

## AUTOMOTIVE

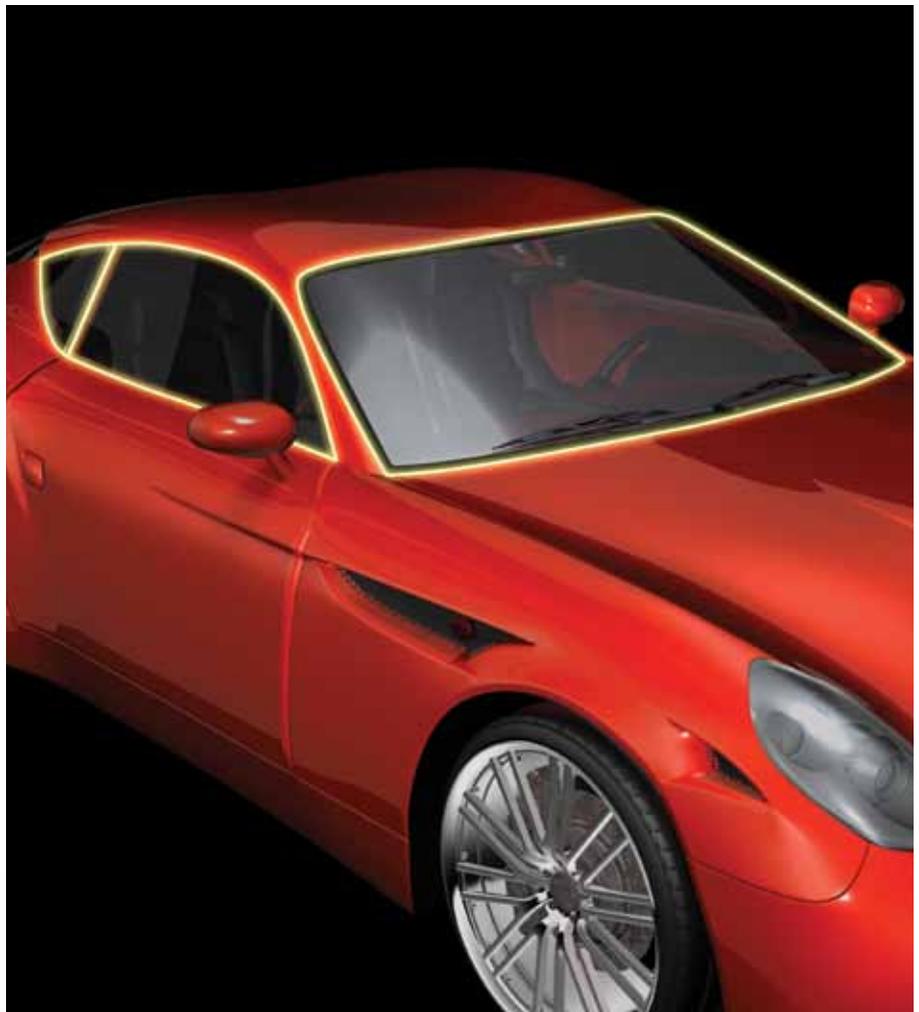
### Meeting Market Demand

The task of producing automotive windshields is getting more difficult, driven by new quality standards emerging along with increased windshield shape complexity.

The new quality standards require quantitative measurement of optical performance and have decreased the dimensional tolerances across the surface of the windshield. This has opened the door for the advanced technology of Glasstech's External Press Bending System for Annealing Automotive Safety Glass (EPB-L™).

#### Tightening Quality Standards

Historically, the surface of a windshield was measured in one to nine locations on the body surface. We have recently seen surface measurements in more than 100 locations. Traditional windshield fabricating systems have been unable to meet the dimensional tolerances over a greater number of measurement locations while also complying with optical performance requirements. Glasstech's EPB-L has a proven record of meeting these tolerances and the accompanying see-through optic requirements.



“We are continuing to see requirements, especially recent windshields being proposed, that are not possible to produce with traditional fabricating equipment,” said Jay Molter, Glasstech's Senior Vice President of Marketing

and Sales. “Our development group continues to enhance our EPB-L process and tooling which enables us to offer customers solutions that efficiently process these challenging shapes that comply with the new quality standards.”

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**The EPB-L system is an innovative, highly versatile glass windshield press-bending system.**

## Meeting Market Demand

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### Asymmetrical Windshields

Spurred by government requirements for increased gas mileage, auto producers have been challenging designers and suppliers to “squeeze” every possible ounce of weight from the producers’ vehicles. Glasstech has risen to the challenge.

The EPB-L system, with Glasstech-developed accurate control technology, enables Glasstech customers to produce asymmetrical windshields that are a half-millimeter thinner and, as a result, lighter than symmetric construction windshields. Instead of laminating two identically shaped 2.1mm glass singles to form a windshield with a glass thickness of 4.2mm, the Glasstech EPB-L permits the combining of a 2.1mm glass single with an identically shaped 1.6mm glass single to form a windshield with a glass thickness of 3.7mm.

Additionally, the automotive industry is pushing for windshield construction incorporating the use of coated glass. Whether for heated glasses for defrosting or for infrared reduction, these coatings present challenges to heating the glass uniformly prior to forming. Glasstech’s patent-pending heat control can efficiently and successfully process these specialty glasses.

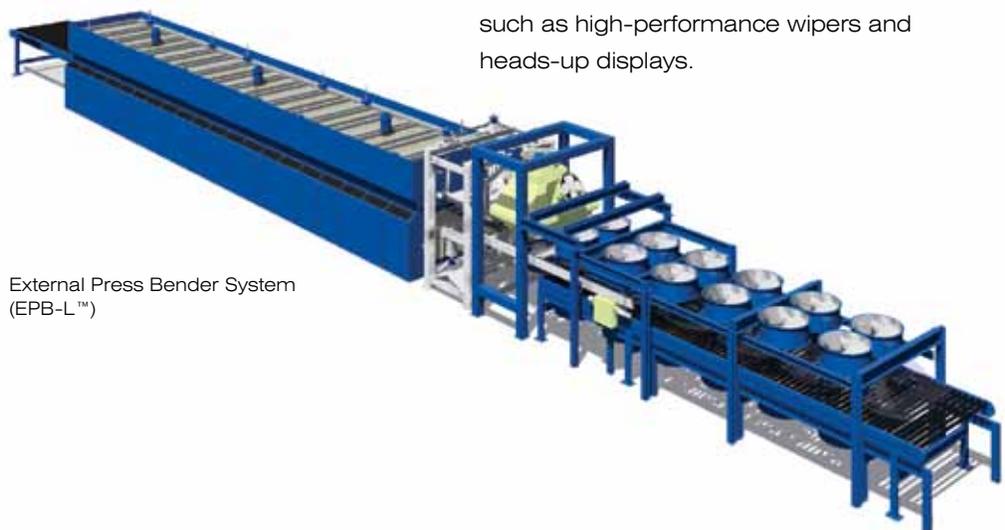
Even for varying thicknesses, the Glasstech EPB-L is able to produce and run the two different windshield singles on the same line, one after the other, because of the uniform heating made possible as a result of Glasstech’s advanced oven technology and the accurate positioning achievable through advanced process control.

Glasstech’s EPB-L system also operates more cost effectively and runs at higher volumes than traditional windshield processing systems. Using only a single tool set ensures the EPB-L uses significantly less energy when compared to gravity sag systems. The EPB-L can achieve a cycle time of 9.5 seconds per glass part, which means the two parts required for lamination can be produced every 19 seconds.

In summary, EPB-L is the system for today’s and tomorrow’s market needs.

The EPB-L system is an innovative, highly versatile glass windshield press-bending system currently operating on the European, North American and Asian continents. The system satisfies the automotive OEM demand for tighter surface tolerances with superior optical quality. In addition, the operating economies of the EPB-L are substantially better than traditional processes.

Unlike traditional windshield production machines that produce imprecise glass parts, Glasstech’s EPB-L meets the requirement for increasing the number of surface measurement points required, especially by German automakers. These extreme tolerances are needed to ensure proper operation of developments such as high-performance wipers and heads-up displays.



External Press Bender System (EPB-L™)

## Why Glasstech? Here Are Seven Reasons

A new requirement of the solar power industry in many countries is the local manufacture of components, such as glass parts, to be used in Concentrated Solar Power (CSP) and Photovoltaic (PV) installations. This approach spurs local economies and reduces transportation costs in bringing the components, such as parabolic glass mirrors, to the solar fields. Once again, Glasstech systems are helping to meet this requirement.

**First:** Glasstech systems are reliable, production proven and produce precision glass parts for a variety of solar glass applications. Glasstech systems can be installed in any location and are efficient and cost effective in fabricating solar glass locally, significantly lowering transportation costs. Glasstech systems produce extremely high-quality curved and complex mirror blanks for the CSP industry as well as ultra-flat panels for the PV solar power industry.

**Second:** Glasstech systems are built to last. They operate long after competitive systems have failed. Plus, Glasstech supports its systems by offering upgrades and enhancements that increase a system's capabilities and useful life. (See separate story on page 5.)

**Third:** Glasstech has a long history. Glasstech engineers understand glass processing and challenges specific to solar glass and can offer customers key insights that help minimize production costs and product lead times.

**Fourth:** Glasstech systems are scalable, allowing for production volume growth as the market expands.

**Fifth:** Glasstech solar systems are capable of processing tempered or heat-strengthened glass, allowing Glasstech customers to supply glass that meets their customers' specifications. Strengthened glass allows for fewer installation failures and in-service failures from wind, hail and debris, as well as less collateral damage should an in-service failure occur.

**Sixth:** Glasstech systems are energy efficient. For Glasstech's Cylindrical Radius Bender System (CRB-S™) for solar parabolic shapes, the energy consumed producing glass shapes is significantly less than other processes, since the Glasstech system heats only the glass and not fixtures or molds. The Glasstech Solar Forced Convection Heater flat glass tempering system (FCH-S™) can offer significant energy savings in many areas of the world due to natural gas fired convection heating, which offers a lower processing cost per part area compared to electric-powered processes.

**Seventh:** Glasstech was a pioneer in the development of flat-glass tempering systems for architectural applications and was a pioneer in the development of bending and tempering systems capable of fabricating high precision complex automotive glass. This rich heritage has positioned Glasstech to be a leader in the supply of flat-glass tempering systems and bent-glass tempering systems for the solar glass industry.

With a rich heritage of 40-plus years of innovation and ruggedness, Glasstech systems now occupy a well-deserved leadership position in the worldwide solar marketplace, based on Glasstech's achievements and breakthrough technological developments in the automotive and architectural markets.

### CSP Applications

Glasstech's newest solar glass processing system, the CRB-S, has now been delivered on three continents. This system, depending on the configuration, is capable of shaping and tempering or heat strengthening parts to LS2, LS3 and LS4 industry-standard sizes used in CSP-based generating systems.

The CRB-S system is known for forming flat glass into parabolic or cylindrical shapes with high output, ease of operation and high repeatability, as well as the ability to temper or heat strengthen the glasses. The system also is capable of meeting precise tolerances for high-level geometric reflection.

The CRB-S system is the leading commercially available solar glass processing system that tempers or heat strengthens glass and is ideal for the high-speed production of parabolic-shaped trough reflectors. Fully tempered glass is up to five times stronger than annealed glass and provides increased impact and windload resistance. If tempered parts are broken, the resulting glass pieces are small and are safer for workers and other nearby components.

## Glasstech engineers understand glass processing and challenges specific to solar glass.

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Additionally, Glasstech's CRB-S system:

- Uses much less energy than the traditional sag-forming systems, since the CRB-S system heats only the glass
- Can change shape set-ups in 60 minutes or less
- Costs less to operate

The CRB-S system can be ordered with a Glasstech electric radiant heater or with a Glasstech convection heater, either electric or gas fired.

### Photovoltaic Applications

Some photovoltaic panels come with specialty coatings that require the unique, uniform heating provided by Glasstech's convection heating options to deliver the ultra-flat panels manufacturers require.

The millions of square feet of PV-panel glass processed each year on Glasstech continuous systems in the United States alone are testimony to Glasstech's understanding and technical achievements in this market.

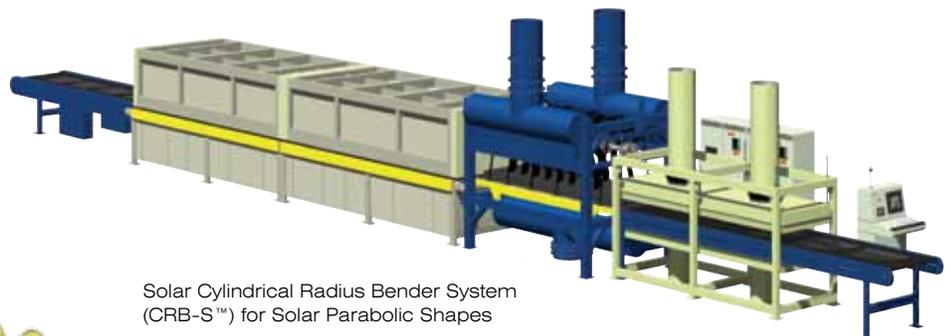
Because Glasstech high-productivity machines have such market penetration, they have helped lower the cost of processing glass for PV cells. A key is Glasstech's highly energy-efficient FCH-S system. This system features a natural gas fired, forced convection heater which allows for reduced heating costs and superior tempering technology.

The FCH-S system processes high volumes of glass very precisely, yielding extremely flat glass. The system efficiently processes low-iron float, pattern glass, TCO-coated and clear glass for PV panels. The FCH-S system will heat TCO glass in about half the time of typical radiant systems, 33 to 35 seconds per millimeter of thickness, depending on the specific coating. The system will heat clear glass at the rate of 30 seconds per millimeter.

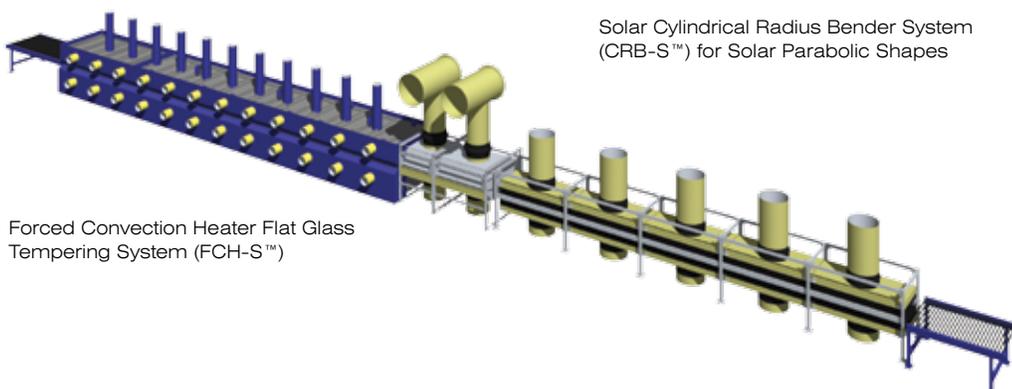
In addition to the CRB-S system and the FCH-S system, Glasstech's comprehensive line of solar glass processing systems includes:

- Solar External Press Bending System (EPB-S™) for tempering and heat strengthening smaller, high-volume spherical and parabolic shapes
- Solar Advanced Deep Bending and Tempering System (DB 4-S™) for complex and deep bend shaped parts for dish segments and parabolic collectors
- Solar Electric Radiant Heater Flat Glass Tempering System (ERH-S™) for continuous, electrically powered flat-glass tempering for photovoltaic panels.

For additional information, please contact your Glasstech sales representative.



Solar Cylindrical Radius Bender System (CRB-S™) for Solar Parabolic Shapes



Forced Convection Heater Flat Glass Tempering System (FCH-S™)

## Glasstech Systems Are Built to Last

Glasstech systems are known worldwide in the industry as rugged, well-designed systems built to last a lifetime. The good news is Glasstech continues to support its systems as they age by offering solutions for controls, drives, high-performance glass processing and enhancements that increase a system's capabilities.

Glasstech doesn't just support systems built in the last 10 years. It supports equipment dating back to the first Glasstech systems built in the early 1970s.

As technology has evolved, Glasstech has evolved along with it, developing updates and enhancements to keep the Company's systems current. Glasstech takes pride in providing leading-edge solutions to replace obsolete components or to enhance performance beyond a given system's initial capabilities.

Glasstech can support all of its systems because the company has an experienced engineering and technical support staff that understands the equipment. Our staff will ensure your Glasstech system gets the care and updating it deserves.

To upgrade your Glasstech system or to source Glasstech aftermarket parts, contact your Glasstech sales representative today or E-mail [aftermarket@glasstech.com](mailto:aftermarket@glasstech.com) and a sales representative will contact you.

Your representative will discuss aftermarket services available for all Glasstech systems, including the following:

- Retrofits
- Replacement parts
- Technical services (contract services)
- Tooling
- Shape Modeler™
- AutoGlassInspector

**Retrofits:** Expansion of your Glasstech system's capability, flexibility and productivity by adding new modifications, computer updates or new heater sections, etc., to handle low-e glass coatings, achieve the tighter tolerances required by auto manufacturers, reduce energy usage, improve yield, lower cycle times and a number of other improvements.

**Replacement parts:** Glasstech is the reliable source for genuine replacement parts for your system as well as for the unique ceramic furnace rollers used in Glasstech systems.

**Technical services (contract services):** Glasstech will design a package of contract services that meets your Glasstech system's needs and your budget including training, system equipment audits, technical support and emergency assistance. Contract service customers receive priority from Glasstech's technicians and can count on a specified number of days of on-site service at the customer's facility.

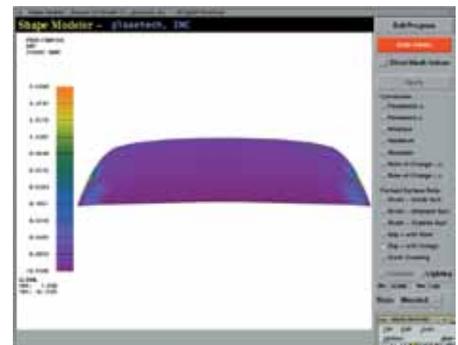
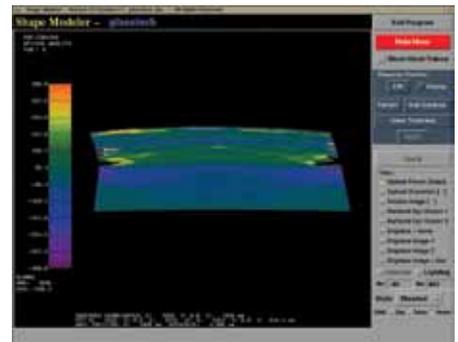
### Automotive Aftermarket

For automotive glass fabricators specifically, Glasstech offers tailored aftermarket services to support the ever-increasing challenges presented by new shapes, tighter tolerances and requirements for improved yields.

Glasstech's automotive aftermarket services include:

**Tooling:** Assistance in design, manufacturing and testing of the complex tooling sets required primarily by the automotive industry, including expert installation and on-site assistance with initial part production. Additionally, the Company will prove-out all Glasstech-fabricated tooling for its DB4™ systems on the Company's prototype system.

**Shape Modeler™ proprietary software:** Mathematically reviews and evaluates new automotive glass designs and predicts the design's transmitted and reflective optical quality. Shape Modeler also can calculate modifications to minimize a design's optical distortion, without the cost of producing design samples. Now available in a Linux operating version for PC.



**AutoGlassInspector** (See separate story on page 6).

With the longevity built-in to all Glasstech systems, the diverse range of aftermarket services and products combined with an expert support staff that knows your Glasstech system, you can understand why we say there's no reason for any Glasstech system to be obsolete.

## Free AutoGlassInspector Software Download

Nearly all automotive manufacturers now require quantitative measurement of transmitted optical distortion. Glasstech's AutoGlassInspector is a cost-effective solution for quantifying transmitted optical distortion in automotive glass. It measures sidelites, backlites and windshields to all current automotive standards.

This Glasstech development has been certified by Volkswagen as evaluating glass to the TL-957 VW standard. The system also easily evaluates glass to standards set by BMW, Daimler and other automakers.

The AutoGlassInspector system consists of a Windows® based, computer-controlled, digital image acquisition system utilizing advanced computer programming to optically analyze automotive transmitted optics.

The system can be used as either an online inspection system or a laboratory-based system. The software also can be used on any desktop or laptop computer for offline evaluation of raw data obtained from the inspection equipment.

The AutoGlassInspector system is gaining industry recognition for its ease of use and powerful glass evaluation tools.

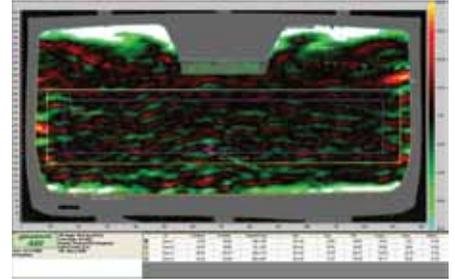
According to Brad Forstner of Guardian Industries: "We have been using the system for over 20 months and have been pleased with the performance. The AutoGlassInspector system allows us the flexibility to check windshields and backlites with little setup time. The interface is easy to navigate and provides a clear optical analysis of the glass."

Among system features are the following:

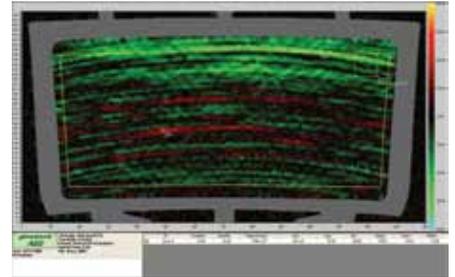
- Intuitive creation and modification of zones and regions
- User control of all common industrial standard filters
- Automatic alarming on user-defined limits
- Convenient full-featured display control
- Full statistical evaluation of zones and regions
- Masking of irrelevant data

Glasstech is offering a free, 30-day download of AutoGlassInspector software. The download will be located on the Company's Web site, [www.glasstech.com](http://www.glasstech.com).

Vertical Distortion in Windshield



Vertical Distortion in Backlite



To receive the free, 30-day trial of the AutoGlassInspector software, go to Glasstech's Web site and complete a short questionnaire and a Glasstech representative will contact you. To get started with the trial software, Glasstech will E-mail you a licensing key and sample data for you to use to evaluate the software.

If desired, you can send samples of your glass to Glasstech to evaluate. Glasstech will take an image of your sample and send the raw data to you so you can evaluate your specific part on the trial software.

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