the first high speed quad gob servo glassmaking machine - and many more breakthroughs along the way. As we have grown into a global company there has always been another “first” in our focus: Keeping our customers first in all we do.

We understand these are challenging times for glassmakers. So we asked our customers, “How can we help you succeed in the market today and prepare for the future?” Then we listened.

Our customers said they need to maximize production efficiencies and reduce dependency on skilled operators. Many plants suffer from skill gaps and find it difficult to attract qualified talent, in fact, knowledge drain is considered the biggest challenge by many glassmakers today.

Our customers also want a true partnership with their suppliers, allowing them to be involved in the development process. With hot end and cold end under one roof they feel that Bucher Emhart Glass is best positioned to take total process control to a next level. Finally, our customers expect Bucher Emhart Glass to continue delivering on its brand promise of best-in-class quality and cutting-edge innovation.

We’re responding to your challenges with solutions that will make glass production easier, safer and more efficient. Today we’re introducing “End to End,” a comprehensive product and service offering that will reduce know-how gaps and unify the hot and cold end processes. Working together, in partnership will provide the very best environment to advance the industry. Through collaboration we can improve the speed of development and provide technological advances based on realtime feedback.

As always, your needs will be our first priority. We look forward to working with you and becoming Stronger, Together.

Martin Jetter
President

Landmark Moments Forming

1913
Invention of the Feeder

1920
Press & Blow operated for the first time

1921
Narrow neck machine for making drinks bottle

1924
Patented the IS machine

1939
1st 4 section DG IS

1944
DG blow and blow for making larger bottles

1952
Vacuum settle introduced

1967
1st 6 section TG launched

1971
Central lubrication and constant cushion

1974
ETS launched and 1st computer system introduced

1976
AIS machine with parallel mould opening & closing

1985
VertiFlow developed

1985
FlexLine introduced; Feeder, shear, gob distribution, pusher

1999
First fully servo electric NIS

2004
First NIS QG introduced

2005
FlexIS Control system introduced

2011
First working BIS prototype created

2012
First offline Hardglass installation

Landmark Moments Inspection

1945
Hartford-Empire launch HE-74

1954
Hartford-Empire launch HE-127

1959
Emhart launch the six-head choke test

1963
Emhart launch the ten-head choke test

1965
Powers introduce the single Spindle Plug Gauge

1966
Powers introduce the Pressure Checker

1970
Powers introduce the Check Detector

1982
AIDA Machine Demonstrated – the forerunner of the TIM

1986
Emhart Powers launches TIM

1989
Emhart Powers launches Bottom Inspector with Kirin Vision

1993
Scanner 3000 and 4000 launched with LumenX Vision

2002
Emhart Glass launches Veritas Inspection

2007
Emhart Glass acquires ICS Inex

2010
Emhart Glass launches FleXinspect

2012
Emhart Glass launches FlexRadar

2016
SCOUT launched

END TO END
Full Process Excellence

2016 | End to End Concept launched

Experience Knowledge Transfer

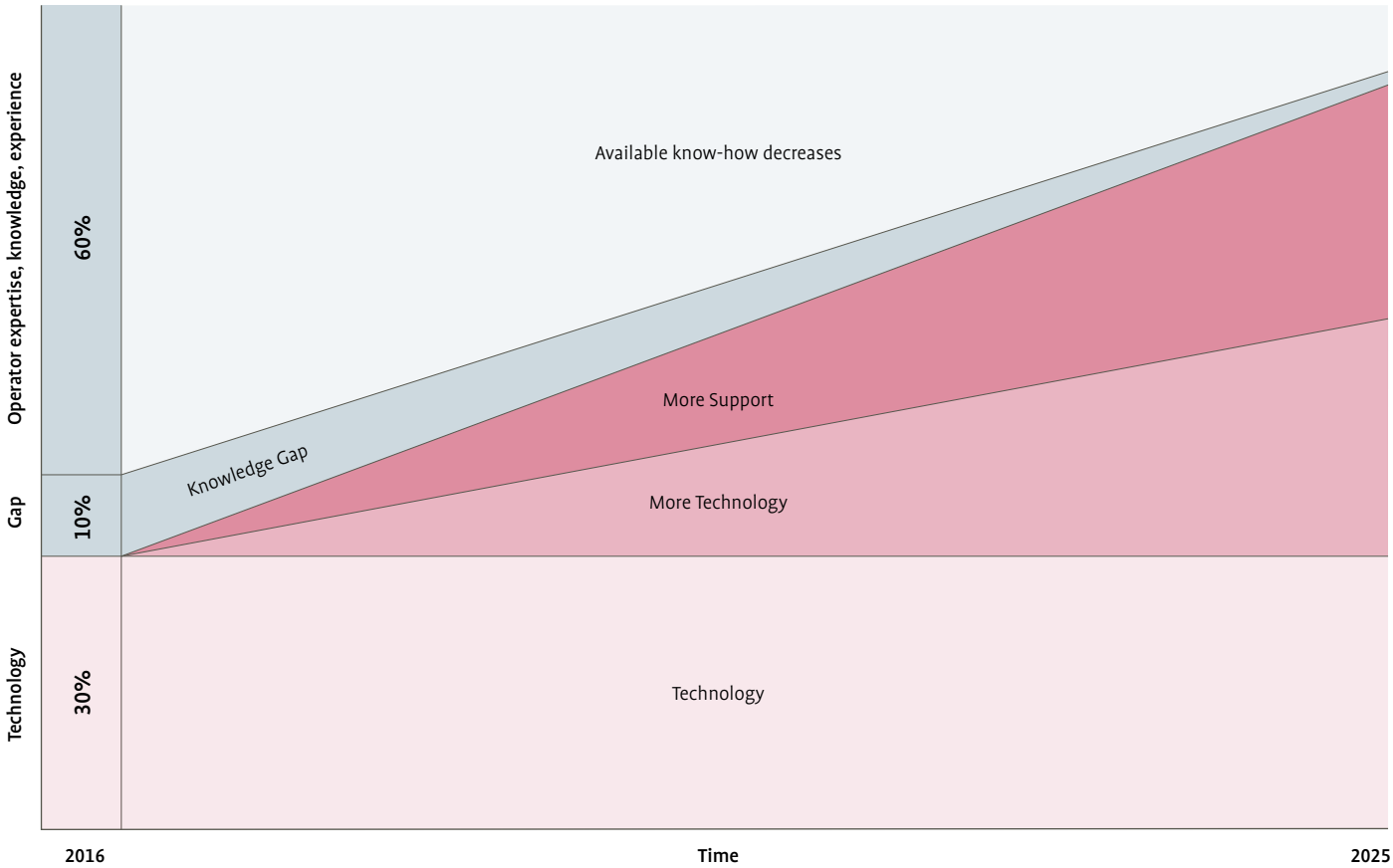
Bridging the gap

Knowledge drain is considered the biggest challenge by many glassmakers today. Our strategy of End to End intends to bridge the technology and the knowledge gap for the glass plants of the future.

End to End Technology is a unique set of solutions and automation technologies designed to make glass production easier, safer and more efficient. It takes a holistic view of the production process and unifies the forming and the inspection technology.

Our End to End Support offers unrivalled expertise to tackle the knowledge gap head on. The support packages have been designed specifically to maintain and expand the best level of knowledge inside the glass industry.

How do we tackle the loss of know-how?



END TO END
Full-Process Excellence

Introduction

With the development of servo-electric machines, closed loop solutions, new inspection technologies and the continuous expansion of our service offerings during the last years, we can proudly offer solutions that support our customers in their continuous quest to increase production output and minimize losses. This brochure gives an updated overview of today's and future product and service offering.

Yet, we cannot be satisfied. With an increasing number of servo axes, sensors and control knobs, the complexity of a modern glass production line has reached levels that are challenging for many plants.

Data across Hot End and Cold End are not consolidated or processed in a holistic approach, leaving forming and inspection as isolated processes. In order to fully exploit the potential of today's forming and inspection equipment, future development efforts must focus on relieving plant operators through more intelligent man-machine-interfaces and process control systems that integrate Hot End and Cold End. This will need to be complemented with even more effective support offerings. "Total plant management is critical. Systems have gotten so complex and produce so much data that it's difficult to keep an overview of the relevant plant processes. A system that consolidates the important production data would change the way we control our process for the better."

Our customers spoke and we listened:

"Total plant management is critical. Systems have gotten so complex and produce so much data that it's difficult to keep an overview of the relevant plant processes. A system that consolidates the important production data would change the way we control our process for the better."

Bucher Emhart Glass is proud to introduce its End to End vision. In the glass plant of the future, integrated equipment will read, analyze and react to data completely automatically. Backed with support, ranging from selecting the right machine to assistance in maintaining and running it, plants can achieve better performance, efficiency, safety, traceability, and reliability, ultimately leading to higher profits.

During the next ten years major R&D efforts will be undertaken to make this vision a reality. Important developments have already started and will be available in the next years.

Information Systems

The Plant Information System will aggregate production data from throughout the plant, providing an overview of key parameters, such as efficiency rates, machine speeds and furnace pulls.

The Control Center will be the central hub for the entire forming and inspection process. It will consolidate data from today's numerous sensors and process monitoring systems, providing operators a much simpler overview of the relevant production information.

Further, an integrated Defect Expert System will display actual defects at the Hot End and propose possible corrective actions to the operator. Including measurement data such as blank temperatures or press durations, defect causes can be narrowed down to the most likely.

Process control and automation solutions

Future Closed Loop systems will use multi-variable controls, combining data from different areas of the forming process. Ultimately, defect data from the cold end will be included, automatically adjusting the forming process to prevent defects. Sending data upstream, Automatic Sensitivity Adjustment will provide safeguards when the forming process deviates from its control limit.

> Our customers spoke and we listened:
>
> "Total plant management is critical. Systems have gotten so complex and produce so much data that it's difficult to keep an overview of the relevant plant processes. A system that consolidates the important production data would change the way we control our process for the better."

For example, temperature sensor data from the Hot End can be used to automatically alert inspection to potential hot-plunger defects. Robots will play an important role in automating certain tasks. Besides swabbing, an application might be the automatic adjustment of deflectors based on loading data.

Simpler man-machine interfaces

Application Oriented Programming will revolutionize the way machines are programmed. Rather than specifying timing drum start- and stop angles for mechanism motion and forming events, the users will focus on forming-and process durations. The control system will automatically manage the collision-free motion of mechanisms, moving as fast as necessary and as slow as possible. This ai ensures maximum life time of all equipment.

Condition Monitoring and Preventative Maintenance tools will help plants schedule repairs proactively to minimize unplanned downtime. Cycle- and runtime counters, air consumption monitors as well as self-monitoring servo drives will provide key information on wear-time and replacement timings. This all ensures maximum lifetime of the equipment.

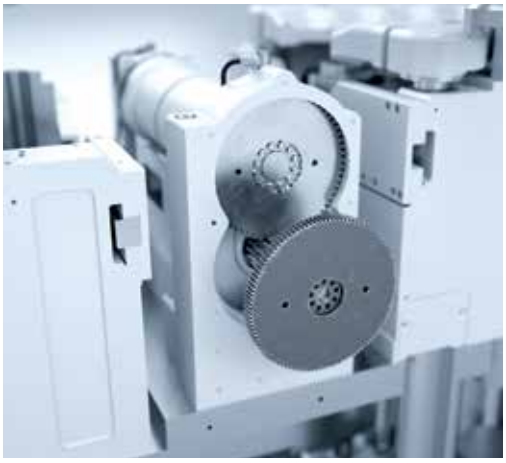
Inspection technology - SCOUT

SCOUT is the intelligent software behind Bucher Emhart Glass inspection technologies. It increases accuracy and control and supports fully modular expansion and upgrades in the future. SCOUT will communicate with the Hot End through the Control Center, thus becoming an integral part of the End to End solution.

We have set out on an exciting journey. Glassmaking in the future will be simpler, safer and more efficient than ever before. We are proud to be part of this journey together with you.

> "Our new offer to customers is very simple: one plant, one partner," says Martin Jetter, president of Bucher Emhart Glass. "We fully understand why, in the past, glass plants may have wanted to cherry- pick technologies from different suppliers. But with the skills gap and economic reality we all face, things have changed. To get the best return on assets, it makes sense to work with a single supplier who understands every area of the plant."
>
> "It is our job to help a glass plant run as efficiently and profitably as possible. That's why End to End is our future, and we trust it's a future our customers will share."

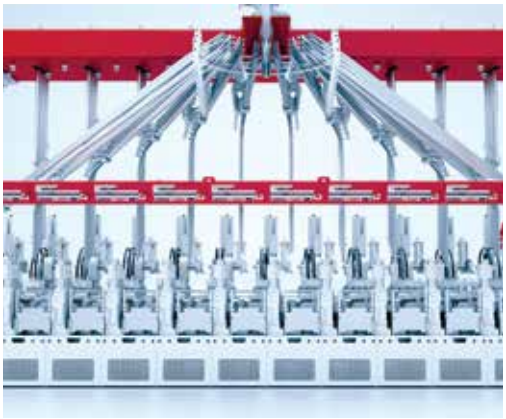
Forming Technology Advancements



Condition Monitoring

Condition Monitoring and Preventive Maintenance tools enable plants to schedule repairs sufficiently, as well as reduce unintentional downtime. Condition and maintenance monitors can be integrated into the control system, providing key information on wear-time and when a mechanism should be replaced.

Air consumption can be monitored to ensure efficiency in usage.
The development of signal analysis from self-monitoring servo mechanisms will also provide key maintenance information.



Closed Loops

Closed Loops focus on monitoring and automating adjustments to integrate the Hot End production process. With control of functions such as Loading, Cooling and Spacing, a process with less variations and reduced necessity for manual labour can be implemented. This provides greater overall control and stabilises the process.

Safety Controls

With End to End's Safety Control system, the Blank and Blow side are electrically separated, allowing operators on either side to switch to a safe state isolated from each other. The Invert and Takeout mechanisms are supervised with an independent safety module.

This keeps mechanisms under electrical power, whilst maintaining the highest safety level using cut-out functions which safeguard against parts moving. The Safety Control system also shortens job-change time significantly. The Safety Control feature of End to End is fully available now.

Defect Visualisation

Defect Visualisation operates by providing a data bridge where images of defects seen in the Cold End are viewable in the Hot End, allowing operators to recognise which defects are being created and how to resolve them.

After this we will welcome the availability of intelligent cause and data analysis, followed by the ability to make automatic changes to the forming process allowing for fully-automated production.

Robots

End to End fully integrates robots into the Hot End process and takes on various roles around the machine. By using loaded measurements from the Blank Radar, the adjustment of deflectors can be automated to improve how gobs are loaded into blanks.

This increases safety and reduces variants, providing a constant level of quality for fewer bottle losses. Available now are Swabbing Robots which can be added to your Emhart machines. Further applications will be made available continuously.

Application Oriented

End to End's Application Oriented Programming frees users from following the old concept of the timing drum, moving to the duration timings rather than angle timings. Through a simplified user interface, Application Oriented Programming provides a modern control system, ensuring against collisions as the management of mechanism motion is removed from the operator.

All motion times, and start and stop durations, will be automatically calculated and therefore is less dependent on the expertise of the user.


END TO END
FLEXRadar
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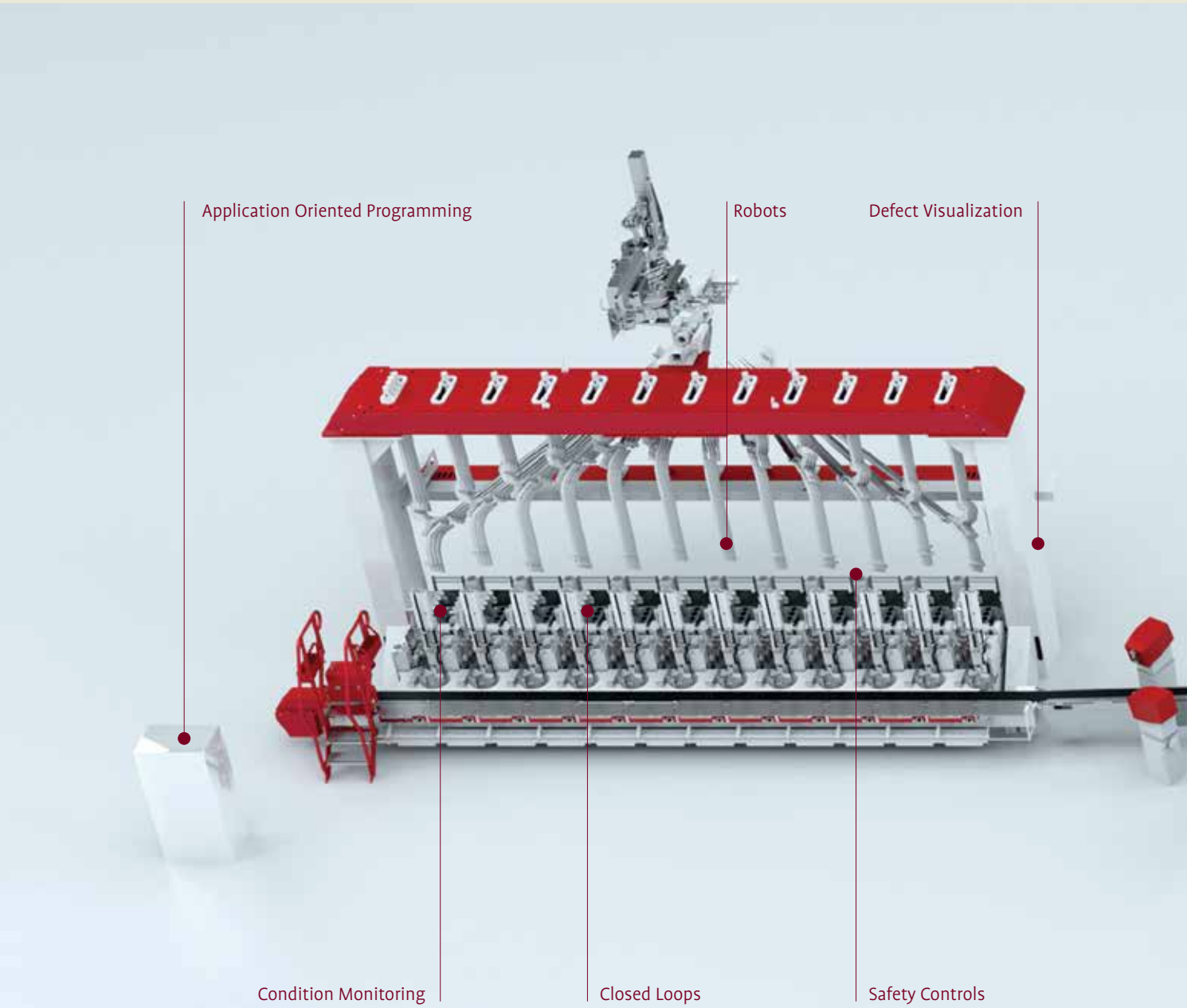
12-9
13
Exit
Ausgang
futronic
futronic
MSK
BUCHER
emhart glass



Application Oriented Programming

Condition Monitoring

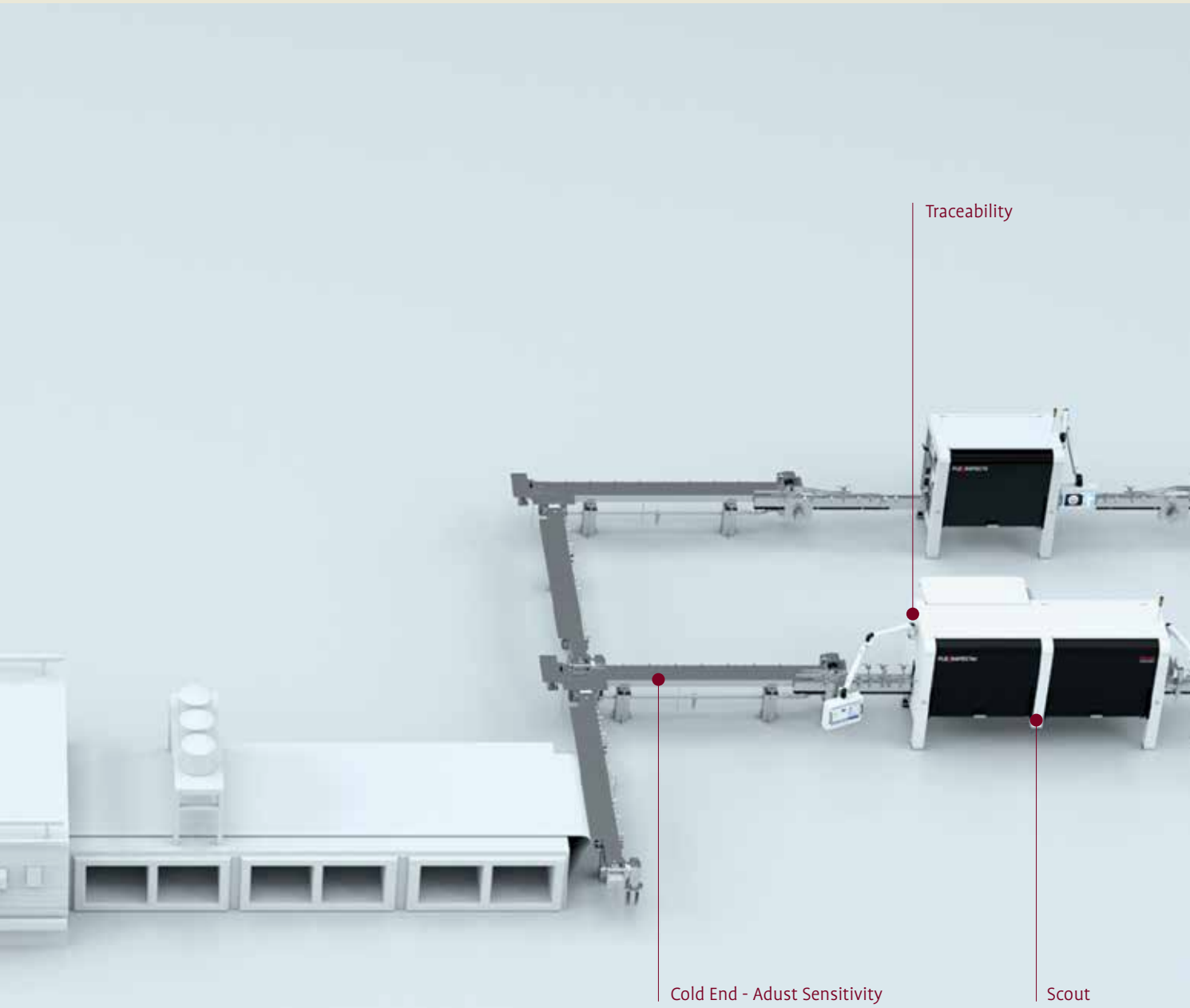
Robots

Control Center

Defect Visualization

Closed Loops

Safety Controls



Control Center

Traceability

Cold End - Adust Sensitivity

Cold End DataTrend Analysis

Scout

Cold End DataTrend Analysis

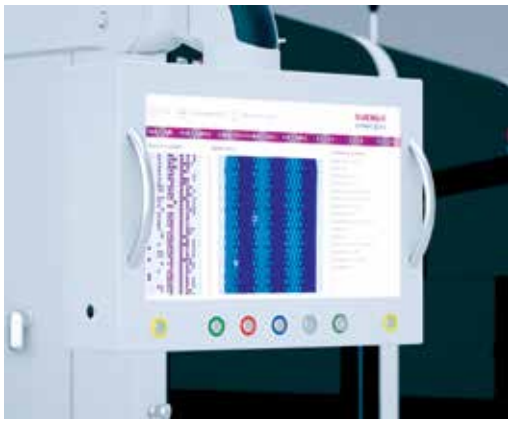
Full plant view

Inspection Technology Advancements

Control Center

The Control Center acts as the central location which connects both ends of the process and allows the review of all data. With so many sensors, controls and screens, it is difficult for operators to have a simple overview of the production process.

However, End to End's central hub means the data is consolidated, to not only make it easier to understand, but for the plant's data to be stored, analysed and monitored. The Control Center technology is out now.



Automatic Sensitivity Adjustment

Automatic Sensitivity Adjustment safeguards against times when the forming process deviates from one of its control limits. Using the temperature sensor data from the Hot End, the master controller will automatically correct a hot plunger condition before it exceeds critical limit. It will then alert the appropriate inspection devices in the Cold End.

At the time when potential defects may arrive in the inspection area, the system automatically tightens the filter to provide extra safeguarding against passing defects.

Traceability

Traceability is something demanded by customers today and with End to End, this is just the beginning. Within the FleXinspect machines, a 2D matrix code is read. The code's information is designed to provide a unique serial number, or 'fingerprint', with each glass container produced then being able to be individually identified, tracked and recorded with the containers specific production parameters.

Scout

SCOUT was the first component of the End to End process to be released and is the intelligence software and hardware that powers inspection equipment today. With new functionality to help increase the accuracy and control of glass quality in both FleXinspect and Veritas machines, SCOUT is the foundation for all future inspection technologies that will be released by Emhart.

With a system architecture created to allow technological advancements via modular upgrades, the new SCOUT technology platform is a key element in making End to End a reality.

Cold End Data Trend Analysis

Cold End Data Trend Analysis is performed using data from the FleXinspect equipment and measurements recorded in the Minilab products within End to End. By analysing critical data of the glass containers, the system identifies when a mould or process is incorrect. When monitoring the measured results from the containers, the system will alert when changes are required and will even trigger automatic adjustments.

This is designed to avoid creating defects, as well as saving on costs and increasing production efficiencies.

The full process

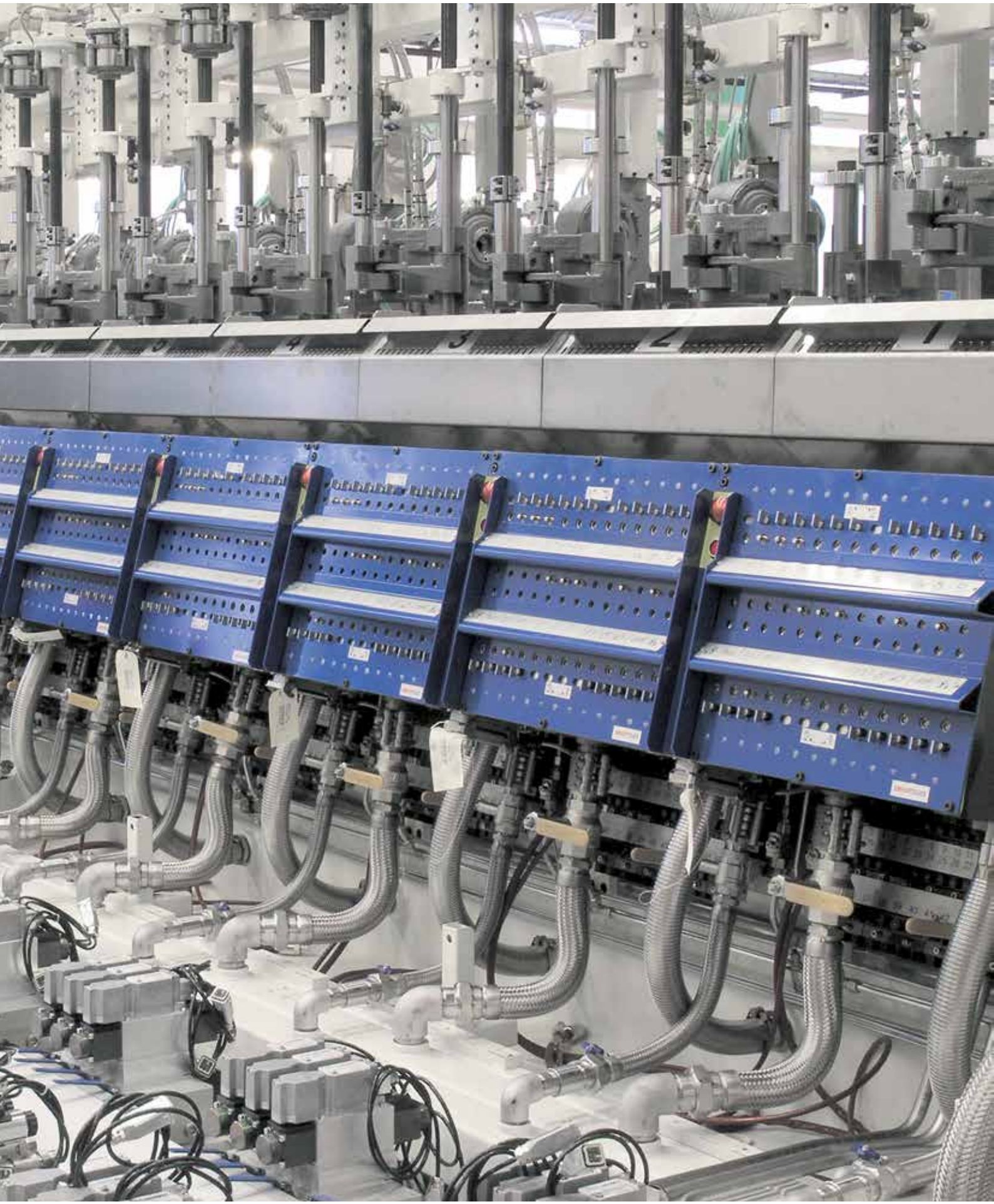
In the glass plant of the future integrated equipment will read, analyze and react to data completely automatically.

Whether in the forming area of the glass plant or in the inspection area - a completely holistic approach will integrate all processes and feed data back to either side of the glass plant. The End to End vision will become a reality.

Our Support

Our network of specialists say that knowledge is power – we are here to empower you in the use of your technology. We show you how to customize, and optimize. With a tailored approach to your specific set-up. Using our support we enable you to get the very best out of your machines.

For more detailed information about our Care, Empower and Academy capabilities please consult the individual brochures or www.bucheremhartglass.com



Capabilities

Emhart Original Parts

There's a good reason why you should choose Emhart Original Parts - the health of your machine. Non-OEM parts can – and do – have an adverse effect on the health and safety of an Emhart machine. That's why we only prescribe the best.

The cost of holding stocks of parts and accessories at the plant level is a significant but often underestimated element in the lifetime costs of an IS machine.

That's why at Emhart we maintain a portfolio of around 150,000 parts for hot end equipment, inspection machines, and refractories.

On-Site Service

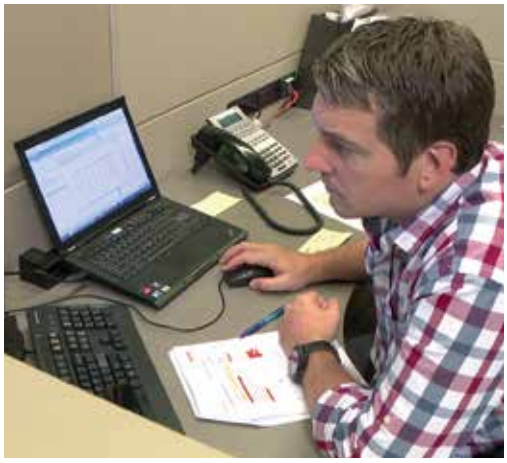
Our global and multilingual team of over 60 professional service engineers and production specialists offer the specialized skills in forming and inspection to assist our customers and resolve problems.

Highly skilled Mechanical, Controls and Inspection Service Engineers and experienced Production Specialists support all our current and legacy forming and inspection equipment as well as automation products.

Refractories

Bucher Emhart Glass refractories are formulated from high purity, special oxide raw materials and manufactured with the properties necessary for the success of each specific glass making operation. In our laboratory, manufacturing and quality operations, we bring together people, processes, and products to meet your needs.

Our refractory craftsmen – most with at least a decade of experience – are the heart of our operation. They are supported by engineering and R&D professionals who emphasize innovative product development and individual customer solutions.



Project Management

Bucher Emhart Glass has developed the internal capabilities to manage the development of a new glass container manufacturing facility from concept to final commissioning and transfer to the customer.

Maintenance Support

Bucher Emhart Glass supports your maintenance of forming and inspection equipment with different support options.

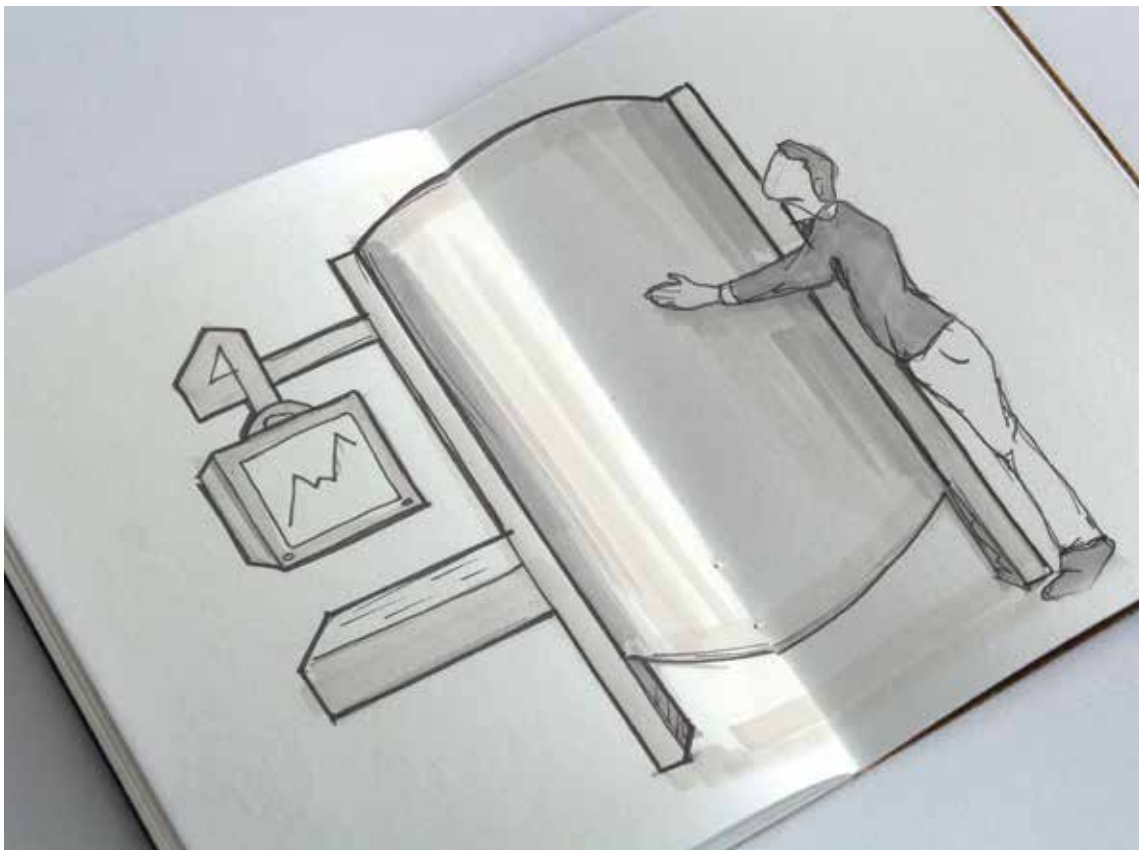
Maintenance Support options for Forming range from equipment condition health checks, detailled repair proposals and repair projects to continuous maintenance supervision in your plant by Bucher Emhart Glass maintenance service engineers. With the Technical Services Agreement TSA for Inspection, Bucher Emhart Glass performs for you periodical complete health check, preventive maintenance as well as minor repairs for each Inspection equipment in your plant to ensure optimum equipment performance.

Inventory Support

The cost of holding stocks of spare parts and accessories at the plant level is a significant but often underestimated element in the lifetime costs of an IS machine.

Bucher Emhart Glass maintains a portfolio of around 150,000 parts for hot end equipment, inspection machines, and refractories. Glass plants can rely on this central stock for most requirements and achieve significant savings compared to the cost of maintaining a supply at the plant level. Distribution centers are located in Luxembourg and the US (Memphis TN, Elmira NY and Owensville MO).


FLEXINSPECT



Stronger Together Philosophy

'Stronger Together' - building on the recent launch of End to End, which 'closes the loop' between the Hot End and Cold End container glass processes - will see Emhart focus on working even closer with customers. It will also see the company integrate their glass forming and business functions to be more powerful, and combine their customer-facing teams to offer better service.

But most importantly the continous efforts that are made to truly understand customers' points of view and the challenges they may face.

Martin Jetter, Emhart Glass President, said: "End to End is an industry-first. We have given a unique vision to truly unite Hot End and Cold End to provide previously untapped benefits and profits. And now we are building on it by becoming 'stronger together'."

Matthias Kümmerle, Vice President, Technology, said: "The fact is, we now don't think of Hot End or Cold End only, but of End to End. Through our innovative systems, glass plants will be able to automatically react to data, enabling them to achieve greater performance, efficiency and profitability."

Werner Gessner, Vice President, Sales and Marketing, added: "The philosophy of 'Stronger Together' has focused our business and will result in greater collaboration with our customers'. We will prove that with End to End we will offer unrivalled support in training, line optimization and the sharing of knowledge."

The Dream

- Nothing less than 90% pack rate
- Only two operators per furnace and shift
- No more need to get "into" the machine: all is safe!
- The control center is the "best consultant" of the machine operator
- No need to reject containers at the cold end, as defects are avoided by "automation intelligence"
- Inspection equipment is becoming "glass makers best friend",as it increases the pack rate
- Together we make Glass more competitive!

How we are implementing Stronger Together

'Stronger Together' - building on the recent launch of End to End, which 'closes the loop' between the Hot End and Cold End container glass processes - will see Emhart focus on working even closer with customers.

It will also see the company integrate their glass forming and business functions to be more powerful, and combine their customer-facing teams to offer better service.

Stronger Together Pledges

Emhart & Customers

Martin Jetter, Emhart Glass, President “We will focus on working even closer with our customers. Not just re-organizing our customer-facing teams to offer a better service, but continuously communicate and listen to our customers’ side and the challenges they face.”

Claude R. Cornaz, Vetropack, CEO “We will continue to share our experiences with the Emhart equipment with their specialists and will partner with the Emhart research teams to continuously enhance the glass production process.”

Result: Working together, in partnership, will provide the best possible return for all – industry, customer and Emhart.

Emhart & Customers

Ben Jost, Emhart Glass, Project Manager “We will listen to CP Glass and their experienced teams. Their inputs are very valuable for us and our engineering team”.

Pawel Urbanek, CP Glass, Senior CE Specialist “Our glass plant will keep challenging the developments in the SCOUT software and inspection equipment of Emhart. We will clearly communicate the proposed changes”.

Result: Working together with customers and jointly refine Emhart’s developments will benefit everybody in the industry.

Hot End & Cold End

Leo Diehm, Emhart Glass, Director Product Management Forming “We will collect the key forming production parameters and relevant process data to send to the FlexCenter for analysis.”

Mike Rentschler, Emhart Glass, Product Management Inline Inspection “We will increase the collection of data in the Cold End inspection and transfer them to the same FlexCenter to merge and analyze.”

Result: Inspection and Forming become one by making smart decisions using the analyzed data to run a container production line at highest performance with little human support.

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