



Oldcastle BuildingEnvelope®

No additional info is available for the GLI-1, GLI-3, and GLI-4 glass.

NGG Ltd Inc.
1850 Craigshire Rd. Ste 202
St. Louis, MO 63146

February 13th, 2017

Dear Dan:

Regarding the request for additional information for the Webster job. I have sent you everything I have for the monolithic glass types.

If I can be of any other assistance, please let me know.

Sincerely,

Mary Ellen Buford
Architectural Glass Sales Representative



Date: January 18, 2017
 Customer: NGG LTD
 Project: Webster
 Location:
 Glass Type:

MONOLITHIC GLASS PERFORMANCE DATA

	<u>ID #</u>		<u>Notes</u>
Lite:	5075	5/8" Clear	a

Nominal Thickness: 0.625 Inches	f
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<u>Performance Properties</u>	<u>COG Results*</u>	<u>Units</u>
Transmittance		
Visible Light	84	%
Solar Energy	59	%
Ultraviolet	49	%
Reflectance		
Visible Light (Exterior)	8	%
Visible Light (Interior)	8	%
Solar Energy (Exterior)	6	%
Thermal		
Winter Nighttime:		
U-factor/U-Value	0.97	Btu/hr-ft ² - °F
Summer Daytime:		
U-factor/U-Value	0.88	Btu/hr-ft ² - °F
Shading Coefficient (SC)	0.80	-
Solar Heat Gain Coefficient (SHGC)	0.70	-
Relative Heat Gain	173	Btu/hr-ft ²
Light to Solar Gain	1.20	-

***Vertically Glazed Center Of Glass (COG) Results Calculated Using LBNL Window 7.4 Software.**

- Notes:** a) NFRC certified spectral data file
 b) Data generated by Oldcastle BuildingEnvelope®
 c) Average solar data
 d) Simulated with LBNL Optics 6.0
 e) Vendor supplied spectral data file
 f) Please reference ASTM C1036 and C1172 for allowable glass thickness variations

Date: January 18, 2017
 Customer: ABC Glass & Glazing Co.
 Project: XYZ Building
 Location: Anywhere, USA
 Glass Types: GL-1, GL-1A, GL-2, GL-3, GL3A, GL-4



Performance Data Comparison*

	ID#	Product Description	Notes	Thick ness (in.) ^f	Transmittance (%)			Reflectance %			U-factor (U-value)		SC	SHGC	LSG
					Visible	Solar	UV	Visible (out)	Visible (in)	Solar (out)	Win.	Sum.			
Outboard:	5075	5/8" Clear	a	0.625	84	59	49	8	8	6	0.97	0.88	0.80	0.70	1.20
Air Space:	1	5/16" Spacer, Air-Filled													

*Vertically Glazed Center Of Glass (COG) Results Calculated Using LBNL Window 7.4 Software.

- Notes: a) NFRC certified spectral data file
 b) Data generated by Oldcastle BuildingEnvelope®
 c) Average solar data
 d) Simulated with LBNL Optics 6.0
 e) Vendor supplied spectral data file
 f) Please reference ASTM C1036 and C1172 for allowable glass thickness variations

ARCHITECTURAL GUIDE SPECIFICATIONS SECTION 08 81 00 GLASS GLAZING

Note to Specifiers:

The specifications below are offered as desirable inclusions in glass and glazing specifications (section 08 81 00), but are not intended to be complete. An appropriate and qualified Architect or Engineer must verify suitability of a particular product for use in a particular application as well as review final specifications.

PRODUCTS

Approved Glass Fabricator Oldcastle BuildingEnvelope®

Glass Description FLOAT GLASS

1. **USA** - Annealed float glass shall comply with ASTM C1036, Type 1, Class 1 (clear), Class 2 (tinted), Quality Q3. **Canada** - Annealed float glass shall comply with CAN/CGSB-12.3-M, Quality Glazing.
2. **USA** - Heat-strengthened float glass shall comply with ASTM C1048, Type 1, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind HS. **Canada** - Heat-strengthened float glass shall comply with CAN/CGSB-12.9-M, Type 2 - Heat Strengthened Glass, Class A - Float Glass.
3. **USA** - Tempered float glass shall comply with ASTM C1048, Type 1, Class 1 (clear), Class 2 (tinted) Quality Q3, Kind FT. **Canada** - Tempered float glass shall comply with CAN/CGSB-12.1-M, Type 2 - Tempered Glass, Class B - Float Glass.
4. **USA** - Laminated glass to comply with ASTM C1172. **Canada** - Laminated glass to comply with CAN/CGSB-12.1-M, Type 1 - Laminated Glass, Class B - Float Glass.
5. Glass shall be annealed, heat-strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.

Monolithic Vision Glass **GENERAL**

1. Glass heat-treated by the horizontal (roller hearth) process shall have the inherent roller wave distortion running parallel to the bottom edge of the glass as installed when specified.

Laminated Glass **GENERAL**

1. Laminated glass products to be fabricated in autoclave with heat and pressure.
2. Interlayer material: Polyvinyl Butyral sheets.

Sealed Insulating Glass (IG) **GENERAL**

Vision Units

1. IG units consist of glass lites separated by a dehydrated airspace that is hermetically dual sealed with a primary seal of polyisobutylene (PIB), or thermo plastic spacer (TPS) and a secondary seal of silicone or an organic sealant depending on the application.
- 2.-**USA** - Insulating glass units are certified through the Insulating Glass Certification Council (IGCC) to ASTM E2190. **Canada** - Insulating glass units are certified through the Insulating Glass Manufacturers Alliance (IGMA) to either the IGMAC certification program to CAN/CGSB-12.8, or though the IGMA program to ASTM E2190.



Oldcastle BuildingEnvelope®

TEMPERED GLASS LIMITED WARRANTY

Customer: _____

Plant Location: _____

Address: _____

Project Name: _____

Project Location: _____

Invoice Date(s): _____

Invoice Number(s): _____

The Tempered Glass product (the 'Product') sold by the company named above (the 'Company') under the invoice referenced above is warranted to meet (1) in the United States, the quality and strength requirements of ASTM C 1048 and the safety requirements of CPSC 16 CFR 1201 (categories I and II), and (2) in Canada, the quality and strength requirements and the safety criteria of CAN/CGSB-12.1-M.

The express limited warranty stated herein is exclusive and is in lieu of and replaces any and all other warranties, representations or conditions of any kind, whether written, oral or implied (including, without limitation, any implied warranties, representations or conditions of merchantability or fitness for a particular purpose, statutory or otherwise), and supersedes any oral or written warranties, representations or conditions made, asserted or implied by any distributor, agent, representative or employee or contained in any manual, brochure, literature, advertising or other materials. No distributor, agent representative or employee has the authority to change, alter, amend or otherwise modify this limited warranty.

SEE OTHER LIMITATIONS, EXCLUSIONS AND EXCEPTIONS ON REVERSE.

LIMITATIONS, EXCLUSIONS AND EXCEPTIONS/TEMPERED GLASS LIMITED WARRANTY

All claims pursuant to this Limited Warranty must be presented in writing by the Purchaser of the Product (the "Purchaser") to the plant referenced on the reverse (the "Plant") within thirty (30) days of the Purchaser learning the facts upon which the claim is based. No warranty claim may be made after the passage of the applicable warranty period. Any legal action in respect of any claim under this Limited Warranty shall accrue on the date the Purchaser discovers or should have discovered with reasonable diligence the facts forming the basis for such claim. Notice of any claim under this Limited Warranty shall not be considered given unless it includes a copy of the Invoice referenced on the reverse; the date and place of purchase of the Product; the name, address and telephone number of the installer of the Product; and the name, address and telephone number of the Purchaser. **No claim under this limited warranty shall be available without proof of purchase of the applicable product by the Purchaser making the claim. Limited warranty claims made prior to payment in full by Purchaser for the Product shall not be honored. Failure to make payment in full for the Product on or prior to the date payment is due therefore shall void this limited warranty.** Upon validation by the Company of any Limited Warranty claim, the Company, at its sole option, shall either (a) furnish the Purchaser with a replacement Product or, if the Product is no longer made, a substitute product which, in the sole discretion of the Company, is comparable to the original Product, F.O.B. the Plant, freight collect, or (b) refund the original purchase price which the Purchaser paid for the failed portion of the Product (less freight and other charges). **A comparable substitute product, whether fabricated by the Company or by a party chosen by the Company in its sole discretion, may have characteristics including, but not limited to, color, shading coefficient, U-value and/or surface appearance which vary from the original product but shall nonetheless satisfy the company's obligation to replace the Product.** If the Company elects to supply a replacement or substitute product, the Limited Warranty on the replacement or substitute product shall extend only for the balance of the original Limited Warranty period of the failed Product. In no event shall the Company be responsible for any costs attendant to replacing nonconforming or defective Products (including, but not limited to, labor costs), other than as specified in this paragraph. At the Company's request, all defective Product which is replaced or substituted for pursuant to this Limited Warranty shall be returned to the Company, at the Purchaser's expense, within thirty (30) days after such replacement or substitution.

The Product must not be modified or fabricated (e.g., ground, drilled, sand blasted or otherwise) as this can weaken the glass and/or impair its safety characteristics. Any modification or fabrication of the product voids this limited warranty.

The Company specifically disclaims responsibility for any damage to any product caused by, or which results from, improper installation, including any installation not performed in a good and workmanlike manner in accordance with industry standards and applicable shop drawings, ordinances and safety codes; provided that, in addition, such installation shall be performed at any higher standards as shall be set forth in any glazing or installation instructions provided by the Company; improper maintenance; storage in other than a good and workmanlike manner; abuse; damage or breakage caused by persons other than employees or agents of the Company while being handled, installed, shipped, glazed or used; damage or breakage caused by improper building design or construction; thermal breakage; building or foundation movement; use upon the product of any cleansing or treating agents; atmospheric pollutants or contaminants, or runoff; leachate from building components; use of the Product with incompatible glazing or other materials; or use of the Product for purposes not considered suitable therefore by the glass industry or, in its sole discretion, by the Company. No warranty is provided in respect of any damage to or failure caused by any of the foregoing. Any product shipped outside the United States and Canada is not warranted by Oldcastle BuildingEnvelope[®].

The remedies provided herein and in the Company's invoice for the Products constitute the Purchaser's sole and exclusive remedy under any claim or theory of liability in respect of the Company's manufacture, sale or provision of the Product or any warranty in connection therewith, including without limitation, claims based upon failure of, or defect in, the Product, whether a claim, however instituted, is based upon contract, indemnity, breach of warranty, tort (including negligence and/or strict liability) or otherwise. The company shall not be liable for consequential, indirect, incidental, punitive, exemplary or special damages, claims or costs of any nature including, without limitation, labor cost of any kind relating to the removal of failed products and/or reinstallation of replacement products therefore, or damages, claims or costs otherwise arising from or in connection with, alleged breach of any limited warranty or negligence on the part of the Company.

If Purchaser is sued by any third party for Product failure under warranty or any other theory, Purchaser shall provide the Company at its Plant at its address above with written notice thereof with a copy of any and all pleadings served upon Purchaser within ten (10) days of such service and provide the Company with an opportunity to inspect the allegedly defective Product. Failure to comply with the foregoing shall void this Limited Warranty.

Products not expressly warranted by the Company are sold "as is, with all faults" and product failures expressly excluded from this Limited Warranty (including for example, but not limited to, glass breakage) and are not covered by any other warranty, representation or condition, express or implied, statutory or otherwise. The Company offers no warranty, express, implied or otherwise for annealed glass, products containing a film opacifier, or any coated glass provided as part of its products. For the sole convenience of the Customer, the Company will facilitate resolution of warranty issues which may occur between the Customer and the coater. To the extent assignable, the Company assigns to the Purchaser any warranty on the Product provided by third parties, including any warranty by a third party glass coater. These assigned warranties will generally be limited and subject to exclusions and exceptions. The Purchaser is advised to apprise itself of such limitations, exclusions and exceptions, and the Company shall have no obligation to so apprise the Purchaser. (In general the limited warranty provided by glass coaters may be void if the coated glass is installed contrary to the Company's or the respective coater's instructions, damaged by improper handling or installation, or if damaged because of scratches or abrasions which may be caused by abrasive cleaners used on the coated surface.)

Any waiver by the Company of a deviation from any of the terms or conditions in this Limited Warranty shall only be for the specific deviation so waived and shall not be construed as a waiver of any other term or condition nor a continuing waiver of the term or condition so waived.

The Company reserves the absolute right to inspect, in the field or at the Plant, any Product that is alleged by the Purchaser to be defective. Failure to afford the Company the right to inspect allegedly defective Product promptly upon the Purchaser becoming aware of any defect therein voids this Limited Warranty.

The Purchaser is solely responsible for all determinations of the compatibility of any glazing or other materials (e.g., sealants, gaskets, tapes, setting blocks, metal or finishes) with the Product. The Purchaser is advised that annealed, heat strengthened or wired glass does not meet the requirements of CPSC 16 CFR 1201 for safety glazing and should not be glazed in hazardous locations, including those defined by applicable codes and law. Hazardous locations should be glazed with approved safety glass.

It is the express wish of the parties that this limited warranty and any related documents be drawn up and executed in English only. Il est la volonté expresse des parties que cette garantie limitée et tous les documents s'y rattachant soient rédigés et signés en Anglais seulement. This limited warranty and any related documents are in the English language and shall be interpreted in accordance with the meanings of the words and phrases used herein as understood in the state or province of seller's plant indicated on the face of this limited warranty. This limited warranty shall be governed by, and construed and interpreted in accordance with, the laws of the state or province in which the Plant is located, without regard to principles of conflicts of laws, any suit, action or proceeding arising out of or relating to this limited warranty shall be instituted in any court sitting in such province or, in the case of a state, in the county of the location of the Plant and any objection which may now or hereafter exist to the laying of the venue or to the jurisdiction of any such suit, action or proceeding in such province or county is waived. The bringing of any suit, action or proceeding by the purchaser which is not in compliance with the foregoing shall void this limited warranty.

This limited warranty; the credit application, if any, completed by Purchaser; the Company's glazing instructions, if any; and the invoice for the purchase of the Product constitute the complete and exclusive statement of the terms of the agreement between the Company and Purchaser with respect to the subject matter hereof and supersede any other writing, document or agreement. This limited warranty may not be modified, including pursuant to any order made by Purchaser or in any other document, unless such modification is made in writing and executed on behalf of seller by its president.

This limited warranty is extended to the Purchaser of the Product only and any claim hereunder must be made solely by the Purchaser. This limited warranty is not transferable without the prior written consent of the Company, which may be withheld entirely in its discretion, and any attempted assignment without such prior written consent shall void this limited warranty.



Oldcastle BuildingEnvelope®

January 20, 2017

NGG

Attn: Mr. Dan Ward
8274 Big Bend Blvd
Webster Groves, MO 63119

Dear Dan:

Reference: LEED® Documents per USGBC v3.0 Guidelines
Project: Webster University
Location: 8274 Big Bend Blvd, Webster Groves, MO 63119
Products: Oldcastle BuildingEnvelope® 1/4" Tint Monolithic Glass
Oldcastle BuildingEnvelope® 5/8" Clear Monolithic Glass

Enclosed is the LEED® document requested for the project listed above.

Energy and Atmosphere Credit 1: Optimize Energy Performance

All building components must meet the minimum insulation and maximum U-factor and SHGC requirements listed for the project's climate zone. Oldcastle BuildingEnvelope® provides high-performance glass products that can contribute to this category.

Indoor Environmental Quality Credit 4.1: Low Emitting Materials:

Oldcastle BuildingEnvelope® insulating glass units are not a source emission of Volatile Organic Compounds (VOC's). Oldcastle BuildingEnvelope provides compounds that do not contribute to environmental damage.

Indoor Environmental Quality Credit 8.1 & 8.2: Daylight and Views:

Oldcastle BuildingEnvelope® provides a wide range of high-performance glass products with a Light-to-Solar Gain Ratio (LSG) up to and exceeding 2.0 that permit the use of natural light with low solar heat gain.

Materials and Resources Credit 4.1 and 4.2: Recycled Content:

Requirement: Combined post & pre-consumer Recycled Content must be >10%.
LEED® requirements preclude glass manufacturers from giving credit for recycled glass that is reclaimed within the same process that generated it. Therefore, all fabricators, including Oldcastle BuildingEnvelope®, are not able to supply glass products that meet the recycled content requirement.

Materials and Resources Credit 5.1 & 5.2: Regional Materials:

Oldcastle BuildingEnvelope® fabricates glass at the address below which is within 500 miles of the project site.

If more details are required, please contact me at the number below.

Sincerely,

Stephanie J. Wilburn
Sales Representative – Architectural Glass

SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

WEBSTER UNIVERSITY ISB	
PROJECT NAME	
8274 BIG BEND BLVD	
ADDRESS	
NUMBER	
WEBSTER UNIVERSITY	
OWNER	
CANNON DESIGN	
ARCHITECT / ENGINEER	
Joe Voypick	
SUBMITTED BY	
088000-010	
CONTRACTOR / CM SUBMITTAL NO.	CANNON DESIGN SUBMITTAL NO.
	088000
DRAWING / DETAIL REFERENCE	SPECIFICATION SECTION / PARAGRAPH
MANUFACTURER / SUPPLIER	ITEM / PRODUCT ID
REQUIRED DATE	PRIORITY
	CRITICAL

ITEM BEING SUBMITTED (check only one)

- | | | |
|---|--|--|
| ☐ Shop Drawings | ☐ Certification / Qualifications | ☐ Coordination Drawing |
| ☐ Samples (____ copies) | ☐ Record Documents | ☐ Calculations |
| ☐ LEED Submittal | ☒ Product Data | ☐ Schedules |
| ☐ Other _____ | | ☐ O&M Manuals |

ITEM BEING SUBMITTED FOR (check only one)

- ☒ Action ☐ Information Only ☐ Record

REMARKS OR DEVIATIONS

Sample not needed for monolithic glass

CONTRACTOR / CM CERTIFICATION (SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)



PARIC CORPORATION
SUBMITTAL STAMP

THIS SHOP DRAWING HAS BEEN REVIEWED BY PARIC CORPORATION

Subcontractor remains responsible for dimensions, quantities, coordination with other trades and compliance with contract documents.

By:

Devin D. Gates

To be completed by Reviewer

08 8000-010
CANNON DESIGN SUBMITTAL NUMBER
2/21/17
RECEIVED DATE

- ☐ A. No Exceptions Taken
No further review of submittal is required.
- ☒ B. Make Corrections Noted
Incorporate corrections in work; resubmission is not required.
- ☐ C. Revise and Resubmit
Revise as noted, and resubmit for review.
- ☐ D. Rejected
Submittal is not in compliance with Contract Documents; provide new submittal.
- ☐ E. For Record / Information Only
Submittal was reviewed for Record / Information purposes only.
- ☐ F. Not Required for Review
Submittal is not required by Contract Documents and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

A/E COMMENTS

☐ See attached sheet(s) for additional comments

GLI-1, GLI-2, GLI-3 and GLI-4 to be 'Tempered Glass' per specification 088000.

Glass thickness for glass types per specification 088000.

Provide warranty per specification as separate submittal.

Provide samples.

Joe Voypick	2/21/17
REVIEWED BY	DATE

Kelvin Patel	3/21/17
REVIEWED BY	DATE

Digitally signed by Kelvin Patel
DN: cn=US, E=kpatel@cannondesign.com, O=Cannon Design,
OU=Architect, CN=Kelvin Patel
Date: 2017.03.21 20:07:34-05'00'



77 Westport Plaza
Suite 250
St. Louis, MO 63146

TRANSMITTAL

No. 15051-0512

Paric Corporation

PROJECT: 15051-Webster University Interdisciplinary Science Building

DATE: 02/21/2017

TO: Cannon Design
1100 Clark Ave
St Louis MO 63102

Fax;
314-241-2203

RE: GLI-1, GLI-3, and GLI-4 Product Data

ATTN: Kelvin Patel

JOB: 15051

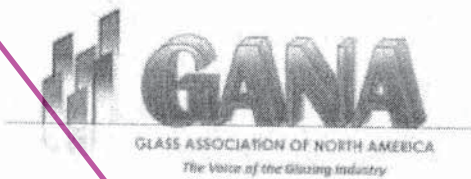
WE ARE SENDING:	SUBMITTED FOR:	ACTION TAKEN:
☐ Shop Drawings	☒ Approval	☐ Approved as Submitted
☐ Letter	☐ Your Use	☐ Approved as Noted
☐ Prints	☐ As Requested	☐ Returned After Loan
☐ Change Order	☐ Review and Comment	☐ Resubmit
☐ Plans		☐ Submit
☐ Samples	SENT VIA:	☐ Returned
☐ Specifications	☐ Attached	☐ Returned for Corrections
☒ Other: Product Data	☐ Separate Cover Via:	☐ Due Date:

Item	Package	Code	Rev.	Copies	Date	Description	Status
Submittal		088000-010	1		02/21/2017	GLI-1, GLI-3, and GLI-4 Product Data	Submitted

NOTES:

CC:

Signed: _____
Devin Gates



International Window Cleaning Association

Glass Informational Bulletin

GANA TD 03-1003 (Reapproved 2010)

Construction Site Protection and Maintenance of Architectural Glass

Steps Must Be Taken to Avoid Permanent Damage to Glass

Architectural glass products used in windows, doors and skylights for today's residential and commercial building projects are more sophisticated than those used in earlier fenestration applications. Performance requirements call for glass to be coated and used in an insulating glass unit in order to be more energy efficient; and often heat-treated and laminated to provide greater strength, safety, and security. As a result of increased performance capabilities, more high performance glass is being used in both residential and commercial construction. The higher valued products and their greater susceptibility to damage have increased the importance of proper site storage, handling, installation and protection throughout the construction process.

During glass manufacturing, fabrication and installation, products are carefully handled to prevent surface and edge damage. Materials are packaged to provide protection during shipment and delivery. Once finished materials are placed on a construction site, they become exposed to a variety of conditions and influences that can adversely affect product aesthetics and functionality. Irreparable glass damage can occur from improper storage and handling, exposure to chemicals and leaching agents, prolonged exposure to moisture, mechanical attack and breakage, damage related to adjacent construction activities and improper cleaning methods.

Site Delivery and Storage

Windows, doors and skylights for residential construction typically arrive on construction sites preglazed, while commercial construction applications often require glass be delivered to the site and glazed at a later date. In both types of construction, it is vital that materials be properly stored for the duration of the construction process. The complex nature of construction projects and site management requires well-planned and executed material delivery and storage. The following is a list of recommended practices that glazing subcontractors should observe for site delivery and storage of fenestration materials:

- Consult glass and glazing system suppliers for specific recommendations on the site storage, handling, installation, and protection of their materials before any work is started.

Glass Association of North America
800 SW Jackson Street, Suite 1500
Topeka, KS 66612
(785) 271-0208 Fax: (785) 271-0166
www.glasswebsite.com

International Window Cleaning Association
400 Admiral Boulevard
Kansas City, MO 64106
(816) 471-4922 Fax: (816) 472-7765
www.iwca.org

- Coordinate glass deliveries, to the extent practical, to minimize on-site storage durations.
- Work with the general contractor or builder to select on-site under-roof storage locations that avoid direct rain and water runoff, work areas of other trades, and areas of high traffic and to minimize material movement and handling.
- Secure, block, and brace individual cases of glass and preglazed materials to prevent falls.
- Ensure blocks or supports keep the bottom edge of materials well above potential puddles of rainwater or other conditions that could cause damage.
- Provide secure, temporary covering that prevents direct water flow, but ensures ventilation and combats condensation buildup on the glass.
- Clearly mark storage areas of glass cases and preglazed materials using colored ribbons or tape.
- Ensure that glazing components held in storage are not subjected to deposits from concrete and masonry building materials or hard water spotting from various sources of tap water at the job site.
- Ensure that stored materials are not exposed to activities of other trades such as welding, painting, insulating, and fireproofing.
- Establish a program for daily inspection of stored glass and glazing systems to monitor conditions and ensure prompt corrective action when needed.
- Follow manufacturer's guidelines when using temporary protection films.
- Do not allow protective films to remain on the surface beyond their useful life, as removal methods may damage certain types of glass and/or their coatings.
- Do not expose open packs of glass to direct sunlight as the insulating effects of the glass layers may increase the thermal stress in the glass and may result in glass breakage.

Trade Awareness

As fenestration materials are delivered to a residential or commercial construction site, it is recommended that the glazing subcontractor and window cleaner contact the general contractor (in person and follow up in writing) to let him know how important it is that he make all construction trades aware of the potential for permanent damage and their level of responsibility in the event materials are subjected to harmful conditions. In the event of damage, prompt action is required to minimize damage.

Site Handling and Installation

Glass and glazing system manufacturer's recommendations for site handling and installation procedures should be followed. Residential and light commercial windows, doors, and skylights should be installed in accordance with ASTM International document E 2112 – *Standard Practice for Installation of Exterior Windows, Doors and Skylights*. Glass for commercial glazing applications should be handled and installed in accordance with guidelines set forth in the Glass Association of North America (GANA) *Glazing Manual*.

Post Installation Inspection and Protection

After installation, special attention by all trades should be given to construction activities in order to prevent exposure of glass in windows, doors and skylights to weld splatter, paint, plaster, sealants, fireproofing, and alkali and chemical attack. The subcontractor, general contractor, or builder should inspect and document the condition of the glazed materials on a daily basis. At this stage of construction, the glazing subcontractor should request, in writing, that the general contractor or builder remind other construction trades of the potential for irreparable damage to the glazed materials and to implement systems and procedures for protection. The following is a list of common conditions and causes that damage glass after installation:

Condition: Glass surface corrosion often characterized by permanent iridescent or white haze surface staining

Cause: Glass got wet during storage due to reasons such as, but not limited to, being stored outside uncovered, or extended storage with inadequate ventilation and/or improper glass separation

Condition: Glass surface or edge damage

Cause: Inadequate on-site protection; ill-advised or vulnerable storage locations; exposure to other trades

Condition: Chemical attack, surface pitting and hard-to-clean deposits

Cause: Overspray and runoff of chemicals from sealing/cleaning of concrete, masonry, roofing, etc; inadequate protection and/or poor storage location

Condition: Weld-splatter surface damage and reduction in glass strength

Cause: Location of glass near welding; inadequate protection of stored or installed glass

Condition: Stubborn, tenacious surface deposits from concrete and masonry runoff, as well as hard water spotting

Cause: Poor storage and/or protection of uninstalled glass; absence of prompt, interim cleaning of installed glass during construction

Construction Clean-Up

If glass is exposed to harmful materials or conditions during construction, the general contractor or builder and the trade involved, if known, should be immediately advised by the glazing contractor of the potential damage. In the event that damage has already occurred, the glazing contractor and glass fabricator/supplier should be consulted to assess damage, take corrective actions, and mitigate the potential for future damage.



Deep surface scratches, contact by hot weld-splatter and edge damage threaten the structural integrity of glass and may require glass replacement. Surface contact with harmful materials will require prompt cleaning by professional window cleaners, such as members of the International Window Cleaners Association (IWCA).

If harmful exposure results in conditions that cannot be cleaned using typical glass cleaning procedures, a professional window cleaner should be consulted for recommendations on more aggressive glass cleaning procedures. The use of a more aggressive procedure may itself damage the glass. Careful thought and discussion must precede the use of aggressive cleaning procedures.

The general contractor or builder may need to schedule periodic glass cleaning during the construction process. Extended construction schedules and site conditions often result in dirt and debris build-up. Professional cleaning at the initial signs of build-up can decrease the potential for glass damage.

Long-Term Building Maintenance & Performance

Following the completion of the construction project and throughout the life of the building, windows, doors, and skylights should be properly cleaned. Building facades may be exposed to sealant rundown, pollutants, dirt and debris, which can attack and damage glass surfaces over time. Building maintenance schedules should include frequent cleaning to ensure long-term glass aesthetics and performance. Cleaning frequencies should be tailored to the individual characteristics inherent to these conditions as well as the severity of local environmental factors such as acid rain and atmospheric pollutants that vary from region to region.

Building owners should ensure that individuals cleaning fenestration materials are well aware of the glazing products in the building and their unique properties and are knowledgeable about and capable of using proper cleaning procedures and practices recommended by the glazing manufacturer and the glass industry.

Proper protection of glass in windows, doors, and skylights throughout the construction process and the life of a building are essential. Planning and execution of the practices described and recommended in this bulletin will enable the glass to meet the aesthetic and performance expectations and the needs of the building occupants.

Consult the *Tech Center* section of the Glass Association of North America (GANA) website (www.glasswebsite.com) for additional Glass Informational Bulletins and flat glass industry reference resources.

This bulletin was developed by the GANA Tempering Division - Construction Subcommittee and the International Window Cleaning Association and approved by the Tempering Division - Standards & Engineering Committee and GANA Board of Directors and IWCA Board of Directors. The document was originally published in October 2003 then republished in May 2008. This edition of the bulletin provides the most recent update and published in October 2010.





Glass Informational Bulletin

GANa 01-0300

Proper Procedures for Cleaning Architectural Glass Products

Architectural glass products play a major role in the comfort of living and working environment of today's homes and commercial office spaces. By providing natural daylight, views of the surroundings, thermal comfort and design aesthetics, glass usage and condition often affect our selection of where we live, work, shop, play and seek education.

Architectural glass products must be properly cleaned during construction activities and as a part of routine maintenance in order to maintain visual and aesthetic clarity. Since glass products can be permanently damaged if improperly cleaned, glass producers and fabricators recommend strict compliance with the following procedures for properly cleaning glass surfaces.

As dirt and residue appear, interior and exterior glass surfaces should be thoroughly cleaned. Concrete or mortar slurry which runs down (or is splashed on) glass can be especially damaging and should be washed off as soon as possible. Before proceeding with cleaning, determine whether the glass is clear, tinted or reflective. Surface damage is more noticeable on reflective glass as compared with the other glass products. If the reflective surface is exposed, either on the exterior or interior, special care must be taken when cleaning, as scratches to the reflective glass surface can result in coating removal and a visible change in light transmittance. Cleaning tinted and reflective glass surfaces in direct sunlight should be avoided, as the surface temperature may be excessively hot for optimum cleaning. Cleaning should begin at the top of the building and continue to the lower levels to reduce the risk of leaving residue and cleaning solutions on glass at the lower levels. Cleaning procedures should also ensure that the wind is not blowing the cleaning solution and residue onto already cleaned glass.

Cleaning during construction activities should begin with soaking the glass surfaces with clean water and soap solution to loosen dirt or debris. Using a mild, non-abrasive commercial window washing solution, uniformly apply the solution to the glass surfaces with a brush, strip washer or other non-abrasive applicator. Immediately following the application of the cleaning solution, a squeegee should be used to remove all of the cleaning solution from the glass surface. Care should be taken to ensure that no metal parts of the cleaning equipment touch the glass surface and that no abrasive particles are trapped between the glass and the cleaning materials. All water and cleaning solution residue should be dried from window gaskets, sealants and frames to avoid the potential for deterioration of these materials as the result of the cleaning process.

It is strongly recommended that window washers clean a small area or one window, then stop and examine the surface for any damage to the glass and/or reflective coating. The ability to detect certain surface damage, i.e. light scratches, may vary greatly with the lighting conditions. Direct sunlight is needed to properly evaluate a glass surface for damage. Scratches that are not easily seen with a dark or gray sky may be very noticeable when the sun is at a certain angle in the sky or when the sun is low in the sky.

The glass industry takes extreme care to avoid glass scratches by protecting all glass surfaces during glass manufacturing and fabrication, as well as during all shipping and handling required to deliver the glass to the end user. A large percentage of damaged glass results from non-glass trades working near glass. This will include painters, spacklers, ironworkers, landscapers, carpenters and others who are part of the construction process. They may inadvertently lean tools against the glass, splash materials onto the glass and/or clean the glass incorrectly, any of which can permanently damage glass.

One of the common mistakes made by non-glass trades people, including glass cleaning contractors, is their use of razor blades or other scrappers on a large portion of the glass surface. Using 2, 3, 4, 5 inch and larger blades to scrape a window clean carries a large probability for causing irreparable damage to glass.

The entire industry of glass manufacturers, fabricators, distributors, and installers neither condones nor recommends widespread scraping of glass surfaces with metal blades or knives. Such scraping will often permanently damage or scratch the glass surfaces. When paint or other construction materials cannot be removed with normal cleaning procedures, a new 1" razor blade may need to be used only on non-coated glass surfaces. The razor blade should be used on small spots only. Scraping should be done in one direction only. Never scrape in a back and forth motion as this could trap particles under the blade that could scratch the glass. This practice may cause hairline concentrated scratches, which are not normally visible when looking through the glass, but may be visible under certain lighting conditions.

Jobsite storage and construction conditions can lead to stains on the glass surface. Cleaning and removal of such stains may require the use of a more aggressive cleaning solution and procedure. If conditions are found that cannot be cleaned using the above procedures, contact the glass supplier for guidelines on stain removal.

Members of the Glass Association of North America (GANA) publish information relating to jobsite protection and cleaning of architectural glass products. In order to ensure long-term performance of the glass in a building, GANA encourages glazing contractors, general contractors, building management and owners to be aware of conditions that can damage glass and to follow the handling and cleaning guidelines provided by their glass producer and fabricator.

Consult the GANA website (www.glasswebsite.com) for additional information on glass and glazing applications and links to members providing additional technical resources.

The Glass Association of North America (GANA) has produced this Glass Information Bulletin solely to provide general information as to basic proper procedures for cleaning architectural glass products. The Bulletin does not purport to state that any one particular type of glass cleaning process or procedure should be used in all applications or even in any specific application. The user of this Bulletin has the responsibility to ensure the cleaning instructions from the glass supplier are followed. GANA disclaims any responsibility for any specific results relating to the use of this Bulletin, for any errors or omissions contained in the Bulletin, and for any liability for loss or damage of any kind arising out of the use of this Bulletin.



GANA 01-0300



NOT REVIEWED. CONTRACTOR TO REVIEW.

GLAZING INSTRUCTIONS

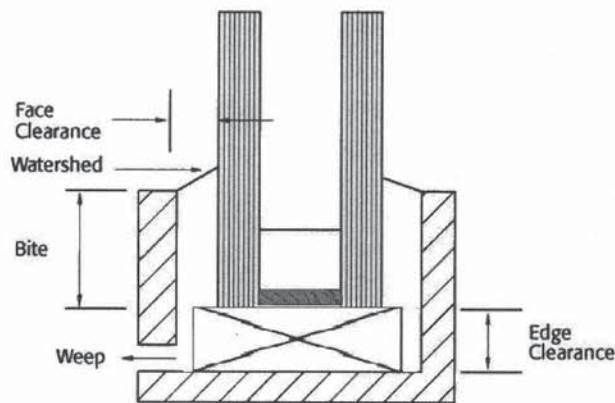
OLDCASTLE BUILDINGENVELOPE® INSULATING GLASS UNIT WARRANTY IS DEPENDENT UPON STRICT ADHERENCE TO THESE GLAZING INSTRUCTIONS

CAUTIONS

1. The Oldcastle BuildingEnvelope® Insulating Glass Unit (IGU) warranty will be void under any of the following circumstances: if glass breakage occurs; if the IGU is installed in a glazing system that retains any liquid near, or in contact with the IGU edge; if an IGU with a non-silicone secondary seal is used in either a sloped glazing application or 4-sided structural silicone glazing (SSG); if there is any chemical or physical damage to the IGU primary and/or secondary sealants; if an acetoxysilicone sealant is used in close proximity to a neutral cure silicone IGU; or if capillary breather tubes are installed in the IGUs but the Oldcastle BuildingEnvelope® proper closing procedure is not strictly followed.
2. The Oldcastle BuildingEnvelope® Insulating Glass Unit (IGU) warranty will be void under any of the following circumstances without a technical project review and written acceptance of the application: if solar-absorbing film, shades, blinds, or any foreign material are used on or near the surface of the glass that causes higher thermal or mechanical stresses; if all sides of the IGU are not fully supported (including, but not limited to, butt-glazed without interior mullion support); if the IGU is installed in high humidity environments (including, but not limited to, swimming pool enclosures and greenhouses) or high vibration environments.
3. Failure of any Oldcastle BuildingEnvelope® product due to incompatibility with any other product not supplied by Oldcastle BuildingEnvelope® (including, but not limited to, blocks, gaskets, glazing sealants, spacers, tapes, plasticizing oils and solvents) voids all warranties and exonerates Oldcastle BuildingEnvelope® from any liabilities.
4. Setting blocks and anti-walk blocks must be silicone for IGUs used in 4-sided SSG, sloped glazing, and with IGUs that have gray silicone secondary sealant. Silicone or silicone compatible EPDM setting blocks and anti-walk blocks can be used in conventional 4-sided captured glazing and vertical 2-sided SSG.
5. Do NOT use razor blades or broadknife blades of any kind to clean glass. Oldcastle BuildingEnvelope® is not responsible for scratches and/or damage caused by window cleaners or other construction tradesmen.
Follow GANA *Proper Procedures for Cleaning Architectural Glass Products*, available at <http://www.glasswebsite.com/techcenter/default.asp>.
6. Use of all abrasives, chemicals, or other surface treatments should be spot tested and evaluated under actual use conditions and under various lighting extremes before proceeding with use.

The following Glazing Instructions are intended to assist the design professional and installer. Additional glazing recommendations and guidelines provided by GANA, AAMA and IGMA must also be followed. If there is any variation in glazing recommendations, the more stringent guideline will apply.

1. **Glass Handling & Protection** - Care must be exercised in the handling and the glazing of glass to prevent edge damage. The glass must not contact the framing members, or other metal components such as screws, during glazing. Glass must be protected from weld splatter, blasting and other impact damage. Alkali or fluorinated materials released from concrete or masonry during rainstorms can stain or etch glass. Weathering steel releases oxides while aging which can result in stained glass if proper periodic cleaning is not done. Solutions used to restore or neutralize masonry surfaces can attack glass and first surface pyrolytic reflective coatings.
2. **Glass Storage** - Glass should be kept on a lean of 5-7° from vertical using broad, sturdy uprights. Never store glass in sunlight without using an opaque cover to protect it. Glass should be stored in a dry, clean and cool location where the temperature is above the dew point. Circulation of dry, cool air is required especially after periods of high humidity and cyclic temperatures. If glass must be stored outdoors, use tarps or plastic coverings to protect it from getting wet, and vent periodically to prevent moisture accumulation. Repeated wetting and drying of glass surfaces can result in staining or etching of the glass.
3. **Glazing Frames** - Frames must be square, in plane, free of any internal obstructions and structurally adequate.
 - a. Squareness: 1/8" maximum diagonal difference
 - i. Bow: 1/16" maximum per any 4' length
 - ii. Plumbness: 1/16" per 6' length
 - iii. Corner Joint Offset: must not exceed 1/32" of adjoining members
 - b. Design Load Deflection: Unless applicable codes or the design professional establish a more stringent requirement, deflection of framing members supporting glass shall not exceed the length of the unsupported span divided by 175 (L/175).
 - c. Dead Load Deflection: Horizontal Framing Member deflection should not reduce glass bite by more than 25% of design dimension, nor reduce edge clearance of glazing below to less than that required to prevent glass to metal contact. Refer to the chart on the following page for recommended clearance and bite values.
 - d. Dead Load Twisting: Twisting of the horizontals due to the weight of glass should not exceed 1°, measured between ends and center of each span.
 - e. Edge and Face Clearance, and Bite: The glazing system must have adequate edge and face clearance to 'cushion' the glass, thermally isolate the glass from framing members, and prevent glass-to-metal contact. An adequate bite is required to provide proper seal; however, excessive bite could increase thermal stresses. Refer to the chart on the following page for recommended clearance and bite values, and exceptions.
4. **Glazing Weep System** - The glazing system should be designed so that any liquid entering the glazing channel drains out quickly. Setting blocks must not hinder the flow of liquid from the glazing channel. Retention of any liquid at close proximity to the IGU edge may lead to seal failure and void the IGU warranty.
5. **Glass Installation**
 - a. **Setting Blocks** - All lites of glass should be set on 2 identical setting blocks with a Shore A durometer hardness of 80 to 90. The preferred location is at 1/4 points of the sill. In some cases it may be necessary to move the blocks equally closer to the corner of the unit but not closer than 1/8 points or 6" from the edge, whichever is greater. The setting blocks should be sized to provide 0.1" of length per square foot of glass but not less than 4" long. Setting blocks should be wider than the IGU thickness in a conventional framing system. In an SSG application, the setting block must support a minimum of half of the outer lite thickness. Setting blocks should not block the weep holes or prevent water from exiting the frame quickly. The thickness of the setting block should provide the recommended nominal bite and minimum edge clearance for the glass. When a lock strip gasket glazing system is used, each setting block should be sized to provide 0.4" of length per square foot of glass area, but not less than 6" long. The lock strip gasket manufacturer should recommend the height of the blocks. Any deviation from the setting block requirements must be approved by Oldcastle BuildingEnvelope® in writing.
 - b. **Edge Blocks, or anti-walk Blocks** - All dry-glazed lites of glass should have at least one edge block per jamb that has a Shore A durometer hardness between 50 to 70. Blocks should be a minimum of 4" long, placed in the vertical channel and sized to allow a nominal 1/8" clearance between the edge of the glass and block.
6. **Dry-Glazing Methods**
 - a. **Pressure-Plate Gaskets**: These gaskets must apply pressure onto the glass uniformly between 1/8" to 9/16" from the unit edge. The sealing pressure should be in the range of 4 to 10 pounds per linear inch, which should be achieved by tightening the pressure plate fasteners with torque controlled wrenches. The fasteners should be tightened at quarter points of sill, then quarter points of head, then quarter points of jambs, and then the remaining bolts. Excessive torque on the pressure plate fasteners may contribute to glass breakage, or cause squeeze out of the PIB into the vision area.
 - b. **Wedge Gasket Glazing**: Wedge gaskets must be properly sized and installed so that the gasket is crowded, not stretched. Refer to the system manufacturer's instructions for proper sizing and installation procedure.
 - c. **Structural Gasket Glazing (Lock Strip Glazing)**: This system must have a continuous wet sealant applied as a cap bead to the exterior glazing leg.
7. **Capillary Tubes** - IGUs that experience an elevation difference of 2,500 feet or more in transportation or installation location from the IGU manufacturing elevation may require capillary tubes. These tubes will be installed on the IGU vertical edge and must be cut, sealed, and then pointed downwards after the IGUs have stabilized for 72 hours (or until flat) at final destination. Oldcastle BuildingEnvelope® Closing Procedure for Capillary Tubes is available on request from any Oldcastle BuildingEnvelope® plant. Failure to follow the Oldcastle BuildingEnvelope® closing procedure will void the IGU warranty.



- (1) Specialty glazing system designs such as ones with glazing tape or sealant back-bedding may be designed for reduced face clearance. Deviations from typical clearances should be fully considered within the context of the design and expected performance of the glazing system. Consult glass manufacturer, fabricator, glazing material manufacturer, and/or design professional for relevant performance properties
- (2) Annealed glass
- (3) Fully tempered and heat-strengthened glass

TYPICAL FACE & EDGE CLEARANCE & BITE

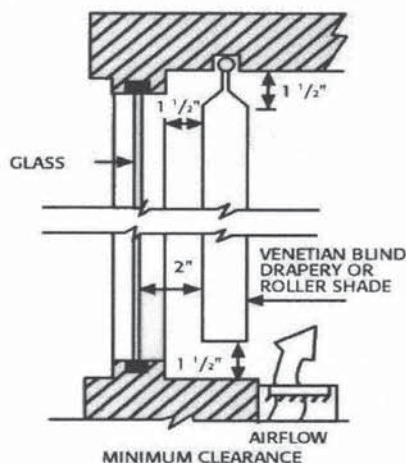
GLASS TYPE	GLASS THICKNESS		MINIMUM FACE CLEARANCE (1)	MINIMUM EDGE CLEARANCE	MINIMUM BITE
	inches	mm	inches	inches	inches
Single Glazing	3/32	2.5	1/16	1/8	1/4
	1/8 (2)	3	1/8	1/8	1/4
	1/8 (3)	3	1/8	1/4	3/8
	5/32	4	1/8	3/16	5/16
	3/16 (2)	5	1/8	3/16	5/16
	3/16 (3)	5	1/8	1/4	3/8
	1/4	6	1/8	1/4	3/8
	3/8	10	3/16	5/16	7/16
	1/2	12	1/4	3/8	7/16
	5/8	16	1/4	3/8	1/2
	3/4	19	1/4	1/2	5/8
	1	25	1/4	1/2	3/4
Spandrel	1/4	6	3/16	1/4	1/2
Insulating Glass	1/2	12	1/8	1/8	1/2
	5/8	16	1/8	1/8	1/2
	3/4	19	3/16	1/4	1/2
	1	25	3/16	1/4	1/2
	1-1/8	28	3/16	1/4	1/2

Thermal Stress

Thermally induced edge stresses are usually the result of the warmer center portion of a glass lite being exposed to solar energy and wanting to expand more than the cooler edges. The amount of thermal stress is dependent on the glass type, size, thickness, and shape, and how it is isolated from the framing system. Other factors are building orientation, interior shading devices, exterior shading patterns, heating register location, etc. Heat-strengthening and tempering increases glass edge strength and decrease the chance for thermal breakage. The following conditions must be taken into account when considering the effects of thermal stress:

1. **Interior Heat Traps** — These situations occur when there is inadequate air circulation to properly remove heat from behind the glass. Spandrel areas are a good example of where glass must be heat-strengthened or tempered to avoid thermal stress breakage. Insulation must be held back from the surface of heat-strengthened spandrel glass a minimum of 1". Placing insulation against the back of spandrel glass is not permitted without a thermal stress review and written approval.

In vision areas, air movement must not be restricted. Suspended ceilings must be well to the room side to allow natural convection. Or the head area should include vents that provide a minimum one square inch of ventilation for each inch of glass width. Or the glass should be heat-strengthened or tempered.



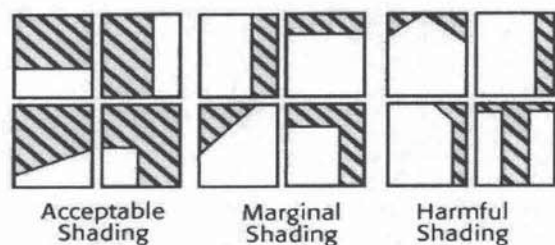
2. **Interior Shading** — Draperies, venetian blinds or other interior shading devices must be hung with space to permit natural air movement over the room side of the glass. The following criteria must be met to avoid formation of a heat trap:

- Minimum 1-1/2" clearance required top and bottom, or one side and bottom, between the shading device and the surrounding construction.
- Minimum 2" clearance between glass and shading device.
- Heating/cooling outlets must be to the room side of the shading device with airflow directed away from the glass.
- Use mechanical stops to prevent complete closure of blinds to 60% of closed position.

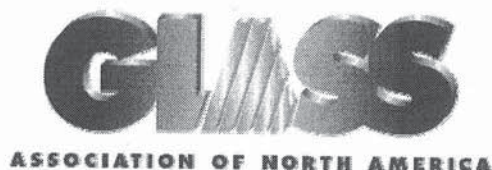
Heat-strengthening or tempering of the glass may be necessary to offset the effects of a lack of adequate ventilation.

3. **Exterior Shading** — Shadows cast by overhangs, light shelves, sunshades, surrounding structures, trees and shrubbery can create shading patterns on the glass, creating thermal edge stress. Maximum stress occurs when 25% or less area of a lite is shaded and the shade includes more than 25% of the perimeter. Generally, horizontal, vertical, and diagonal shading patterns are not as critical as shading that combines several patterns. Double diagonal shading is generally the most critical pattern. See the sketches of typical shading patterns that are labeled "Acceptable", "Marginal", and "Harmful". Oldcastle BuildingEnvelope® Technical Services will offer suggestions on the need to heat-treat the IGU when requested.

EXTERIOR SHADING PATTERNS



Submit requests to: Oldcastle BuildingEnvelope®
Technical Services
1273 N. Church Street, Suite 100A
Moorestown, NJ 08057



Glass Informational Bulletin

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Heat-Treated Glass Surfaces Are Different

Industry Cleaning Procedures Must be Followed to Avoid Glass Damage

As the use of glass increased over recent years, issues of strength, safety and thermal performance became increasingly important design considerations. The availability of tinted and coated glasses had a dramatic impact on glass use in building projects. The vastly expanded aesthetic options, combined with the improved energy conserving and comfort capabilities of tinted and coated glasses allowed architects to use more glass, as well as larger sizes in their designs. A consequence of this trend was a corresponding increase in the use of tempered and heat-strengthened glass in order to meet both thermal and windload design requirements. The demand for tempered glass further increased with the passing of safety glazing legislation in 1977, which mandated its use in certain locations.

Currently, there are two types of heat-treated glass as defined in the American Society for Testing and Materials (ASTM) C 1048 - *Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass*. The two types are heat-strengthened (Kind HS) and fully tempered (Kind FT). Both types of glass are produced using the same equipment. A majority of the heat-treated glass produced over the last 30 years has been fabricated in horizontal roller hearth furnaces. The preparation stage for the heat-treatment process requires annealed float glass to be cut to the required final size, the edges to be treated according to the specified finish (commonly seamed or polished) and the glass to be washed. The process then requires the glass to be transported on horizontal rollers through an oven and heated to approximately 1,150° F (621° C). Upon exiting the furnace, the glass is rapidly cooled (quenched) by blowing air uniformly onto both surfaces simultaneously. The cooling process leaves the surfaces of the glass in a state of compression and the central core in compensating tension.

The color, clarity, chemical composition and light transmission characteristics of glass remain essentially unchanged after heat-treating. Likewise, hardness, specific gravity, expansion coefficient, softening point, thermal conductivity, solar optical properties and stiffness remain unchanged by the heat-treating process. The only physical properties that change are improved flexural and tensile strength, and improved resistance to thermal stresses and thermal shock. Under uniform loading, heat-treated glass is stronger than annealed glass of the same size and thickness. The heat-treating process does change the break pattern of the glass, i.e. fully tempered glass disintegrates into relatively small pieces meeting the safety glazing requirements and thereby greatly reducing the likelihood of serious cutting or piercing injuries.

As mentioned, the heat-treating process typically involves the transport of very hot glass on rollers. As a result of this soft glass-to-roller contact, some glass surface changes will occur. Minute glass

particles (fines) from the glass cutting and edging process, typical manufacturing plant air-borne debris or dust, refractory particles from the tempering oven roof, as well as external airborne dirt and grit carried into the plant by the large volumes of quench air used in the process, may adhere to one or both glass surfaces. Also, the physical contact of the soft glass surface with the rollers may result in a marking or dimpling of the glass surface. Current glass quality specifications contained in ASTM C 1036- *Standard Specification for Flat Glass*, establish the size and number of glass imperfections allowed based on specific visual inspection criteria. The glass surface conditions listed above are not usually visible to the eye under normal visual circumstances. These surface conditions do not threaten the visual nor structural integrity of the product, and are not reason for rejection of glass under the ASTM consensus standards.

However, despite being invisible, such surface conditions can be detectable to the touch. This difference in "feel", between annealed and heat-treated glass, can lead to issues during cleaning of the glass, as glass cleaning workers attempt to remove microscopic particles. With the best of intentions, they may attempt to scrape particles that can be felt, but not seen, and very often end up scratching and chipping the glass surface.

Additionally, once the glass is delivered to the construction site, construction materials and debris may be deposited on the glass. Paint, stucco, concrete, adhesives, and other materials may be splattered on the glass and left there for long periods of time. These materials and the methods for removing them may also damage the glass surface.

It is important to note that the recommended cleaning procedures for heat-treated glass are the same as for annealed glass. The use of scrapers, abrasives, and harsh chemical cleaning agents is not recommended for any glass product because they can cause irreparable damage. With the best of intentions, window cleaners, and other tradesmen, may attempt to remove construction dirt and debris from the glass surface by scraping the surface. This can lead to glass damage, such as scratching and chipping if any microscopic particles have adhered to the surface and are dislodged and transported across the glass in the scraping process.

Acceptable cleaning procedures are available from glass manufacturers and fabricators. In addition, the Glass Association of North America has published a Glass Information Bulletin entitled, *Proper Procedures for Cleaning Architectural Glass Products*, which includes industry recommended cleaning procedures, as well as a list of Do's and Do Not's.

Heat-treated glass products are critical components of today's high-performance coated, insulating, laminated, spandrel, safety glazing, bullet-resistant, blast-resistant, and hurricane-resistant fenestration products. Millions upon millions of square feet of heat-treated glass have been installed and have provided trouble free performance for almost 50 years. Continued use of acceptable cleaning practices, combined with good judgment, will prevent glass damage and enable the glass to maintain its original attractive appearance for years to come.

This bulletin was developed by the GANA Tempering Division - Construction Subcommittee and approved by the Tempering Division - Standards & Engineering Committee and GANA Board of Directors. The document was originally published in April 2002. This edition of the bulletin provides the most recent update and published in May 2008.

Quick-Reference Guide to Cleaning Architectural Glass Products

The following "Do's" and "Do Not's" are offered as a supplement to the Glass Association of North America (GANA) Glass Informational Bulletin – *Proper Procedures for Cleaning Architectural Glass Products*:

The following are things to DO:

- DO clean glass when dirt and residue appear
- DO determine if coated glass surfaces are exposed
- DO exercise special care when cleaning coated glass surfaces
- DO avoid cleaning tinted and coated glass surfaces in direct sunlight
- DO start cleaning at the top of the building and continue to lower levels
- DO soak the glass surface with a clean water and soap solution to loosen dirt and debris
- DO use a mild, non-abrasive commercial window cleaning solution
- DO use a squeegee to remove all of the cleaning solution
- DO dry all cleaning solution from window gaskets, sealants and frames
- DO clean one small window and check to see if procedures have caused any damage
- DO be aware of and follow the glass supplier's specific cleaning recommendations
- DO caution other trades against allowing other materials to contact the glass
- DO watch for and prevent conditions that can damage the glass
- DO read the entire GANA bulletin on glass cleaning before starting to clean glass



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The following are things to NOT do:

- DO NOT start cleaning without reading the entire GANA bulletin on glass cleaning
- DO NOT use scrapers of any size or type for cleaning glass
- DO NOT allow dirt and residue to remain on glass for an extended period of time
- DO NOT begin cleaning glass without knowing if a coated surface is exposed
- DO NOT clean tinted or coated glass in direct sunlight
- DO NOT allow water or cleaning residue to remain on the glass or adjacent materials
- DO NOT begin cleaning without rinsing excessive dirt and debris
- DO NOT use abrasive cleaning solutions or materials
- DO NOT allow metal parts of cleaning equipment to contact the glass
- DO NOT trap abrasive particles between the cleaning materials and the glass surface
- DO NOT allow other trades to lean tools or materials against the glass surface
- DO NOT allow splashed materials to dry on the glass surface

This bulletin was developed by the GANA Tempering Division - Construction Subcommittee and approved by the Tempering Division - Standards & Engineering Committee and GANA Board of Directors. This is the original version of the document as approved and published in March 2000.