



OSG Innovative Glazing Solutions for the Transportation Industry



Operating environments in the transportation industry demand innovative solutions. Windows need to withstand conditions involving long periods of intense heat and cold, and yet be strong enough to withstand falling and scraping debris from vegetation and heavier objects, while protecting operators from the dangers of the sun's radiation. Visual glare, fogging and internal reflections are additional hazards that can affect the well-being and productivity of equipment operators.

Windows that are designed for the task at hand, from windshields designed to international certification for high speed trains, to complex ballistic compositions for the Defense and Security industry, OSG has designed and implemented glass solutions for all sectors of the transportation industry, including:

- Agricultural machinery
- Buses
- Commercial trucks
- Construction & mining vehicles
- Cranes
- Firetrucks
- Forestry harvesting equipment
- Forklift vehicles
- Trains and locomotives
- Military and VIP protected vehicles

> OSG's Focus on Newer Technologies Results in Better Windows

Research, development and innovation keep OSG at the forefront in the glass fabrication industry. This investment results in specialty glass solutions that respond to the unique requirements for both the vehicles and the highly skilled professionals which operate them. OSG continuously investigates and tests new materials, techniques and technologies in order to create the most advanced solutions that today's customers demand.

Many of the industry's most groundbreaking innovations have occurred from OSG's investment in innovation, people, plant and advanced materials. OSG also collaborates with leading academic institutions around the world to enhance and improve its technological competencies for the global marketplace.

Together, these ongoing investments and relationships position OSG in the forefront of our industry.

Customer Commitment

OSG has become a market leader in fabricated glass solutions for the transportation industry through long-term, cooperative relationships with major international customers and an ongoing commitment to R&D funding.

This leadership position can only be maintained by making large investments in research, development and innovation, and working together with customers to solve complex operational problems where modern glass technologies can make a difference. OSG is committed to providing its customers with high quality advanced window compositions that meet and exceed the glass standards used by industry today.



World-Class Capabilities

OSG provides a wide range of glass products specific to the needs of both the Original Equipment Manufacturer (OEM) and Automotive Replacement Glass (ARG) markets. While producing industry standard laminated, insulated or tempered flat or curved glass products, OSG is able to design and fabricate a whole range of advanced and specialty window products, including:

- Lightweight Compositions
- Impact-Protection Glass
- Anti-Reflective / Non-Glare Glass
- Heated Glass Compositions
- Heat Protection Compositions
- Noise Reduction & Infrared Radiation Blocking Solutions
- Anti-Vandalism Protection / Anti-Riot Glass
- Smart Compositions
- Screenex - Smart Window With Integrated LCD Panel
- Bullet-Proof and Blast-Resistant Glass
- Emergency Egress Systems

> Lightweight Composition

Customers today are concerned with weight reduction technologies to improve operational costs. OSG has developed a laminated composition using a unique glass that **has a 30% weight savings** over existing glass compositions. After several years of testing and deployments, OSG's lightweight composition meets or exceeds industry standards while delivering additional benefits, including energy conserving optics that are more durable in harsh environments with less wear and tear on the equipment. Together, these benefits deliver a fast ROI for the customer.

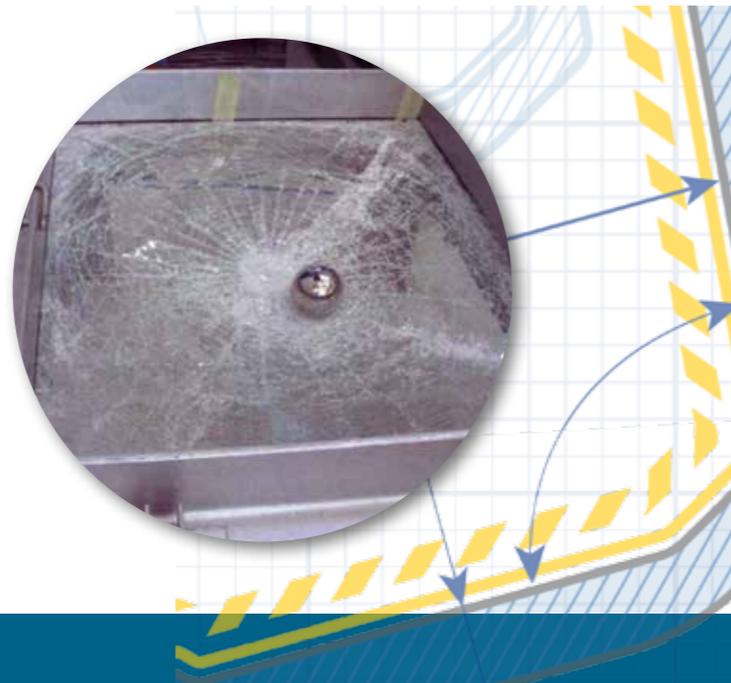
> Impact Protection Composition:

One of the world's largest manufacturers of heavy construction equipment approached OSG to develop a new glass solution to protect operators from falling rocks and debris, while enabling them to perform their work at maximum efficiency. This customer wanted to replace parts on their equipment that were manufactured from a variety of materials, including metal bars, plastic materials, and very thick glass compositions. The solution also needed to meet two specific impact standards and normal automotive standards. In response, OSG developed the following compositions:

Hi-Glass

- A safety laminated glass composition only 8.3mm thick.
- Developed to withstand the DIN EN356 category P5A norm. (370J: For example stopping a 7Kg metal ball from three meters)

This innovative OSG composition has since been implemented in the production of the company's equipment, replacing their former, very thick, heavy glass composition and associated materials.



IP-Glass

- A safety laminated glass composition only 12.6mm thick.
- Developed to withstand the FOPS LEVEL 1 standard at -18°C, and ISO 10262 and FN3449. (1,365J: For example stopping a 45Kg metal ball from 3.1 meters in -18°C).

Product testing was conducted on the operator's cab with OSG's glass at the DLG Lab in Germany. As a result, this new OSG

12.6mm composition has replaced the older 19-21mm thick compositions with protective metal bars. Aside from the reduction in thickness and weight of approximately 40%, the new composition passed international automotive standards in contrast to the poorer performing former compositions. It has since been adopted as the material most appropriate to serve as the sunroof for the customer's heavy equipment.

OSG Impact Protection Solution Advantages

- Maintains a clean, transparent design while protecting operators from the threat of different impacts.
- Saves weight by using thinner compositions than those in use today.
- Replaces more expensive and heavier metal parts which interfere with visual clarity.
- Longer Life Cycle (LLC) than plastics, once their clear appearance is lost.
- Less vulnerable to environmental influences than plastics.
- Extends the LLC in comparison to today's standard compositions.
- Along with meeting the impact protection requirements, the OSG compositions also meet the standard transportation regulations as opposed to the compositions it has since replaced.
- The OSG impact protection solutions may be fitted, serviced and replaced as standard windshield compositions.

> Anti-Reflective / Non-Glare Compositions:

Night-shift heavy equipment operators in highly lit open environments (i.e. road construction, overhead cranes, airports, demolition and other construction sites, etc.) often face the problem of seeing their own reflection in the windshield, thereby creating an extremely dangerous situation.

To counteract this problem, OSG developed a non-glare / anti-reflective solution for both flat and curved laminated and/or tempered, one-

sided and double-sided anti-reflective glass compositions.

OSG's non-glare compositions reduce the natural reflection (mirror effect) by 90%, from a standard 8% to 1%, while maintaining the required standards for transportation equipment.

The compositions are highly durable with high light transmittance and good resistance to chemicals and abrasions.

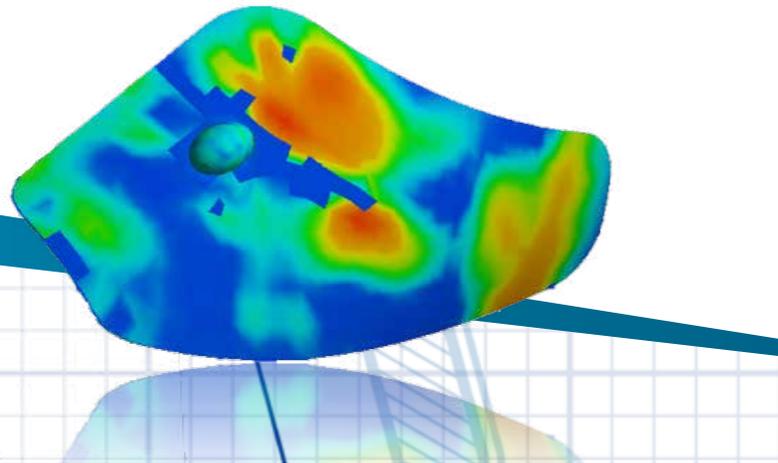
> Heated Compositions:

OSG can offer solutions to difficult and problematic defrosting and de-icing situations.

OSG offers a large variety of flat, curved, tempered, laminated, or heated compositions, among others, using silver paste, coated glass and PVB with micro-wires, to solve difficult

and problematic defrosting and de-icing situations.

OSG can also provide a tailor-made solution from the original design to the most effective system that meets a specific requirement.



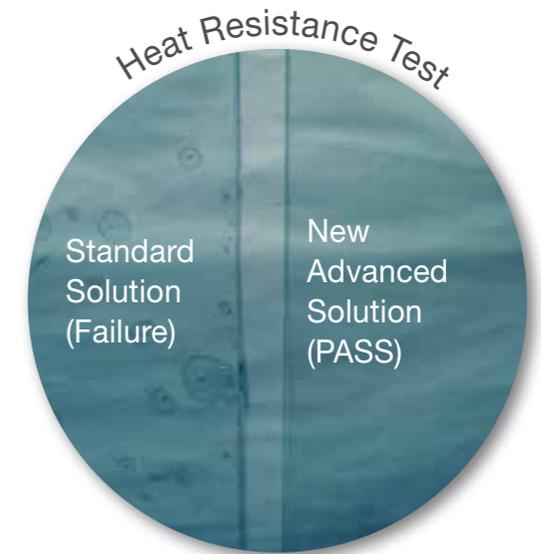
> Heat Protection Compositions:

For long heat exposures, standard safety laminated compositions can work in environmental conditions up to 75°C, and up to 90°C for a short peak period. What happens if there is a requirement to work in hotter environments for longer periods of time?

OSG, based on one equipment manufacturer's request, developed a special laminated composition, using special materials, that provides much better heat resistance and durability than standard compositions in use today.

Aside from durability, this OSG composition was also designed to protect the equipment operator in any extreme situation. This OSG heat

resistance composition has proven its success in the field and it is now being used in extreme heat conditions.



> Noise Reduction and Infrared Radiation Blocking Solutions:

Lowering the sound levels within the operator's cab can lead to higher operator comfort and performance. OSG has developed a laminated solution that will reduce annoying and harmful noise levels (measured in dB's) to a lower level than found in standard compositions. This composition has been successfully tested, both

in laboratories and in real-life situations, and is being supplied to OSG's customers worldwide. OSG has also developed glass compositions for use in hot, direct sunlight applications designed to protect operators from IR radiation by effectively blocking its harmful effects, while maintaining high light transmittance.

> Smart Compositions

Today's work environment presents many technical challenges. OSG smart glazing solutions provides a range of platforms with different options / solutions for a variety of operational environment to help ensure compliance with the health, safety and comfort of your equipment operators.

OSG offers a combination of different solutions

that meets customers' varying requirements in one fabricated glass composition. For example, a lightweight composition combined with acoustic and IR reduction solutions or impact resistance, heated with an anti-reflective or heat resistance solution, can be produced. OSG can design, test and deliver a solution to meet the most exacting requirements.

ScreeneX® - Window of Opportunities:

ScreeneX® is a ground-breaking technology that offers the ability to communicate directly with operators through a type of window with an embedded LCD panel. This innovation allows the control and tailoring of data and information displayed to equipment operators.

ScreeneX® was designed to use only a portion of an existing window or

glass area, while maintaining the functionality of the window.

The ScreeneX® System Solution includes hardware, software and content management.

For the first time, glass becomes more than just glass. It becomes a part of a world of digital information available to equipment operators.

ScreeneX® - Major Benefits

- Transforms the vehicle's internal cab display media into a more modern and ergonomically-pleasing information display system which enhances the operator's experience.
- Central content management system allows location-based specific programming and provides operators with real-time information.
- Increases the life cycle in comparison to independently mounted displays.
- The entire system is highly resilient to vibration and varying temperatures, as well as to rough and harsh environments.
- The LCD screen is embedded inside the glass window and remains out of reach. The glass



SUBWAYS

BUSES

TRAINS

TRAMS

- component can also be fabricated using anti-glare and scratch-resistant technologies.
- No need to compromise on the location of your in-cabin screen panels.
- Using the existing windshield, ScreeneX® allows you to locate
- the screen closest to the operator, increasing its exposure and efficiency.
- Suitable for installation in new / existing platforms.

- Saves internal cabin space.
- Allows the substitution of several outdated mounted screens by more efficient use of existing areas of glass.
- Installation and maintenance of the system is as simple as installing a regular window.
- Compatible with all major operating systems (Windows, Android, Linux and others) and media player software.

> Emergency Egress Systems

OSG has designed a number of emergency window exits and opening mechanisms to provide for the safe evacuation of operators via a window or overhead sky-lite emergency exit.



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