

SERVING CUSTOMERS WITH INNOVATION AND INDUSTRY-LEADING SOLUTIONS FOR 50 YEARS.

Glasstech is excited to have celebrated its 50th anniversary last year and we look to a future full of potential. As we reflect on our first half-century, we're filled with gratitude and appreciation toward our loyal customers.

As we look forward, we do so with a strong, experienced, senior management team, a supportive ownership structure that has given Glasstech the financial resources to develop and patent its next generation of products, and a research and development team with exciting, industry-leading products in the pipeline.

We are particularly excited about the next generation of EPB products with the introduction of the EPB-XL and EPB-XLT offerings, which have been enthusiastically embraced by the automotive glass market. The ability to meet the ever-expanding requirements of the automotive OEMs for tighter tolerances, larger sizes and technology enhancements for the booming electric vehicle market and the autonomous vehicle market is exciting.

We are, however, most excited about the launch in 2020 of our AGI-Gauging and Reflective Measurement System. This revolutionary technology will transform glass inspection, as it can provide an accurate surface map of the entire glass part while eliminating the need to invest in costly electronic probe gauges.

Glasstech is very excited about the future and we look forward to serving our great customers for many years to come.



50 YEARS OF INNOVATION

Innovation established Glasstech, and it continues to spur the company's growth. Our industry advancements are chronicled through an active worldwide patent portfolio. Here is a chronological look at these innovations over the years.

1972 – Roller Hearth Tempering System

1974 – Batch (oscillating) Tempering System

1978 – Quick Sag™ Automotive Bending and Tempering System

1985 – Deep Bend 4™ Complex Automotive Bending and Tempering System (DB4)

1992 – Gas Fired Forced Convection Heating (FCH)

2001 – DB4 Quick Change and Fast Cycle System

2002 – External Press Bender System for Tempered Parts (EPB-T™)

2007 – Solar Parabolic Bending and Tempering System (CRB-S™)

2009 – External Press Bender System for Windshield Parts (EPB-L™)

2010 - Automotive Glass Inspector for Transmitted Optics (AGI-T™)

2016 – DBX-T™ Complex Automotive Bending and Tempering System

2019 – EPB L/T™ Combination Bending and Annealing and Bending and Tempering System

2020 – Automotive Glass Inspector for Gauging and Reflection Measurement (AGI-G/R™)

2021 – EPB-XL™ Bending System for Large Size Windshield and Roof Lite Forming

2021 – EPB-XL/T™ Combination Bending and Annealing and Bending and Tempering System for Large Size Lites

FOUNDED IN 1971, GLASSTECH REACHES ITS HALF-CENTURY MILESTONE.

Headquartered in Perrysburg, Ohio, since 1979, Glasstech is a global company with offices in New York, Shanghai and Mumbai, and hundreds of glass processing systems and glass inspection systems installed in over 40 countries on six continents.

From the very first horizontal roller hearth flat continuous system, Glasstech has been an industry leader. In the architectural glass market, when high performance low-e coatings were introduced to the market, Glasstech launched the gas fired Forced Convection Heater (FCH), which is the most energy efficient system available for processing low-e coated glass.

In solar glass processing, Glasstech was the first company to offer tempered or heat strengthened glass for parabolic troughs for the solar thermal energy market with the introduction of the Solar CRB-S. Fully tempered glass is up to five times stronger than annealed glass, so the introduction of Glasstech's CRB-S was revolutionary, as it provided glass to the solar thermal market with increased impact and wind load resistance, and if

broken, is much safer for workers and other components nearby.

In automotive glass, Glasstech was the first company to offer a Bending and Tempering System capable of processing 3.0 mm thick glass without tong marks, which was revolutionary at the time. Glasstech built off this success and subsequently launched Deep Bend 4, a system that produces high optical quality glass to precise tolerances and in complex shapes that allowed automotive designers to develop a whole new range of glass shapes. Glasstech further improved DB4 by offering a Quick Change and Fast Cycle version, which was capable of part changeover times of 90 minutes or less and lower cycle times. Furthering that technology, the DBX has demonstrated productivity gains of 50 to 75 percent and reduced energy consumption by 15 percent. DBX improves process yield by way of improved glass positioning accuracy and can process parts as fast as 10 seconds.

Glasstech is not only committed to evolving backlite processing technology. The Glasstech EPB-L is recognized

as the world's leading system for the processing of high precision windshields. The prevalence of HUD windshields, augmented reality HUD, beam wiper systems and ADAS camera systems requires the most precise forming technology available, and that technology is the Glasstech EPB-L.

Glasstech has recently expanded its EPB-L product line to include EPB-XL. With windshields becoming larger and panorama roof systems increasing in quantity, Glasstech has expanded the size of the EPB-L to be capable of producing parts up to a height of 1600 mm and a width of 2134 mm.

Glasstech has further expanded the EPB product line with the launch of the EPB-XLT System. The EPB-XLT System is capable of producing low stress parts up to a height of 1600 mm and a width of 2134 mm, semi-tempered parts up to 1600 mm x 2000 mm and fully tempered parts up to 1.3 square meters.

TECHNOLOGICAL SOLUTIONS FOR LOWERING OUR CARBON FOOTPRINT

There is significant focus on reducing the carbon footprint in all manufacturing operations. Glasstech remains focused on doing its part by developing technologies that require less energy to temper glass and use fuel sources that provide lower emissions.

Specifically, in tempering 3.2 mm architectural glass, while roughly half of the total energy is consumed through heating the glass, the other half is consumed in tempering and then cooling the glass down to ambient temperature. Glasstech has developed a new architectural quench that consumes 15 to 20 percent less energy than its traditional quench for 3.2 mm glass.

While counterintuitive, Glasstech's gas fired FCH carbon footprint is lower than an electrically heated system in most areas of the world. The FCH technology directly converts natural gas combustion into the heating source for the glass, while electrically heated systems consume electricity into the heating source. In most regions of the U.S., the FCH generates 20 percent less CO₂ emissions heating glass than an electrically powered system supported by utility based electrical power.

Glasstech has also concluded that its burner systems can be retrofitted to hydrogen fuels when they become more readily available and cost effective.

The same is true on automotive systems. Glasstech has focused on ways to lower the consumption of energy in tempering and cooling glass. Glasstech's EPB windshield technologies consume roughly 50 percent of the energy required for a gravity bend windshield system. Glasstech's DBX backlite technologies consume roughly 15 percent less energy than previous generation backlite technologies.

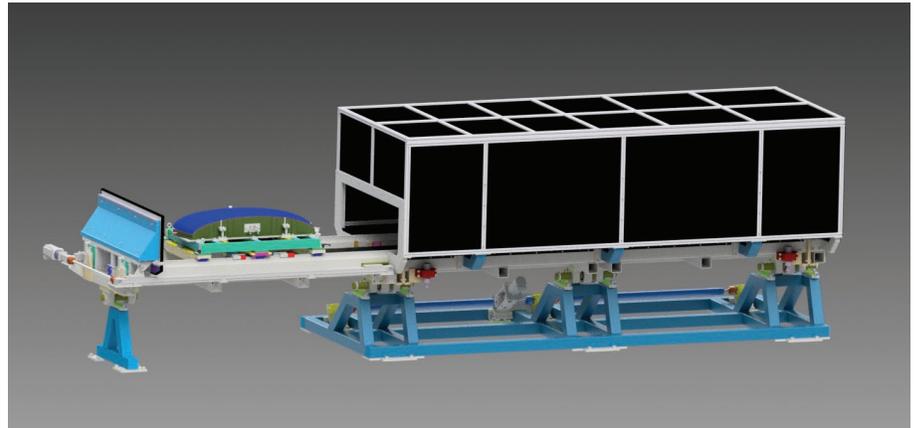
For more information on how to lower your carbon footprint, please contact Glasstech.

AGI-G/R: NON-CONTACT GAUGING AND REFLECTION INSPECTION

The AGI-G/R technology has been endorsed by many automobile manufacturers to gauge glass at the end of a manufacturing line. The automobile companies understand the power of measuring the entire glass surface with the accuracy of a CMM at scan rates that can allow 100 percent part measurement. This protects both the glass fabricator and automobile manufacturer against non-compliant parts reaching the end consumer.

AGI-G/R continues to be refined and soon it will be capable of measuring the peripheral size of complete shaped parts. Specific off form data points can be recorded along with a jpg of the shape's conformance to either an approved limit sample or the part's design intent.

A multitude of different backlite shapes have been measured, from those that are J bent with the primary bend at the roof, to challenging SUV backlites with a bent radius of 45 mm near the wings and approaching a 70 degree bend into the D pillar.



AGI-G/R is sized to match various glass sizes. The technology is configured to measure three maximum part sizes: 1) 1067 mm x 1830 mm, or 2) 1220 mm x 1830 mm, and finally 3) 1600 mm x 2134 mm.

AGI-G/R can be integrated with an AGI -T system where a complete quality report, including off form and size data, transmitted and reflective optical distortion measurements, can be saved for each part. This type of reporting allows cradle to grave data on critical

parts that protect the glass fabricator in certain cases.

The financial payback for the AGI technology can occur through fixture cost reduction, faster new product launch time and quicker reaction to process conditions through rapid and better part quality reporting.

To learn more about AGI-G/R, please contact Glasstech.

AUTOMOTIVE EPB: EXTERNAL PRESS BENDING SYSTEM

In 2002, Glasstech debuted the EPB forming technology which served the complex shaped sidelite market. This state-of-the-art system incorporated many patented features that allowed for high precision compound curvature sidelites to be produced as fast as 8 seconds per part. Similar to most all Glasstech systems, the first EPB system is still producing high quality sidelites at high throughput, uptime and yield.

The EPB technology platform has evolved and advanced to keep up with the automobile manufacturers' expectations for windshields and rooflites. During its 20 years of service, EPB has expanded its capabilities from sidelites to backlites to windshields and panoramic rooflites, all while

meeting the ever more stringent quality requirements needed to support Head Up Display, forward viewing cameras and blade wiper technologies. More recently, the industry trend is toward larger windshields that incorporate high performance coatings to manage solar heat gain.

In 2022, 20 years after launching the first EPB system, the most capable EPB system is ready to produce large-area windshields and rooflites. The newest EPB system can form parts with an overall size of 1.6 m x 2.13 m in either low stress mode for windshields or heat strengthened mode for some laminated rooflites. This EPB system incorporates features that can improve transmitted optics, technology that can form more

complex shaped parts, reduce system maintenance, and even reuse existing standard sized EPB-L tooling.

All EPB systems can incorporate Smart Aspiration™ which allows coated glass to be processed. The Smart Aspiration™ option can alter the heating provided to the inner or outer glass sheet. This technology has been used on a variety of glass thicknesses, colors and coatings. It provides the most versatility in operating an EPB system.

Contact Glasstech to learn more about this exciting new technology.

GLASSTECH SUPPORTS THE ENTIRE AUTOMOTIVE GLASS INDUSTRY.

Glasstech celebrated its 50th anniversary in 2021. What started as a small company that was the first to develop a horizontal roller hearth tempering system that grew into a technology company that supports the automotive glass industry. Glasstech currently has over 500 patents and patent applications worldwide. It extends its competencies from early glass shape evaluation with its Shape Modeler™ software suite, to world-class glass fabricating technology to now state-of-the-art glass inspection technologies. All of these competencies complement each other and allow direct feedback between the areas for further improvement. As time goes on, each of these capabilities, while working together, provide the optimal solutions to automotive glass fabrication.

Shape Modeler™ can be used to evaluate the automobile company's glass design for optical properties and manufacturability. Shape Modeler™ can be used to fully simulate the forming of a glass sheet from a flat state to its final three-dimensional shape. It emulates all the forming forces that are applied to the glass which can impact the final part quality. Some automobile manufacturers utilize Glasstech's Shape Modeler™ to refine their designs before any hard tooling is developed.

Glasstech's various glass forming processes can be deployed to manufacture the glass that is installed in automobiles the world over. Feedback from the parts produced (e.g., shape and optical performance), is fed back to the group responsible for Shape Modeler™, to continue to refine the software's algorithms.

Finally, Glasstech has a group that develops glass inspection technologies and evaluates transmitted and reflective optics as well as the geometric shape of a part. This group further closes the loop on Glasstech's forming processes and Shape Modeler™ program. Real time quality information can further enhance process control on Glasstech processes as well as further refinement of Shape Modeler™.

It will be interesting to see where the automotive glass industry goes in the next 50 years and how Glasstech will be positioned to lead and support the industry's future needs as electric and autonomous vehicles shape future transportation.

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