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# Architectural Glazing Practices

**Preventing problems with glazed curtain walls**

**By Robert G. Spindler**

Aluminum curtain walls for commercial office buildings began to evolve in the early 1950's. Today these glass and metal building facades have proven themselves cost-effective, aesthetically pleasing, energy efficient and capable of performing under stringent environmental conditions. Architects continue to design unique structures with innovative concepts requiring, at times, the building materials to meet extraordinary specifications. With the advent of new materials and philosophies in architectural design concepts, the total curtain wall, including metal, glass, sealants and gaskets, has had to perform under a variety of conditions; namely, thermal environment, negative and positive wind loads, wall system dead loads, water penetration, and air infiltration. The design of a properly functioning curtain wall system requires specific consideration of the glass retaining system or glazing members.

## Glass Considerations

With advent of heat absorbing and high performance reflective glasses, sealants, gaskets and other materials used in the glazing channel are exposed to considerable temperature extremes and high concentrations of ultraviolet light. Temperatures of monolithic reflective glass in spandrel or nonvision areas have been measured at 190° F. This imposes considerable expansion and high temperature resistance requirements on all materials that come in contact with the glass. Depending on the type of glass, significant amounts of ultraviolet light can be reflected from the glass into the glazing material. If the materials used in the glazing channel are affected by ultraviolet light, these materials most likely will degrade, producing costly repairs on the project.

Chosen glass materials must meet the architect's specifications for performance, which usually are:

- Glass thickness and type (annealed, heat treated) to meet specified and wind load requirements,
- Thermal efficiency requirements for both summer and winter conditions,
- Aesthetic requirements,
- Glass type to resist the potential of breakage due to thermal stress conditions, and
- Building codes.

## Glass and Shading Devices

Draperies, blinds or other interior shading devices must be hung so as to provide space either at the top and bottom or one side and bottom to permit natural air movement over the room side of the glass. Figure 1 depicts the

criteria that should be met to avoid formation of a heat trap. The use of heat treated glass may be necessary to offset the effects of a lack of adequate ventilation.

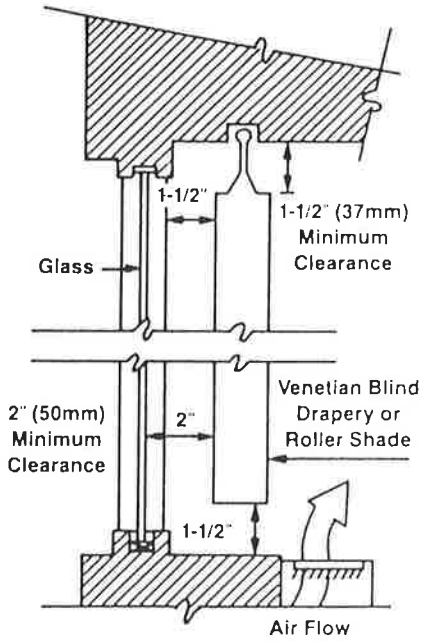



*Figure 1. indoor shading and heat duct locations*

1. Minimum 1-½" clearance required top and bottom or one side and bottom between shading device and surrounding construction.
2. Minimum 2" clearance between glass and shading device.
3. Heating/cooling outlets must be to room side of shading device.

## Metal Considerations

Because the coefficient of thermal expansion for aluminum is approximately 13 x $10^{-6}$ inches/inch, thermal movement of the curtain wall metal system must be properly considered. Expansion at high temperatures and contraction at low temperatures may impose significant stresses on glass, sealants and gaskets.

The metal framing system must uniformly support the glass. The glass industry has set guidelines that the framing needs to be within limits for bow, squareness, and corner offset as indicated:

- Bow - 1/16 inch in any four foot length of framing;
- Squareness - 1/8 inch difference in the lengths of the diagonals of the frame;
- Corner Offset - 1/32 inch at each corner.

The glass industry has also set guidelines on glass framing member deflection under design loads. This guideline states that to minimize the potential for glass breakage, the glass surround should not impose any bending or high concentrated compressive loads on the glass and should not deflect more than 1/175th of its span under loading or 3/4 inch, whichever is less. In addition, the glazing system chosen should isolate the glass from other parts of the wall.

## Sealant and Gasket Considerations

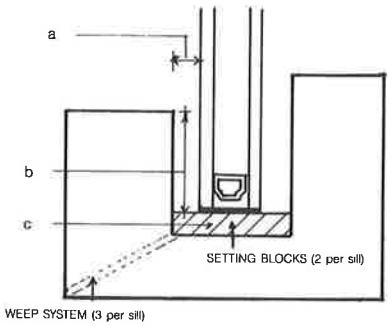
Sealants and gaskets must withstand the anticipated movement of members with which they come in contact, be compatible with other materials being used, retain their properties after exposure to anticipated environmental conditions and not impose any undue stress on the glass. Gaskets should be designed so that the section contacting the outer glass face has a slope on it to provide water runoff. Gaskets should be designed to give a uniform contact pressure of four to six pounds per inch to make the seal watertight. Pressures of over 10 pounds per inch should be avoided.

## Glazing Guideline Dimensions

The glazing system should provide for minimum face clearances, edge clearances, and nominal bite (Figure 2). Adequate edge and face clearances will properly cushion the glass, thermally and mechanically isolate the glass framing members, and prevent glass to metal contact. A nominal bite on the glass will provide adequate glass retention without excessive glass coverage. Excessive glass coverage can increase thermal stresses at the glass edge.

## Setting Blocks

Glass lights should be set on two 80 to 90 durometer neoprene setting blocks positioned at the quarter points. When this is impractical, the




| | Overall Thickness | (a) Face Clearance | (b) Bite | (c) Edge Clearance |
|---|---|---|---|---|
| Monolithic Glass | 1/4" | 1/8" | 3/8" | 1/4" |
| Insulating Glass Units | 5/8"<br>3/4-1" | 1/8"<br>3/16" | 1/2"<br>1/2" | 1/8"<br>1/4" |

*figure 2. glazing dimensions*

setting blocks can be installed to within six inches of the vertical glass edge. The setting block should be 1/10 inch in length for each square foot of glass area, but no less than four inches in length. The setting block should be 1/16 inch less than the full channel width and be of sufficient height to provide the nominal recommended bite and minimum glass edge clearance (Figure 2).

## Clearances, Shims, Drainage

Tolerances for the metal frame and glass must be taken into account so that the glass is free to float in the opening and does not directly touch the framing system (Figure 3). Edge blocking should be used to limit lateral movement or side walking of the glass caused by horizontal expansion or contraction and building vibration. Lack of edge blocking can permit glass to framing contact on one edge that could result in glass breakage. If the glass is permitted to move to one side of the glazing channel, air and water infiltration can result.

Water should not be permitted to remain in the glazing rabbet. A weep system should incorporate enough weep holes to ensure adequate drainage; usually this consists of three $^{3}/_{8}$ in. diameter holes or equivalent, equally spaced at the sill (Figure 2).

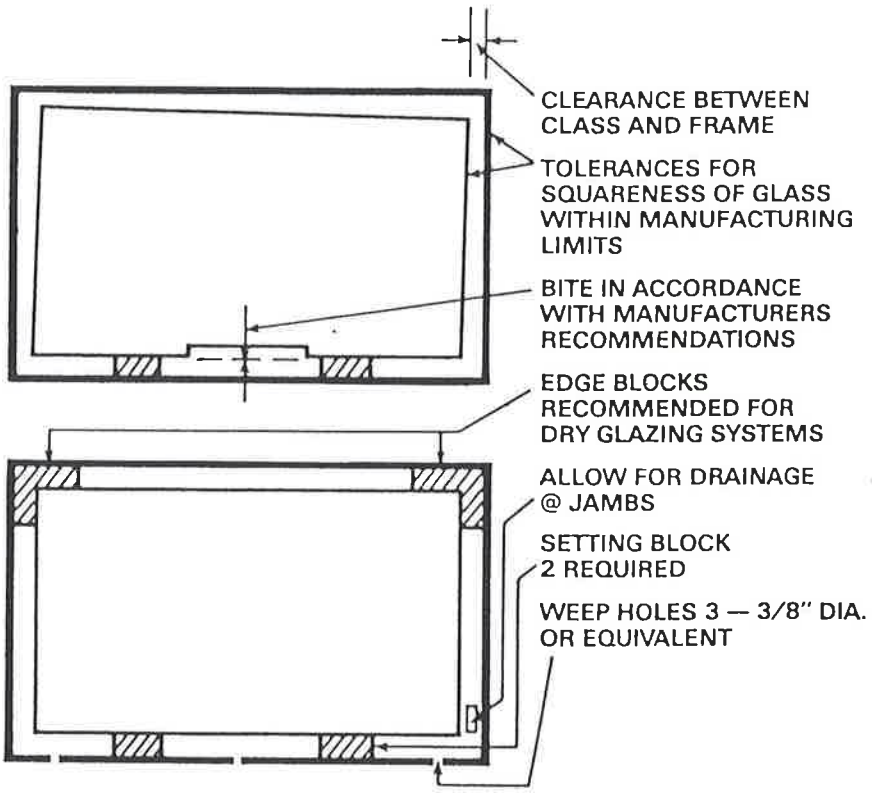



*figure 3. clearances, shims, drainage*

## Glazing System Performance Consideration

The glazing system must have the capability of transferring wind and impact loads to the surrounding structure while cushioning the glass. It must accommodate thermal expansion and contraction of the frame and glazing materials and accommodate temperature differentials caused by various adjoining material, shading patterns and shading devices. It must also have the ability to prevent water penetration, prevent or minimize air infiltration or exfiltration, and create thermal barriers to prevent heat loss through the frame and condensation on the frame.

At the same time, the system must also present an appearance consistent with design goals and retain its appearance and function over the anticipated life span of the building, given the maintenance program planned. Finally, the glazing system must match any special performance required of the rest of the glazing components.

Considerations that may influence the choice of glazing systems include the initial and replacement costs, and the workmanship available, since wet systems require better workmanship. The location of the glazing joints may also have an influence. These are, from least to most demanding: completely interior, interior joint or exterior light, protected interior and exposed exterior.

The choice of glazing system can also be influenced by the glazing or

sealant materials used. Tinted and reflective coated glass can heat sealants to high temperatures. Reflective glass also increases intensity of ultraviolet radiation on exterior cap beads. Polysulfides, polyurethanes, and silicones are generally well suited for severe conditions; acrylics and butyls can be used in less demanding locations. Polysulfides, polyurethanes, and silicones can withstand more joint movement than acrylic or butyl based sealants.

The location of sealant bead in glazing joint is also important:

- **Cap bead** - expected to provide primary weather seal, therefore its adhesive strength, weather resistance, and movement capability will be major properties to consider;
- **Toe bead** - applied on exterior side of channel before glazing material is installed; provides a secondary seal under cap bead or preformed tape; weather resistance is less critical but adhesive and movement capabilities remain important.
- **Heel bead** - applied on interior side after glazing material is installed; provides a seal at removable stop; same considerations as those for toe beads.

Solvent release butyls, acrylics and acetic acid liberating silicones should not be used when they come in contact with insulating glass units, as the sealant may not be compatible with the sealing material used for the insulating glass units. The sealant supplier and the glass supplier should be contacted to determine specific compatibility recommendations.

## Installation Considerations

Most sealants cannot be installed below 40 F. Silicones can be applied at very low temperatures (-20 F) with proper precautions. Acrylics may require warming if temperatures is below 60 F. If the sealant bead is installed on a hot day, it will be in constant tension during cold weather. If installed on a cold day, the bead will be in constant compression during hot weather. Ideally, the sealant should be installed at a temperature about halfway between the extremes. Tack free time affects the time available for tooling and clean up. If the new sealant bead must attain properties quickly to withstand wind loads or thermal movement, setting or full cure time will be important and fast curing sealants should be considered.

The basic concept in glazing systems to deal with the requirements cited is floating the glazing material within its frame by means of setting blocks placed under the bottom edge of the glass and spacer shims to ensure proper clearance between the face of the glazing material and the framing channels.

## Common Causes of Glazing Failures

These are the most common causes of glazing failures:

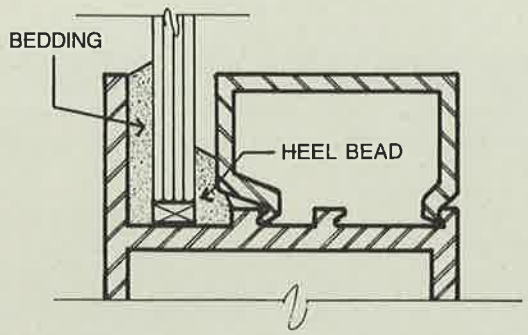
- Installation at temperatures below 40 F.
- Failure to properly seal miter and butt joints.
- Sash rabbet not clean and free of contamination.
- Lateral shifting or walking of glass.
- Failure to properly bed, cushion or center the glass.
- Improper glazing system used, one that is not suited to the sash design or building conditions.
- Setting blocks used incorrectly or not at all.
- Frames or surrounds out of plane, improperly anchored and/or out of square.
- Lack of or improper positioning of spacers or edge blocks.
- Damage to sash, rabbet or stops.
- Incompatibility of sealants.

*Excerpted from "Architectural Glazing Practices" which appeared in the September 1985 issue of* ASTM Standardization News, *a publication of the American Society for Testing and Materials and used with permission. Mr. Robert G. Spindler is Director of Sales and Marketing for Cardinal IG.*

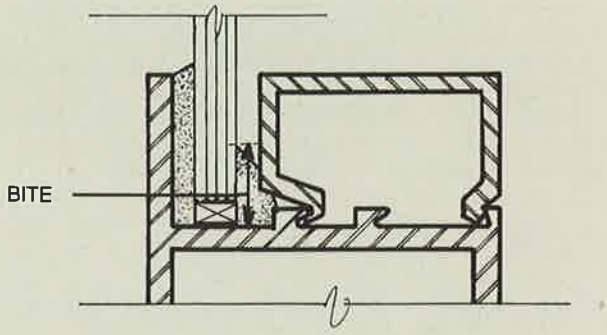
Hoffmann Architects

# Glossary of Glazed Curtain Wall Terms

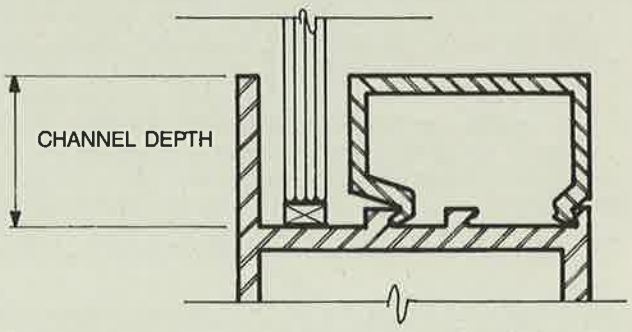
**Acrylic** - A group of water white thermoplastic resins formed by polymerizing the esters of the acrylic acid.
**Adhesion** - The ability of a coating or sealant to stick or bond to the surface to which it is applied.
**Adhesive Failure** - Failure of a compound by pulling away from the surface with which it is in contact.
**Angle Bead** - A bead of compound whose cross section is triangular shaped with the hypotenuse side exposed. Also called fillet.
**Annealed Glass** - Normal glass that is basically free of residual internal stresses so that it can freely cut. Annealed glass will fracture into jagged shards when broken.
**Annealing** - A process of slow cooling during curing which removes internal stress inherent in the material.
**Anodize** - To coat aluminum with an oxide coating by electrolytic action. May include dye materials as colorants.
**Backer** - A material placed into a joint primarily to control the depth of the sealant.
**Bead** - Sealant after application in a joint irrespective of the method of application, such as caulking bead, glazing bead.




**Bed or Bedding** - The bead of compound applied between light of glass or panel and the stationary stop or sight bar of the sash or frame, and usually the first bead of compound to be applied when setting glass or panels.
**Bent Glass** - Flat glass that has been shaped while hot into a cylindrical or other curved shape.
**Bite** - Amount of overlap between the stop and the panel or light.
**Block** - A small piece of lead, neoprene, or other suitable material used to position the glass in the frame.
**Bow and Warp** - The departure from flatness normally inherent in tempered glass from the manufacturing process. They are measured while the glass is resting on a flat surface with the concave side down.
**Break Pattern** - The resultant geometric pattern formed by the cracks within an individual glass light when it is broken. (also called fracture pattern)
**Butt Joint Glazing** - Method of installing glazing where the glazing is held at the head and sill by conventional methods, and the vertical edges are sealed with a silicone sealant. No vertical framing members are used between lights.
**Buttering** - Application of putty or sealant to the flat surface of a member before placing the member in position, such as buttering a removable stop before fastening the stop in place.
**Butyl** - Synthetic rubber formed by the co-polymerization of isobutylene with isoprene.
**Cap Bead** - Bead of compound applied so as to have a slanted top surface that will drain water away from the glass or panel. (also called beveled bead)

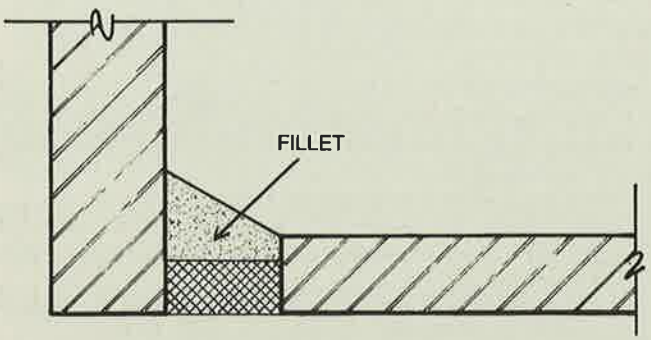



**Ceramic Frit** - A colored reflective coating fused to a glass panel (usually spandrel panels) during the heat-treating process.
**Channel** - A three-sided, U-shaped opening in sash or frame units in which the light or panel is retained by a removable stop. Contrasted with a rabbet which is an L-shaped opening.
**Channel Depth** - The measurement from the bottom of the channel to the top of the stop, or measurement from the sight line to the base of the channel.
**Channel Glazing** - The sealing of the joints around lights or panels set in a U-shaped channel employing removable stops.
**Channel Width** - The measurement between stationary stops (or stationary stop and removable stop) in a U-shaped channel.
**Cladding** - Material used as skin of curtain wall.
**Clips** - Wire spring devices used to hold glass in rabbeted sash without stops, and face glazed.
**Cohesive Failure** - Splitting and opening of a compound resulting from over-extension of the compound.

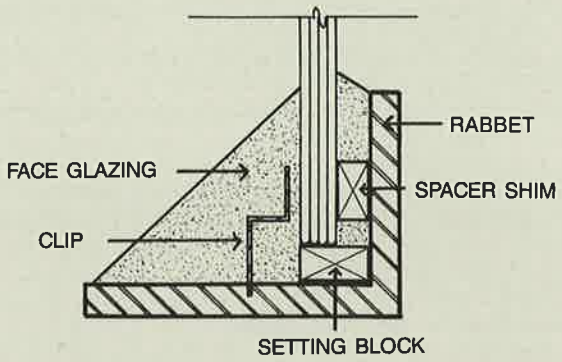



**Compatibility** - The ability of two or more materials to exist in close and permanent association for an indefinite period with no adverse effect of the one on the other.

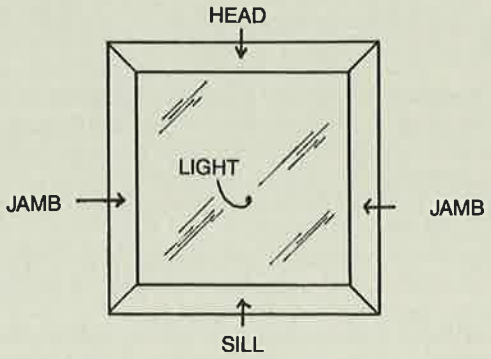
**Compound** - A formulation of ingredients, usually grouped as a vehicle or polymer, pigment, and fillers, to produce caulking compound, elastomeric joint sealant, glazing putty, etc.
**Compression** - Pressure exerted on a material that tends to squeeze it.
**Curtain Wall** - A non-bearing wall built between piers or columns that carries no structural loads except its own weight.
**Dry Glazing** - Installing lights using extruded rubber gaskets or closed cell sponge as one or both of the glazing seals.
**Durometer** - A device used to measure hardness. Also a word used to describe the hardness of a material.
**Exterior Flush Glazing** - Glazing installed outside the structural frame of the building and attached on all four sides to the framing system by means of sealants. (also called structural glazing or stopless glazing.)
**Exterior Glazed** - Glass set from the outside of the building.
**Exterior Stop** - The removable molding or bead that holds the light or panel when it is on the exterior side of the light.
**Face Glazing** - On a rabbeted sash without stops, the triangular bead of compound applied with a glazing knife after bedding, setting and clippingt the light in place.




**Fillet** - A bead of compound whose cross section is triangular with the hypotenuse side exposed. (also called angle.)
**Float Glass** - Glass composed of silica sand and added alkaline salts made by floating a continuous stream of molten glass onto a bed of molten tin.
**Front Putty** - The putty forming a triangular fillet between the surface of the glass and the front edge of the rabbet.
**Gasket** - Pre-formed shapes of rubber or rubber-like composition, used to fill and seal a joint or opening either alone or in conjunction with a supplemental application of a sealant.
**Glazing** - The act of securing of glass in prepared openings.
**Gun Consistency** - Compound formulated in a degree of softness suitable for application through the nozzle of a caulking gun.
**Head** - The top of a window or door.
**Heat Strengthened Glass** - Glass strengthened by subjecting annealed glass to a special heat treating process. Not considered a safety glass because it fractures in the same patterns as regular annealed glass.
**Heat Treated** - Indicates that the glass has been treated to create compression stresses in the surface.
**Heel Bead** - Compound applied at the base of channel, after setting the light or panel and before the removable stop is installed. One of its purposes is to prevent leakage past the stop.
**Insulating Glass Units** - Multi-paned glass units consisting of two or more panes of glass that enclose a hermetically sealed air space.
**Interior Glazed** - Glass set from the interior of the building.

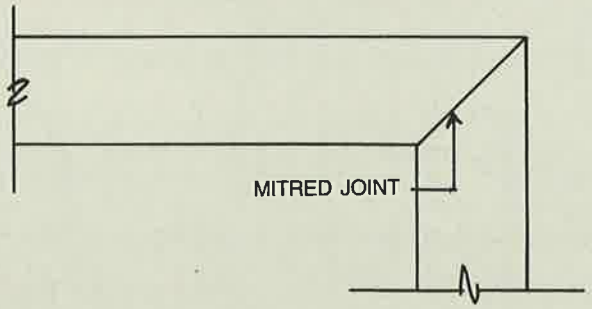



**Interior Stop** - The removable molding or bead that holds the light in place, when it is on the inside of the light.
**Jamb** - The two vertical members of a window or door sash. See also Reveal.
**Kink** - An abrupt deviation from a flat plane or normal bow contour, most commonly found near an edge of a piece of tempered glass. A kink is always localized as compared with bow or warp.
**Knife Consistency** - Compound formulated with a degree of hardness suitable for application with a glazing knife.
**Laminated Glass** - Two or more plies of glass sandwiched with clear or tinted polyvinyl butyl, a plastic, between them.
**Lateral Shims** - Material used to center the light laterally within the glazing rabbet.
**Light** - Another term for a pane of glass used in a window or curtain wall.

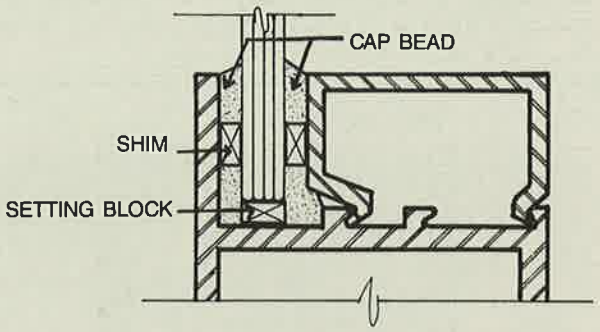



**Lock-Strip Gasket** - A synthetic rubber gasket designed to engage the edge of glass or other sheet material in a surrounding frame by forcing an interlocking filler strip into a pre-formed groove in the face of the gasket. (also called zipper or structural gasket)
**Mastic** - Heavy consistency compounds that may remain adhesive and pliable with age.
**Methacrylate Lacquer** - A temporary protective coating applied to aluminum panels in the factory to protect against damage during shipping.

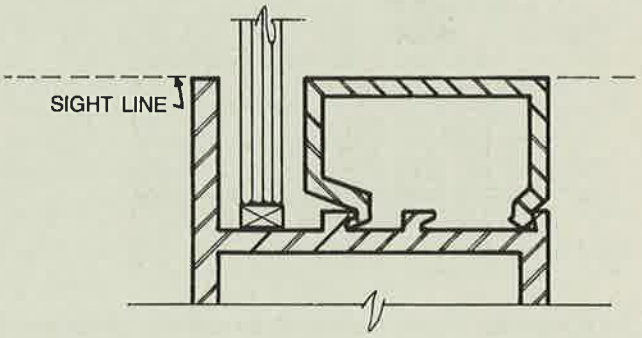
**Mitred Joint** - A 45 degree joint where horizontal members meet vertical members in a sash.
**Mullion** - A vertical member that supports and holds two adjacent units of sash, glass, panels or sections of curtain wall.
**Muntin** - Bars that divide the window into smaller lights of glass or holds panes of glass within a window, window wall or glazed door.
**Neoprene** - A synthetic rubber having physical properties closely resembling those of natural rubber, but not requiring sulphur for vulcanization.
**Panel System** - A type of curtain wall system that is similar to a unit system except that panels are homogeneous stamped or cast metal, masonry, or concrete monoliths.
**Plate Glass** - A high quality glass sheet of the same chemical composition as sheet glass, but both faces are ground flat and parallel and then are polished.
**Polycarbonate** - Plastic sheet used as glazing material, often in skylights.
**Polysulfide** - A synthetic rubber used for sealing glazing joints.
**Polyurethane** - A synthetic rubber used for sealing building joints.




**Pressure Wall** - A wall assembly in which the units are all held in place through pressure applied by tightening bolts or clamps with gaskets.
**Pyrolytic Deposition** - A method of coating glass by applying the metallic oxide to hot glass in a heat strengthening oven or float glass line.
**Rabbet** - A two-sided, L-shaped recess in sash or frame to receive lights or panels. When no stop or molding is added, such rabbets are face glazed. Addition of a removable stop creates a channel.
**Racking** - Movement or distortion of sash or frames due to lack of rigidity.
**Rainscreen** - Waterproofing system that works by negating the water driving force of wind by equalizing air pressure on either side of joints.
**Reflective Glass** - Clear or tinted glass coated with an extremely thin layer of metal or metallic oxide causing it to reflect a significant amount of the light and heat which strikes it.
**Reveal** - The side of an opening in a wall for a window or door.
**Safety Glass** - Glass so constructed, treated or combined with other materials as to reduce the likelihood of injuries to people when the glass cracks or breaks.
**Sash** - The framework which holds the glass in a window or door.
**Screw-on Bead or Stop** - Stop, molding or bead fastened by machine screws as compared to those that snap into position without additional fastening.
**Sealant** - Compound used to fill and seal a joint or opening, usually by means of a caulking gun but may be pourable.
**Setting** - Placement of lights or panels in a sash or frame. Also, action of a compound as it becomes firmer after application.




**Setting Block** - Small block used to distribute the weight of the glass or panel to the strong points of the sash, aid in the centering of glass or panel and to prevent glass to metal contact.
**Shading Patterns** - Shadows thrown onto partial areas of installed glass which cause differential thermal stresses in the glass.
**Shim** - Small blocks of composition, lead, neoprene, etc. placed under the bottom edge of a light or panel to prevent its settling down onto the rabbet or channel, thus distorting the sealant.
**Shore Hardness** - Measure of firmness of a compound by means of a durometer hardness gauge.
**Sight Line** - Imaginary line along the perimeter of lights or panels corresponding to the top edge of stationary or removable stops.



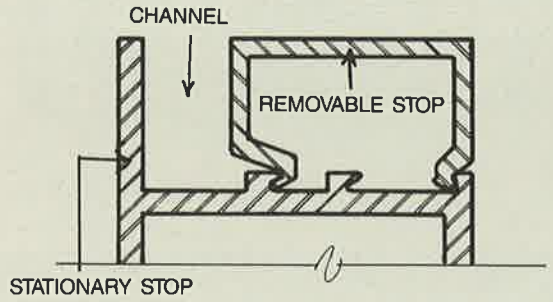

**Silicone** - A synthetic rubber used in sealing glazing joints and adhering exterior flush glazed panels and lights.
**Sill** - A horizontal closure at the bottom of a glazed unit or assembly.
**Sloped Glazing** - Any glazing installed 15 degrees or more from the vertical.
**Spacers** - Small blocks placed on each side of lights or panels to center them in the channel and maintain uniform width of sealant beads.
**Spandrel** - The panel of a curtain wall between adjacent structural columns and between the window sill and the window head below it. Spandrels are usually used to obscure the floor line.
**Spandrel-and-Column-Cover** - Custom designed curtain wall systems where column cover panels are attached directly to the

structural columns and spandrel panels connected to the floor slab, spanning the distance between columns.

**Spandrel Glass** - Heat strengthened or tempered glass with a ceramic frit color permanently fused to the interior surface. Not a vision light.

**Spline** - A thin strip locking two panels together by being inserted into a groove cut into the end of each panel.

**Squareness** - Measurement of the accuracy of the glass dimensions.

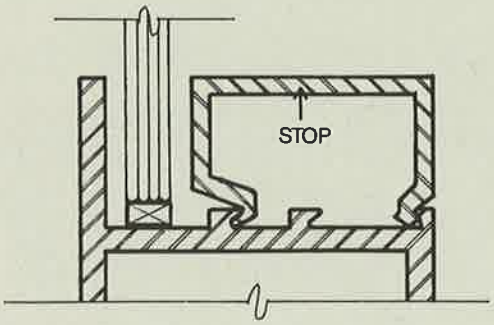



**Stationary Stop** - The permanent stop or lip of a rabbet on the side away from the side on which lights or panels are set.

**Stick System** - Type of curtain wall system made up of vertical and horizontal members that assemble in place on the building.

**Stile** - One of the upright structural members of a frame.

**Stop** - The stationary lip on the back of a rabbet or the removable molding at the front of the rabbet, either or both serving to hold light or panel in sash or frame.




**Tempered Glass** - Glass strengthened by subjecting annealed glass to a special heat treating process that prestresses the glass making it four times stronger than normal annealed glass. Tempered glass will fracture into small pebble size fragments with rounded edges.

**Thermal Break** - A gasket system that separates the outside and inside metal surfaces to reduce the heat flow by conductance through the metal.

**Tinted Glass** - Glass made by adding various colorants to the normal clear glass batch. The color reduces the solar transmittance of the glass by filtering out part of the color spectrum, cuts down glare, and may be used to control ultraviolet radiation and increase heat absorption.

**Toe Bead** - Compound applied at the base of a channel before setting the panel or light, its purpose being a secondary seal to prevent leakage past the exterior stop.

**Ultraviolet** - Short wave length light outside the visible spectrum at the violet end.

**Unit** - Term normally used to refer to one single light of insulating glass.

**Unit System** - Type of curtain wall system that are prefabricated, shop assembled, one story or multi-story units designed to interlock vertically and horizontally. Usually shop glazed.

**United Inches** - Total of one width plus one height in inches.

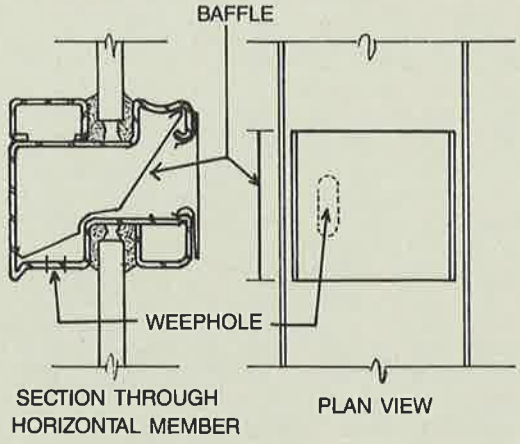
**Unitized Stick System** - Type of curtain wall system that consists of prefabricated vertical mullions and interlocking horizontal members that function like a unit system after installation.

**Vacuum Deposition** - A method of coating glass by means of vacuum chambers and electrical energy.

**Vent** - Provide circulation of air between two partitions.

**Weatherstripping** - A thin strip of material used to cover the joint between the sash and the jamb, casing or sill to keep out rain, air, dust, etc.

**Wedge** - An extruded resilient dry glazing component shaped so as to develop a sloped, finished top.




**Weep** - A small opening in a wall or window to drain water to the exterior.

**Wet Chemical Deposition** - A method of coating glass by precipitating metal from a chemical solution by means of a reagent.

**Wet Glazing** - Installing lights by use of preformed tape, gunnable sealants, putty or glazing compounds.

**Wired Glass** - Glass that has a welded wire netting introduced into molten glass just before rolling.

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# Representative Projects

Specialists in the solution of roofing, masonry, curtain wall and structural problems, Hoffmann Architects recently completed work on the following representative projects.

## Curtain Wall and Facade

The firm prepared construction documents and will assist in the bidding process for roof and masonry restoration at the **Prentice-Hall Building** in Englewood Cliffs, New Jersey.

The **Durst Organization,** a New York City real estate owner, retained Hoffmann Architects to survey the condition of the windows, masonry and curtain wall of the **Random House Building** at 825 Third Avenue in Manhattan.

For the **Rockefeller Center Management Corporation,** Hoffmann Architects prepared construction documents and administered the construction contracts for curtain wall rehabilitation at the **Warner Communications** and **Eastern Airlines** buildings.

825 Third Avenue in Manhattan

Another **Rockefeller Center** project involves rehabilitation of the limestone facade of the **Exxon Building.** Hoffmann Architects completed construction documents and will administer the construction contract for repair of the stonework, resealing of the joints and cleaning of the limestone. The building is owned by **Mitsui Fudosan (New York) Inc.**

Hoffmann Architects is preparing construction documents and administering the contract for an exterior rehabilitation project involving repointing, sealing, painting and window repair of a **Southern New England Telephone** facility in New Haven, Connecticut.

## Roofing

For the **Schering-Plough Corporation,** Hoffmann Architects surveyed the roofs of 5 buildings in Bloomfield, New Jersey.

In White Plains, New York, the firm surveyed the condition of the roof of a **General Foods Corporation** facility.

For **Union Carbide Corporation,** Hoffmann Architects surveyed the roof and is preparing construction documents for a facility in Moorestown, New Jersey.

*Journal is a publication of Hoffmann Architects, specialists in investigative and rehabilitative architecture/engineering, including the analysis and solution of roofing, exterior wall, glazing and structural problems.*

*We welcome contributions to HA/J from our clients and friends. Please send news, technical information, address changes or requests for free subscriptions to Ann Prokop, Hoffmann Architects/Journal at 432 Washington Avenue, North Haven, Connecticut 06473.*

# Some Precautions in Specifying Low-E Glass

**By Donald Vild, PE**

Low emittance (Low-E) coatings offer major improvements in the thermal performance of insulating glass units. But there is a potential pitfall that is often overlooked.

Low emittance coatings for glass have been available for 40 years or more. Unfortunately, they tended to have distinct, unpleasant colors by reflection, often with severe variations. Within the past decade, improvements have been made in the aesthetic quality of the coatings. The color is subtle, often unnoticed, and uniform. This has caused a rapid growth in the use of Low-E coatings in insulating glass units.

The coating is applied to one of the air space surfaces of the glass and reduces the heat transfer by radiation across the air space of the insulating glass unit. Thermally, the result is similar to inserting a blanket of fiber glass in the air space. The outboard glass is closer to outdoor air temperature and the inboard glass closer to room temperature.

Nominally, a double (two panel) insulating glass unit with a Low-E coating will have the same insulating value as a triple (three pane unit) without a Low-E coating. Equal insulating value is achieved at a markedly reduced cost. Insulating glass with a Low-E coating is primarily a residential product. It is furnished on clear glass only, except in rare cases. The coating does little to reduce solar heat gain — the main concern in commercial buildings.


Regardless, its use is increasing in commercial buildings, principally in conjunction with reflective and heat absorbing glasses. This is where the problem starts. The effect of the coating on glass thermal stresses is ignored.

Based on analysis and practical field experience, certain types of high performance insulating glass units have most often been furnished with both panes of annealed glass. Typical are units with gray, green, or bronze tinted heat absorbing glass as the outboard pane. The maximum edge thermal stress for these types of glass in a wall with no major exterior shading is roughly 2050 psi. Breakage would not be expected. The stress might increase to 2400 to 2700 psi when there is shading from vertical or horizontal projections. At these levels, breakage would be minimized if the glass cutting is proper and the edges are not seriously damaged. Field experience has supported this.

## The pitfall

However, when a Low-E coating is included, the outboard sunlit glass will reach a higher maximum temperature

than without the coating, all other things being equal. This increases the edge thermal stresses and the potential for thermal stress breakage.

For insulating glass units with heat absorbing glass, the stress increases to roughly 2400 psi for a flush wall and to a range of 2800 to3200 for a wall with shading from projections. This assumes that the coating adds no absorptance to the glass. For most types of Low-E coatings, their absorptance will add 200 to 300 psi to the stresses.

It is generally agreed that an edge thermal stress of 3000 psi is the upper working limit for annealed glass. Above this value, thermal breakage is possible. If thermal breakage is to be prevented, annealed glass may have to be heat-strengthened when a Low-E coating is applied. Examples for many reflective coated glasses used in combination with a Low-E coating lead to the same conclusion.

**Two basic precautions to follow:**

a. Do not assume that glass products that have historically been furnished with annealed glass will not be affected by a Low-E coating.

b. Require that a thermal stress analysis be furnished by the glass manufacturer or fabricator. Be certain that the analysis addresses the shading patterns that may occur on the building. □□■□

*Reprinted from* EXTERIORS *magazine, Winter 1988. Used with permission. Donald Vild, PE is with Donald J. Vild Associates, Oregon, Ohio.*

# Window Standards Alert

In 1985, the American Architectural Manufaturers Association (AAMA) introduced a voluntary standard for aluminum prime windows. In 1988, AAMA updated those standards and as of June 30, 1989, all certification tests will be to those standards.

Thermal transmittance and condensation resistance have been added, but are optional. "U-Value Classes" have replaced the Roman numeral designations formerly used by AAMA. "CRF Classes" have been added to enable the specifier to select windows that will not have an objectionable amount of condensation based on outside temperature and indoor relative humidity factors, also replacing Roman numeral designations. A specification for "Dual Action" windows has been added. Dual Action windows are those that may be opened two different ways at the user's option.

Wind load tables have also been revised to reflect an upgrading of Design Pressure from 1.1 to 1.25 times the Wind Velocity Pressure. In some combinations of wind speed and height, this may require changing the window specification to the next highest Performance Class designation compared to the old standard. Several Area Factors in the Glass Table have been increased. Area factors are factors by which the tabulated maximum glass area may be multiplied to take into account the strength of various types of glass.

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# staff news

## Staff News

**Jane B. Beaudry** and **Frank B. Scherr,** associate members of AIA, are participating in the National Council of Architectural Registration Board's (NCARB) Intern Development Program.

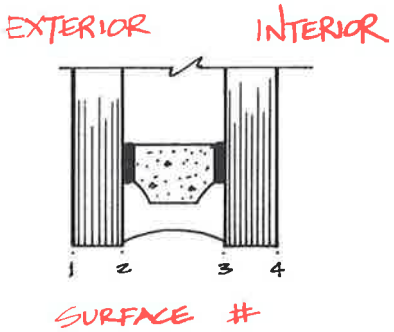
**Brian W. Schafer** has been appointed to the Membership Development Task Force of BOMA New York.

**Richard P. Kadlubowski** and **Jane B. Beaudry** recently completed CADD training for the firm's new CADVANCE computer aided design and drafting system.

Hoffmann Architects is pleased to announce the addition of three new staff members. They are **Ernest E. Swanberg, AIA,** who joins us as senior architect, **Scott D. Chamberlain,** drafter/project representative, and **Malik M. Nawaz,** also drafter/project representative.

## Glazing Surfaces

Which glass surface in an insulating glass unit is considered the No. 1? For architectural glass materials, the glass surfaces are counted from the outside in. Therefore, the No. 1 surface is to the exterior of the building. This becomes extremely important when specifying coated glass for multiple glazing applications, since where the coating is located affects its usefulness.




## We've Moved!

Hoffmann Architects is pleased to announce its move to new offices at 432 Washington Avenue, North Haven, Connecticut 06473. Our new phone is (203) 239-6660.

Hoffmann Architects
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ADDRESS CORRECTION REQUESTED