

GASP® INSTRUMENTS – For Measuring Surface Stress in Tempered, Heat-Strengthened, and Annealed Glass

GASP Models

GASP PRO – NEW IN October 2020! Our newest GASP measures surface stress automatically *in real time*. It works with any mobile device via its own, secure wifi network. Measures, stores, and exports stress data automatically and easily. Measures in *real time* for quick checks.

Auto-GASP2 also measures semi-automatically via an embedded touchscreen. It includes a pyrometer for thermal equilibrium verification and the ability to produce customized reports.

LCD-GASP – fringe patterns visible via attached black-and-white LCD monitor for easier use.

Laser-GASP – tried and true. Our original GASP that still works perfectly without bells or whistles.

EACH GASP MODEL IS ALSO AVAILABLE IN THREE ADDITIONAL TYPES

GASP-HS – high-sensitivity GASP with 2x wedge for measuring annealed glass.

GASP-CS – for curved surfaces. Able to with a radius of curvature <200 mm.

GASP-CS-HS – both of the two above... combined.

Every GASP package includes:

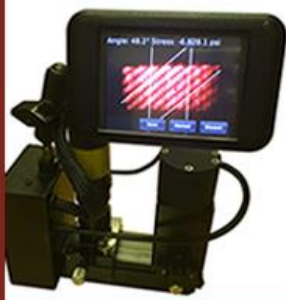
- **GASP-STAND™**
- **CAL-PLATE™** (calibration plate) for instrument verification
- Rechargeable batteries for battery-operated models (all except Laser-GASP)
- One Measuring Wedge:
 - Standard (1X) measuring wedge for heat-treated glass is standard.
 - GASP-HS types include high-sensitivity (2X) measuring wedge for annealed glass.
 - Extended range wedges (0.5X) for very highly tempered glass also available.
- GASP index matching fluid (4 oz)
- Portable UV light (tin side detector)
- Operator manual with calibration chart and certification documents
- Heavy-duty, instrument-quality carrying case with **Strainoptics** logo

GASP PRO

Wifi-Enabled



Auto-GASP2



LCD-GASP



Laser-GASP



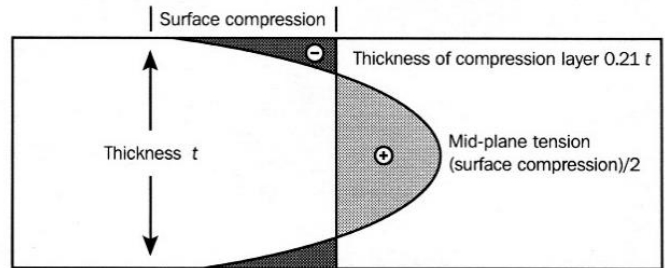
The **GASP** (Grazing Angle Surface Polarimeter) is the world renowned instrument used for obtaining quantitative, non-destructive measurements of residual surface stress on the “tin side” of flat, soda-lime float glass. Suitable for in-plant or field testing, it provides fabricators and end users with an accurate and simple method to:

- Measure surface compression levels in heat-treated architectural, structural, solar, and automotive glass to ensure required mechanical strength and fragmentation characteristics
- Reduce or eliminate the need for destructive testing for many types of glass products
- Improve process control and productivity through optimization of furnace parameters
- Assure proper annealing
- Comply with worldwide industry standards and test methods, including ASTM, GANA, and CE requirements*
- *Models for borosilicate float glass available on special order.*

Applications

Fully Tempered Glass (Surface Stress > 10,000 psi or 69 MPa).

The strength of tempered glass is created by a heating and quenching process which creates a surface layer of compressive stresses, offsetting any tension caused by wind pressure, thermal shock, impact or other applied forces. ASTM C1048, EN12150-1 and other specifications require a minimum level of surface compression for glass to be classified as "Fully Tempered". While higher surface compression assures glass strength, the tempering process also creates tensile stress in the glass mid-plane (see figure) which should also be controlled. If the tensile stress is too high, the glass may spontaneously rupture if it contains certain inclusions or defects. For this reason, an upper stress limit should be established to avoid potentially serious problems.



Heat-Strengthened Glass (Surface Stress between 3500 and 7500 psi / 24 and 52 MPa). Heat-strengthened glass is stronger than annealed glass, but does not break into small fragments like Fully Tempered or Safety glass. This characteristic is desirable when "fallout resistance" is required, such as for exterior glass in high story buildings. Surface stress in heat-strengthened glass must fall within narrow limits, specified by ASTM C1048, EN1863-1 and related standards. Fragmentation testing is not practical because the break pattern is very unpredictable, making the [GASP](#) surface polarimeter the most reliable way to test heat-strengthened glass for conformance to industry specifications.

Safety Glass. "Safety" glass is strong, and it breaks into small, relatively harmless fragments. The surface stress in safety glass is typically above the fully Fully Tempered range. Break pattern testing is destructive and imprecise, and can result in substantial production loss if the results are not satisfactory. As with fully tempered glass, spontaneous breakage is known to develop in safety glass, with even larger financial losses. To optimize furnace settings, ensure conformance to specifications and avoid under- or over-stressing, safety glass should be frequently tested with the [GASP](#).

Annealed and Low-Stress Glass. Non-destructive measurements of surface stress in annealed and low-stress glasses can be measured using a GASP instrument equipped with a high sensitivity wedge. In bent glass and in laminated automotive windscreens, the surface stresses are higher than in annealed glass and should be tightly controlled to remain within limits and detect areas of undesirable surface tension caused by bending.

Solar Glass. Manufacturers supplying the solar glass industry use the [GASP](#) surface polarimeter to ensure that both cover glasses and substrate glasses conform to their customer's specifications. Solar panel fabricators use it for incoming QC for the same reason. Non-uniform stresses in glass used for solar applications can cause a range of problems, ranging from degraded efficiency, poor impact resistance and mechanical strength, to lamination and assembly issues that can cause expensive field failures.

Note: the [GASP](#) instrument is not suitable for the following types of glass: chemically-strengthened, patterned (rolled), low transmittance (<25% LTA), low tin, or coated on the tin side. For these applications, Strainoptics may be able to offer an alternative means of stress measurement. Please inquire.

Specifications

GASP or GASP-CS for Tempered or Heat-Treated Glass (1X Standard Wedge)

Measuring Range: 0-180 MPa (0-25,000 psi)

Resolution (+/-):

Tempered Glass:	3.4 MPa (500 psi)
Heat-Strengthened:	1.7 MPa (250 psi)
Annealed Glass:	0.75 MPa (100 psi)

GASP or GASP-CS for Annealed Glass (2X High-Sensitivity Wedge)

Measuring Range: 0-84 MPa (0-12,000 psi)

Resolution (+/-):

Annealed Glass:	0.5 MPa (75 psi)
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GASP PRO™ and Auto-GASP2™

In the past three years, Strainoptics has released two different semi-automatic* GASPs

- The **NEW (Q4 2020!)** **GASP PRO (shown at right)** measures surface compression automatically in real time, without the push of a button. Easily capture measurement data and save it quickly to any computer. GASP Pro works anywhere with any mobile device via its own, secure wifi network. Phone mount allows users to attach mobile device directly or work remotely.
- The **Auto-GASP2** comes with a tethered touchscreen and a pyrometer for ensuring that your glass is at thermal equilibrium. The AG2 also allows users to generate custom reports for their specific application or for ASTM reporting. Export your measurement data via a simple SD card.
- All GASPs can be sold with a **vertical attachment** (shown at right) that holds the instrument in place against vertically oriented glass. Great for measuring in the field.

**GASPs are semi-automatic because the user still must attain an image manually. After an image is shown on the screen, GASP Pro or Auto-GASP2 is automatic.*

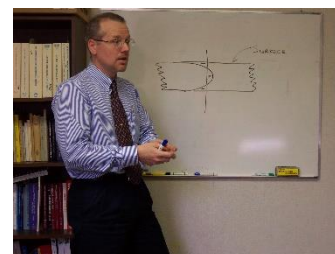


Calibration and Certification

Each GASP instrument is factory calibrated and comes with a certificate of traceable calibration according to ASTM Procedure C1377. Strainoptics offers annual or periodic recalibration services as required. A certified CAL-PLATE is supplied with each complete GASP system to enable customers to self-certify their instrument where possible. A CAL-PLATE and certificate of calibration are shown at left.

Testing and Training Services

Surface stress, edge stress, and other laboratory residual stress testing services are available from Strainoptics using equipment and test methods in accordance with ASTM and NIST standards. Strainoptics also provides training programs free to customers at our facility in North Wales, PA, or on a fee basis at a customer's location.



Other Strainoptics Products

In addition to the GASP, Strainoptics manufactures a complete range of manually operated and PC-based instrumentation for glass manufacturers and fabricators. These include on-line **stress scanners** for float glass production, visual and automatic **edge stress meters**, laboratory **polarimeters** and polarizing microscopes for analyzing stress distribution, **reflective polarimeters** for measuring stress in the "black band" of windshields, **roller wave gauges** for measuring reflective distortion in architectural tempered glass, and simple **strain viewers** (polariscopes) for visual inspection using photoelastic evaluation. Custom inquiries are always welcome - please visit our website or call.



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