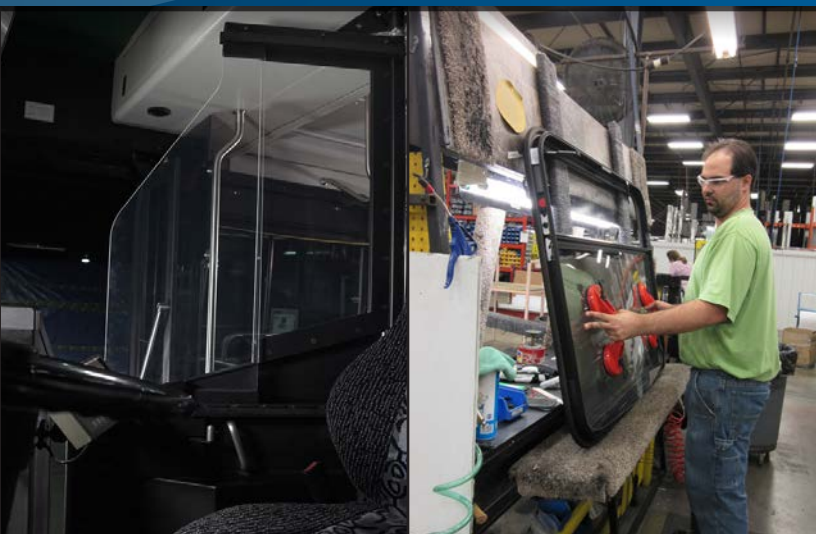


Mass Transit **PRODUCT CATALOG**



WHO WE ARE

AROW Global Corp. has been operating in Canada and the United States since 1965, specializing in the design and production of glazing systems for major North American bus and recreational vehicle manufacturers since 1980.

Our mission is to develop innovative product and service solutions for our customers that leverage our core competencies into exceptional value for our stakeholders, and we continuously strive to improve in a safe and healthy environment.



WHEN YOU CALL ON AROW YOU CAN ALWAYS COUNT ON

Availability

Someone is always there to answer the phone or reply to an email, and we encourage direct contact with our technical team.

On-time delivery

Coast-to-coast.

Superior product quality

All of our products surpass ANSI, SAE, and FMVSS testing and are designed to meet your needs.

Comprehensive product support

Before and after the sale.

At AROW Global, we focus on delivering exceptional customer service from the moment we first meet you. Our team takes the time to listen to your every need to develop a solution that is suited to your specific application. We believe in partnering with our customers through solution development to assure a strong relationship throughout all functional areas.



The selection of passenger windows in a vehicle is a critical decision point that can have a significant impact on vehicle aesthetics, passenger comfort, ridership, operating costs, and safety. When making a selection, several factors should be considered, including:

Window Functionality

Material Type

Impact Resistance

Cost

Color & Light Transmittance

CHOOSING THE RIGHT WINDOW

Material Type

Material type refers to the glazing material used in windows. AROW Global's standard offering includes four different materials: laminated safety glass, tempered safety glass, acrylic, and polycarbonate.

Laminated safety glass includes two thin pieces of annealed glass with a plastic PVB interlayer bonding them together. The interlayer holds the glass together upon fracture. Laminated glass has fairly low impact and scratch resistance compared to other glass alternatives, and is only used in fully framed window applications.

Colors and %LT

- Gray: 11%, 30%, 44%, 60% (6mm)
- Green: 73% (6mm)
- Azure (Blue/Green): 76% (6mm)

Tempered safety glass can bend slightly further than annealed glass before breaking, and has a much higher strength (4-5 times greater). In addition, upon fracture, fully tempered glass "shatters" into small, granular pieces which are less prone to causing lacerations when handled.

Colors and %LT

- Gray: 9% and 44% (6mm), 14% and 50% (5mm)
- Green: 77% (6mm) and 80% (5mm)
- Azure (Blue/Green): 68% (6mm) and 72% (5mm)

Acrylic has an impact resistance 5-8 times greater than annealed glass and a weight which is approximately 50% less than glass options. Acrylic has a low scratch resistance and is therefore typically specified with an additional scratch protection in the form of an interior/exterior hard coating.

Polycarbonate has an impact resistance 60-70 times greater than annealed glass and a weight which is approximately 50% less than glass options. Polycarbonate has a very low scratch resistance and is therefore typically specified with an additional scratch protection in the form of an interior/exterior hard coating.

Impact Resistance

Material impact resistance is measured by the ability of the material to withstand impacts from various forces and is typically governed by ANSI/SAE Z26.1 standards. Generally speaking, impact resistance increases as the material thickness increases. Non-glass options (acrylic and polycarbonate) offer the highest impact resistance followed by tempered glass and laminated glass.

Cost (typical)

Costs for glazing depend on many factors, and the more “features” desired (high performance solar properties, exotic colors, atypical thickness, non-standard shapes or edge treatments), the higher the cost.

If cost control is the primary consideration, the following configuration provides the most economical window:

- **Glass:** 44% Gray tempered or laminated glass
- **Style/Configuration:** Full fixed, non-opening windows (or tip-in style if an “openable” window is desired)
- **Frame:** Black anodized (although painted frames may offer cost advantages, anodized is a more durable alternative and is AROW’s standard offering)
- **Locks:** Tip-in windows come standard with set-screw locking
- **Egress:** Minimize the number of egress windows while remaining in compliance with FMVSS standards
- **Graffiti protection:** If graffiti protection is desired, select from single-layer 0.006” polyester film (lowest installed cost), sacrificial acrylic liners (mid-range cost, easiest serviceability), or multi-layer film (highest installed cost)

Color / %Light Transmittance

Common colors include un-tinted (ie. clear), various shades of gray, green, and azure (bluish-green); colors for laminated glass can be customized in accordance with PVB offerings, however costs increase substantially for atypical color selections.

Color	Acrylic	Polycarbonate	Tempered Glass	Laminated Glass
Clear	Common	Common	Common	Common
Gray	Common	Common	Common	Common
Green	Special Order	Special Order	Common	Common
Azure (Blue/Green)	Special Order	Special Order	Common	Common

Light transmittance or luminous transmittance is defined as the percentage of visible light permitted to pass through the glazing and often referred to as %LT. As %LT increases, more light passes through the glass, thus leading to a less encumbered view through the glass. The %LT tops out at approximately 89% for (nominally) clear glass and may commonly be as low as 9% for certain tints of 6mm tempered glass. The ability of the human eye to detect small (5% or less) %LT differences is unique to each individual and variance in float glass (the raw material) is typically in the +/- 4% range.

%Light Transmittance

Gray 60% LT

Gray 50% LT

Gray 44% LT

Gray 30% LT

Gray 14% LT

Gray 11% LT

Gray 9% LT

Green 80% LT

Green 77% LT

Green 73% LT

Azure 76% LT

Azure 72% LT

Azure 68% LT

SAFETY GLAZING STANDARDS

When selecting a window it is important to make sure the window meets safety standards, such as the Federal Motor Vehicle Safety Standards (FMVSS). The tables below breakdown the seven basic standards which affect transit bus vehicles.

All glazing must be labeled according to the requirements imposed by the U.S. Department of Transportation (DOT). The DOT label identifies the glazing manufacturer and the standard to which the glazing was manufactured. A manufacturer or distributor who cuts a section of glazing material to which this standard applies, for use in a motor vehicle, must:

- a) Mark that material is accordance with Section 7 of ANSI/SAE Z26.1 - 1996; &
- b) Certify that its product complies with this standard in accordance with 49 U. S. C. 30115.

Glazing materials covered under this standard include (but are not limited to) laminated glass, tempered glass, and safety glazing plastics (including sacrificial protection shields). This standard also covers new as well as replacement glazing and sacrificial protection shields.

Table 1: Acceptable Applications of DOT Glazing Standards

ACCEPTABLE APPLICATION	GLAZING STANDARD						
	AS-1	AS-2	AS-3	AS-4	AS-5	AS-14	AS-15B
May be used anywhere in the vehicle	•						
May be used anywhere in the vehicle, except windshields		•					
May be used anywhere in the vehicle, except windshields and certain specified locations (those required for operator driving visibility)			•				
May be used anywhere in the vehicle, except windshields and certain specified locations (those required for operator driving visibility)				•	•		
May be used anywhere in the motor vehicle						•	
May be used anywhere in the motor vehicle except windshields							•

Table 2: Glazing Type

GLAZING TYPE	GLAZING STANDARD						
	AS-1	AS-2	AS-3	AS-4	AS-5	AS-14	AS-15B
Laminated Glass	•						
Laminated or Tempered Glass		•	•				
Rigid Plastics				•	•		
Glass-Plastics (interior film lamination)						•	
Tempered Glass-Plastics (interior film lamination)							•

Table 3: Permissible Light Transmittance

% PERMISSIBLE LIGHT TRANSMITTANCE	GLAZING STANDARD						
	AS-1	AS-2	AS-3	AS-4	AS-5	AS-14	AS-15B
Greater than or equal to 70%	•	•		•		•	•
No restriction			•		•		

NOTE: Data extracted from ANSI/SAE Standard Z26.1-1997.



WATER TESTING

At AROW Global, we ensure that every product produced is capable of withstanding our rigorous water test program. Each design is thoroughly tested using our state-of-the-art in-house testing facility to ensure the product meets our high performance standards. Statistical test sampling ensures adherence to design performance.

- Energy efficient single pump design uses four fully coned spray nozzles. Spray nozzles are optimized to simulate water on both the side and roof of the bus.
- Water test can be completed in as little as 15 minutes increasing our overall testing capacity.
- Design of water test simulates actual bus structure and roof design.
- Upper cascade rail simulates rainfall runoff from bus roof down to the side of the bus and windows.
- Standard test parameters exceed normal OEM specifications and can be adjusted for more rigorous requirements.



EGRESS / PUSH-OUT TESTING

AROW Global tests our windows in accordance with Federal Motor Vehicle Safety Standard (FMVSS) 217. This standard establishes requirements for the retention of windows in buses, and criteria for operating forces, opening dimensions, and markings for bus emergency exits. The purpose of this standard is to minimize the likelihood of occupants being thrown from the bus and to provide a means of readily accessible emergency egress.

The testing occurs in a certified laboratory and requires that an increasing force be applied to the center of, and perpendicular to, the inside surface of the window glazing (glass, acrylic or polycarbonate). The test is terminated when one of the following occurs:

- A force of 1200 lbs is reached (**pass**)
- The glass shatters, or cracks have formed in at least 80 percent of the window glazing (**pass**)
- The window glazing deflects beyond a calculated limit, depending on the size of the window glazing (**pass**)
- An opening develops, that permits the passage of a 4-inch diameter sphere (**fail**)

FRAMED WINDOW SERIES



Tip-in over Fixed



Fixed over Fixed



Full Fixed



Fixed over Slider



Slider over Fixed



Dual Slider

AROW's Evolution Framed Window Series feature a combination of the economies of traditional transom-hinged egress window designs with the premium performance and features associated with our legacy window series. Available in rapid-replacement glazing configuration and with or without hidden clamp-ring fasteners, the Evolution Series can be equipped with all available graffiti protection options offered including our G3 sacrificial protection shields that may be replaced in less than one minute. Available in all common glazing and window configurations, a superior and updated low profile appearance adds an exceptional aesthetic appeal to this series of windows.

Product Features

- Full contingent of window configurations available
- Black or clear Class 1 anodized frame finishes are standard with no unfinished surfaces
- Glazing available in tempered or laminated glass, acrylic and polycarbonate
- Interior graffiti protection options available for additional vandal resistance
- Premium fasteners and hardware
- Superior weather tight design and UV stable sealing materials for long term durability without shrinkage
- All configurations available in egress or non-egress style
- Built and tested in accordance with FMVSS 217 guidelines with materials that conform to the applicable requirements of ANSI Z26.1 and the recommended practices defined in SAE J673

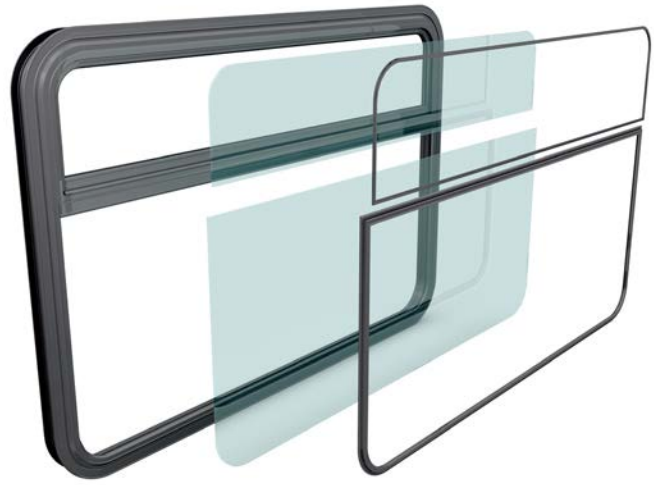
Product Assembly Options

QUICK CHANGE / RAPID REPLACEMENT GLAZING

Our G3 Rapid Replacement glazing system has been designed to allow removal and replacement of primary window glazing in under three minutes.

An optional 1/8" interior acrylic glazing shield may be added for vandal protection and can be replaced in under one minute without disturbing the primary glazing.

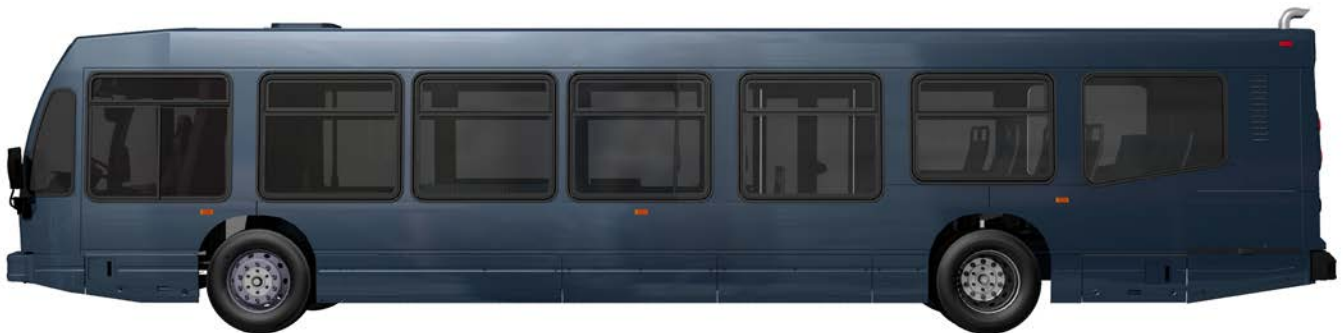
- Glazing retention is facilitated by a single proprietary welded spline.
- Spline is designed to withstand multiple installations.
- Optional sacrificial shield can be removed / replaced without removing any of the surrounding components.



Quick Change / Rapid Replacement Glazing – Single welded spline

GRAFFITI PROTECTION OPTIONS

- Single-layer 0.006" Vandalshield (VS-12 or equivalent)
- Multi-layer Vandalshield (3M Scotchgard 1004 or equivalent)
- 1/8" sacrificial acrylic liners



FLUSH WINDOW SERIES



Tip-in over Fixed



Fixed over Fixed



Full Fixed



Fixed over Slider



Dual Slider



Full Slider

Our signature Storm-Tite brand Flush Window Series was designed to address the needs of the more style-conscious fleet operators that place a high value on “road appeal”. The flush window’s streamlined appearance creates an aerodynamic and visually appealing effect that is truly impressive on the road.

With an exterior comprised entirely of glass, the windows do not include the use of painted metal panels that are susceptible to fading from environmental exposure.

The Storm-Tite Window series utilizes the same superior water management system that is typical for AROW Global products and combines a simple, high performance design with attractive interior and exterior aesthetics.

Product Features

- Fixed, full-height-slider, and tip-in combination configurations available
- All configurations available in egress or non-egress style
- Glazing available in tempered or laminated construction
- Interior graffiti protection options available for additional vandal resistance
- Superior weather tight design
- Premium fasteners and hardware
- Exceptional functional performance
- Built and tested in accordance with FMVSS 217 guidelines with materials that conform to the applicable requirements of ANSI Z26.1 and the recommended practices defined in SAE J673

Serviceable Glazing

Serviceable glazing now comes standard on all Storm-Tite orders. Through the use of a hinging mechanism you can now replace the entire glazing assembly in less than four minutes.

- Replacement of glazing assembly requires removal of a few fasteners and manipulation of upper hinge joint.
- Optional sacrificial shield can be removed / replaced without removing any of the surrounding components.



GRAFFITI PROTECTION OPTIONS

- Single-layer 0.006" Vandalshield (VS-12 or equivalent)
- Multi-layer Vandalshield (3M Scotchgard 1004 or equivalent)
- 1/8" sacrificial acrylic liners



DRIVER SIDE WINDOWS

Both our **Evolution Framed Window Series** and **Storm-Tite Flush Window Series** offer options to suit any budget and style need.

Window Designs



FULL SLIDERS

Window can be opened via a front sliding sash or front and rear sliding sash.



FIXED OVER SLIDERS

Window has a fixed upper portion and a lower sliding section which can be opened via a front sliding sash or a front and rear sliding sash. This design is recommended for taller window openings that do not permit a full slider design.



HI-VIZ SLIDERS

Designed to maximize driver viewing, Hi-Viz full height slider windows use fewer frame components and can be equipped with a front sliding sash only.



All windows, except for the Evolution Framed Hi-Viz Slider, are available in egress or non-egress configurations

Shade Bands

All driver windows can be equipped with shade bands either in a dot matrix form or a tinted band.



Glazing

Glazing required for driving visibility must conform to ANSI Z26.1 AS2 which necessitates that the glazing must have a minimum of 70%VLT (% Visible Light Transmittance).

Common glazing specifications include:

Type	Color	Thickness	%VLT ¹	%TSET ¹	%UV ¹	Notes
Laminated Glass	Green	6mm	72%	68%	<1%	Laminated glass is not recommended for Flush Glass/Frameless style windows due to the fragile nature of the exposed edges.
	Blue/Green	6mm	75%	31%	<1%	
	Green SMG ²	6mm	74%	40%	0%	
Tempered Glass	Green	6mm	75%	47%	31%	Tempered glass possesses more strength and impact resistance, but does not have the premium UV rejecting properties associated with non-tempered, laminated glass.
	Green	5mm	79%	51%	35%	
	Blue/Green	5mm	72%	36%	46%	

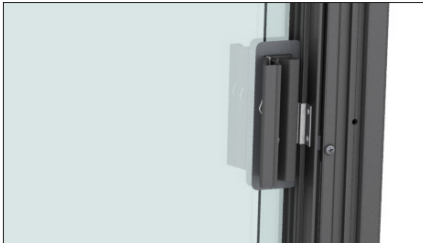
¹Data is approximate and subject to change due to float glass manufacturing and window fabrication tolerances

VLT=Visible Light Transmittance, TSET=Total Solar Energy Transmittance, UV=Ultraviolet Light Transmittance

²SMG is a trademark of Guardian Glass

Handle Options

All of the handle options outlined below are available on all of AROW Global's driver windows.



PULL HANDLE: The size and shape of the pull handle makes it easy to hold onto while opening and closing the window.

- Material - Extruded aluminum and anodized to a black or clear finish.
- Location - Front and/or rear sliding sash.
- Other Features - Exterior handles may be specified to permit dash access from outside the vehicle. Handles may be specified with an optional pinch latch on both Evolution and Storm-Tite windows.



ROCKER LATCH: The rocker latch provides the greatest visibility and control to the driver. The rocker latch allows the driver to effortlessly open and secure the window in various positions; the strikes can be set to open at various increments of 2.75".

- Material - Machined aluminum and black powder coat paint.
- Location - Front and/or rear sliding sash.



PULL KNOB*: The smaller size of the pull knob provides greater visibility to the driver.

- Material - Machined aluminum and black powder coat paint.
- Location - Front and/or rear sliding sash.

*Available with tempered glass only.



DRIVER PROTECTION SYSTEMS

STANDARD FEATURES

Design

- Bottom edge of glass is completely protected
- Swinging the door past the standee line is limited with a heavy duty impact and tear resistant strap
- Door weighs approximately 75 lbs.
- Approximately 5 in. of protrusion into the aisle way above the ADA area
- Door swings as complete unit
- Lower panel is constructed of welded aluminum sheet metal panels
- Available on low floor and coach buses



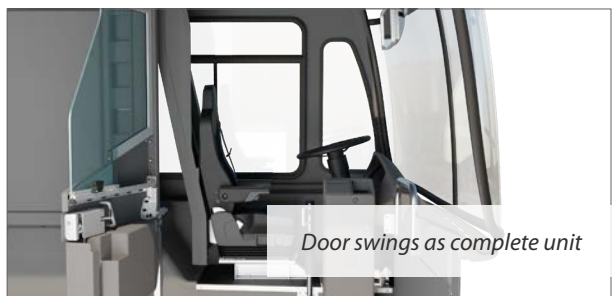
Driver Accommodations

- Approximately 37 in. of elbow room (street side wall to DPS glass)
- Unobstructed view of curbside mirror for the 95th percentile of drivers (per SAE J941)
- Clear view of the bottom of the entrance door
- Minimal protrusion into the passenger aisle
- Latch stanchion takes up minimal space in the driver entrance/exit area



Hinge Assembly

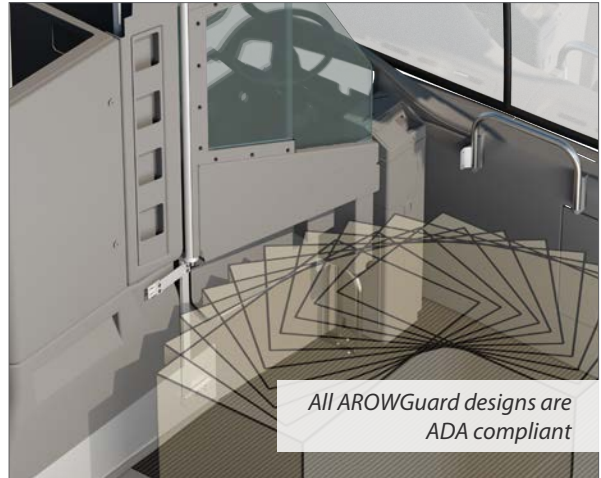
- Matte black finish
- 1 - 3/4 in. diameter pivoting tubular hinge
- Design is free of pinch points
- Uses UHMW bearings to prevent rattling and reduce maintenance requirements
- Mounts directly to bus chassis



ADA Compliance

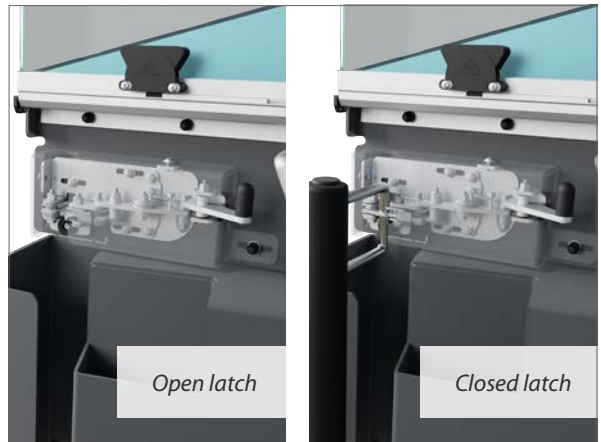
(Box Test)

- Exceeds requirements for passing a 30 in. x 30 in. x 48 in. long box through entry door and aisle way
- Box path is evaluated in CAD for each product configuration



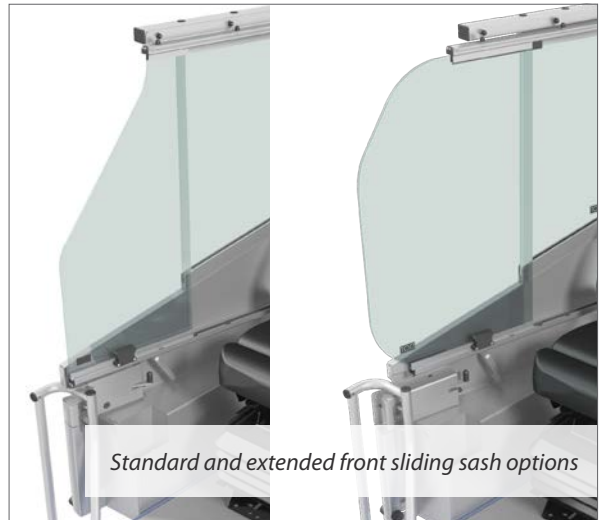
Latching Mechanism

- Heavy duty/low maintenance automotive grade rotary slam latch
- Snag free latch stanchion and striker mount directly to bus chassis
- Self adjusting, low maintenance, vibration dampening mechanism
- Easily serviceable components
- Easy to actuate latch release knob



Additional Features

- Tempered, laminated, anti-glare and anti-spall glass options
- Proprietary Rapid Replacement glazing system permits glass replacement in three minutes or less
- Tubular structural mounting system complements existing stanchion infrastructure and vehicle interior
- Robust welded aluminum lower panel provides lightweight yet durable and long-lasting protection
- Components can be custom painted or polished to complement vehicle interior



AROWGUARD MODELS

SLIDE STOW

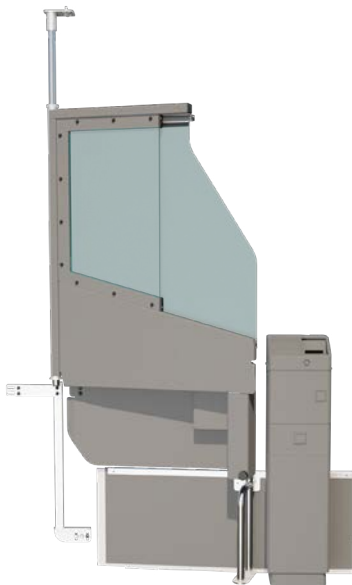
- Allows drivers to select a glass position in the same manner as a driver's window
- Easy to close and protect the driver in the event of an emergency
- Utilizes the time-tested and robust AROW Global rocker latch
- Low-friction track controls slide force and provides long-lasting, reliable operation
- Incorporates new hinge design free of pinch points and rattles
- Front sliding sash available in a standard and extended size

Glazing System

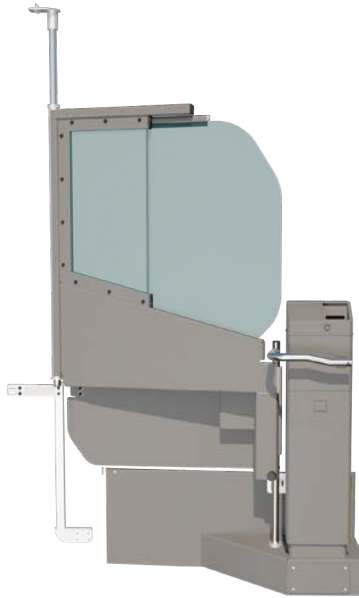
- Rear glazing is clamped into aluminum extrusion frame
- Front glazing slides in aluminum extrusion/PVC t-slot track to prevent rocking/rattling
- Front glazing indexes in place with rocker latch operation similar to a driver window
- Standard glazing material: 8mm laminated tempered glass with pyrolytic anti-glare coating

Various Glass Configurations

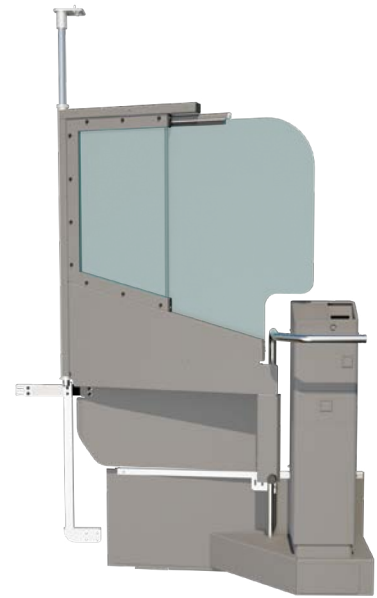
- Standard Glass
- D Shape Extended Glass
- P Shape Extended Glass



Standard Glass



D Shape Extended Glass



P Shape Extended Glass



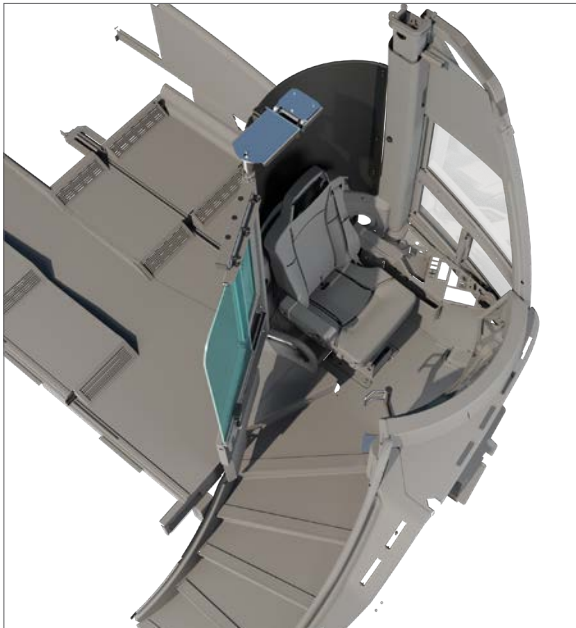
Low Floor Installation

MODEL: SLIDE STOW



Coach Bus Installation

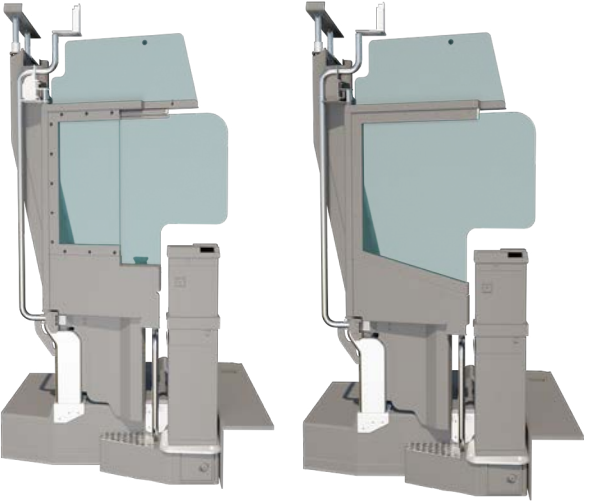
MODEL: SLIDE STOW



AROWGUARD MAX

Designed to provide the driver with maximum protection, the AROWGuard Max features a glass system that extends as far forward to the windshield as possible. The sliding confirmation of this door gives the driver total control by allowing them to slide the larger glass into various position to achieve maximum protection. The new design also has a polycarbonate panel at the top of the door that provides even more protection and minimizes airborne pathogens from passing through to the driver by extending as close to the ceiling as possible.

Available as a standalone product or as an upgrade to select legacy product installations.



Available in slider or fixed glass configuration

FULL FIXED

- Designed to extend as far forward as possible without obstructing access to the fare box and payment media
- Contoured design increases elbow room in an otherwise narrow driver's compartment
- Provided with contoured glass allowing an unobstructed view of specified items, including the curbside and rearward facing mirror
- During bus operation the door must be latched closed, with the glazing in place (mandatory use)

Various Glass Configurations

- Standard Glass
- D Shape Extended Glass
- P Shape Extended Glass





AROW GLOBAL CORPORATE

924 North Park View Circle

Mosinee, Wisconsin USA 54455

Ph: 715.693.6020

Fax: 715.693.7108

askarowglobal@arowglobal.com

AROW GLOBAL LIMITED

404 Egesz St.

Winnipeg, Manitoba Canada R2R 2H1

Ph: 204.272.5056