



Technical Bulletin

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Handling, Inspecting, Fabricating & Glazing Pilkington **Eclipse Advantage™** Low-E Glass

Summary

Pilkington recommends the following handling, inspecting, and fabricating guidelines for:

Pilkington **Eclipse Advantage™** Low-E Clear, Blue-Green, Bronze, Grey, EverGreen, and Arctic Blue glass. Although individual fabricating conditions will vary, the guidelines in this bulletin offer an excellent starting point for optimizing typical operations.

Pilkington **Eclipse Advantage™** Low-E Glass can be glazed monolithically, or incorporated into an insulating glass (IG) unit, with the reflective coating on the #2 (room side) surface of the outer light. It is not intended for use on the #1 surface of single glazing or IG, and it is not intended for use on the #3 surface of an IG unit. When laminated, the coating should not be touching the pvb interlayer in order to preserve its thermal performance values.

Pilkington **Eclipse Advantage™** Low-E Glass can be opacified for use in spandrel panels with typical Flourine-free ceramic frits or water based Silicone opacifiers applied to either the glass or reflective surfaces. Note, applying opacifiers to the coated surface will change the appearance by reducing its reflectivity, and will mask the Low-E property.

GLASS HANDLING

Care should be taken to avoid excessive contact with the coated surface.

Pilkington **Eclipse Advantage™** Low-E Glass should be cut, washed, and generally processed with the reflective coated surface facing up. Note heat treatment (see below) can be with the coating down against clean rollers.

INSPECTION

It is the responsibility of the fabricator to carefully inspect Pilkington **Eclipse Advantage™** Low-E Glass, both before and after washing, as well as before any further fabrication. Glass not rejected by the fabricator during inspection prior to fabrication will be considered acceptable by Pilkington.

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Pilkington **Eclipse Advantage™** Low-E glass should be inspected in transmitted and reflected light, both from the Low-E coated side, and the glass side of the lite.

When inspected in transmitted light, there should be a bright, uniform, diffused light (similar to an overcast sky) behind the glass. The objects which are seen in reflection (walls, ceilings, etc.) on the viewing side of the coated glass should be dark color or matt black and should have low level illumination on them to minimize masking reflections.

When inspected in reflected light the glass should be placed in front of a uniform, dark background to minimize transmitted images and the reflected image of a uniform diffuse light source or uniformly illuminated white wall or screen (similar to an overcast sky) should be visible to the inspector.

UNPACKING

Pilkington **Eclipse Advantage™** Low-E glass is shipped in either standard cases or stoces. Like other Pilkington glass products, the glass surfaces are protected with a powdered interleaving material that resists moisture staining and abrasions between individual lights. Pilkington **Eclipse Advantage™** Glass should never be removed from cases by "end opening" the case since sliding glass surfaces past each other may damage the reflective coating or the glass surface.

Pilkington **Eclipse Advantage™** Low-E Glass can be handled with suction cups. The cups must be clean and dry to prevent damage to, or marking of, the reflective surface. The cups should not be slid across the reflective surface.

CUTTING

Stock Sheets

The fabricator is responsible for cutting stock sheets to eliminate imperfections from the finished cut piece.

Standard procedures used in cutting ¼" (6 mm) float glass should be practiced. All stock sheet edges must be trimmed a minimum of 1" (25 mm) to obtain a clean-cut edge. Special care should be exercised in cutting to avoid sliding tools over the reflective surface.

Pilkington **Eclipse Advantage™** Glass should be cut with the coated side up to eliminate coating damage that could result from glass particles on the cutting table.

Cutting oils should be light, evaporating lubricants such as "Low Odor Base Solvent" No. 529-66 available from Ashland Chemical, Charlotte, NC, phone: 800 522 1409. Keep the quantity of cutting oil to a minimum to reduce contamination of gloves and to allow easier washing the coated surface.

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WASHING

Pilkington **Eclipse Advantage™** Low-E Glass has a pyrolytic slightly reflective low-e coating. As with any coated product, care should be taken while washing the glass to prevent damage to the coating. The following recommendations are for washing coated glass:

Mechanical Washing

Pilkington **Eclipse Advantage™** Low-E Glass should be washed, with the coating side up, in a rotating drum brush flat glass washing and drying machine. Pilkington recommends using a detergent solution of hot 50-60°C (120 to 140°F) clean water and a commercial detergent designed for glass washing. The final rinsing should be with clean deionized water heated to at least 43°C (110°F). As with all washing machines, either the water should be changed on a routine basis or a continuous overflow system should be used. Drying air should be filtered and controlled in such a manner so as not to leave water droplets on the glass surfaces. Polypropylene brush rolls are recommended for glass washing machines. Nylon brushes must be properly adjusted to avoid the possibility of coated surface damage. When selecting the proper brush for washing Pilkington **Eclipse Advantage™** Low-E Glass, consider that polypropylene brushes usually have a lower coefficient of friction, and are softer, and more flexible than nylon. Brush height settings should be such that only the bristle tips sweep the glass surface, rather than the sides of the bristles, uniformly across the glass width.

Do not allow the glass to remain stationary under rotating brushes.

It is recommended that a test light be run through the washer before starting production. The glass should then be inspected, in transmission and in reflection, with a bright spotlight close to the reflective surface, to determine if brush and/or air drying adjustments are needed. If abrasive materials are trapped in any washing equipment, abrasion damage to the glass can occur.

Hand Washing

Pilkington **Eclipse Advantage™** Low-E Glass can be cleaned and maintained by hand washing with non abrasive cleaners. For hand washing Pilkington **Eclipse Advantage™** Low-E Glass, a mild detergent and water solution is recommended. Uniformly apply the solution to the glass and wash with a clean, soft cloth, sponge, or pad. Rinse thoroughly with clean water and wipe or squeegee dry immediately. Make sure no metal parts of the cleaning equipment touch the coated glass surface, and that no abrasive particles are trapped between the glass and the cleaning materials. Do not use HF (Hydrofluoric) acid, harsh chemical cleaners, abrasives, steel wool, or razor blades on the Pilkington **Eclipse Advantage™** Low-E coated surface.

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LAMINATING

Pilkington **Eclipse Advantage™** Low-E Glass can be laminated. However laminating it with the coated surface towards the plastic interlayer will result in: a small but noticeable reduction in reflectivity; an increase in transmission; a small change in reflected color; and an adverse change to the thermal properties (SHGC and U-Factor) by masking the low-e effect.

It is recommended that each laminator conduct in-house adhesion tests, prior to actual production, to determine if an adequate bond to the coated surface has been obtained.

The LBNL Optics 5 and Window 5 programs can be used to compute laminated performance with the coating facing air. See ATS Bulletin #171.

HEAT TREATMENT

Heating

Pilkington **Eclipse Advantage™** can be heat strengthened, fully tempered or bent, after it is cut to size. (Please refer to ATS Bulletin #177 for bending details). Pilkington recommends that Pilkington **Eclipse Advantage™** be properly cleaned and dried prior to heat treating. The glass should be visibly clean at this stage to eliminate hand prints, fingerprints or other marks, which could be burnt into the surface during heat-treating. The Low-E coating can be facing up or down when heat treating in a horizontal furnace. If the furnace rollers are clean, the glass can be processed with the coating down.

As with all Low-E coated glasses, when the coating is facing up, it will reflect radiant heat and so will require a longer furnace cycle time to achieve the same uniform temperature as for uncoated glass of the same tint and thickness. Note that with the coated side facing up, the bottom surface will run hotter and the glass will need to be watched for roller marking or center-rub ('Skunk Stripe' or 'Belly Rub') from temporary, concave surface up, warping during heat-up.

Coating Facing Down

With the coating facing down, a more rapid heating of the glass may be achieved by thermal convection, and conduction from the hot rollers, to the lower surface, and by radiation heating to the top surface. However, care must be taken to prevent marking from the furnace rolls, and the load and unload conveyors. The glass should not be slid over stationary machine parts (rollers, castors, etc.) when the coating is facing down. With the coating down, the furnace cycle time will be close to that of an un-coated glass of the same tint and thickness. If the fabricator is experienced at heat treating ¼" (6 mm) Pilkington **Optifloat™** Clear, then those furnace and quench settings make an excellent starting point for processing Pilkington **Eclipse Advantage™** Clear test lights, with the coating down against clean rollers. The effective radiant temperature of the furnace will determine the actual heat transfer to the glass. Individual furnaces will have different heating characteristics. Use a slightly shorter time (about 10 seconds shorter than the time for clear glass) for tinted Pilkington Eclipse Advantage™ Low-E Glass with the coating facing down because the near-IR absorption of the

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tinted substrate glass will allow the product to heat up faster in the furnace. Pilkington **Eclipse Advantage™** Grey absorbs more near-IR than Pilkington **Eclipse Advantage™** Bronze or Blue-Green and should be run on a cycle time about 15 seconds less than Pilkington **Eclipse Advantage™** Clear. Similarly, the high performance tinted Pilkington **EverGreen™** and Pilkington **Arctic Blue™** glasses will cause these Pilkington **Eclipse Advantage™** products to absorb heat even faster in the furnace and so the heating cycle time should be further reduced (about 20 seconds less than the cycle time for Pilkington **Eclipse Advantage™** Clear glass).

Coating Facing Up

A very rough rule of thumb for heating non-coated clear glass for tempering is: 1 second in the furnace for each 0.001 inch of thickness. i.e. 6 mm (0.222") glass will require about 3 ½ minutes heating time. Individual furnace times will differ.

For Pilkington **Eclipse Advantage™** Solar Control Reflective Low-E Glass, with the coating up, the furnace cycle time may need to be 15%, or more, greater than that for non-coated glass of the same tint and the same thickness to achieve adequate heating.

If the fabricator has no previous experience in heat treating glass, Pilkington recommends a furnace setting of approximately 670°C (1240°F) and a heating cycle time of 240 seconds as the starting point for Pilkington **Eclipse Advantage™** Clear test lights.

¼" (6 mm) Pilkington **Optifloat™** Blue-Green, Bronze, Grey, EverGreen or Arctic Blue tinted glass furnace settings can be used as starting points for those tinted glasses with Pilkington **Eclipse Advantage™** Solar Control Reflective Low-E coating. With the coating is facing up, the furnace cycle time may need to be 15%, or more, greater than that for non-coated glass of the same tint and the same thickness to achieve adequate heating.

The use of 'aspirators' in a furnace increases forced convection heat transfer and reduces the heating cycle time with Low-E coated glass facing upwards.

Uniform top and bottom surface heating with temperable Low-E glass is best achieved with forced convection furnaces.

Remember: the rate of feeding cold glass (individually or in continuous batches) into a hot furnace will have more effect on the glass temperature reached in the heating cycle than the presence or absence of the Pilkington **Eclipse Advantage™** Solar Control Reflective Low-E coating.

Since each furnace is unique, individual furnace time and/or temperature adjustments will be required.

Quenching

The forced convection heat loss during the quenching part of the tempering process is little affected by the presence of the coating, though there is some initial difference in radiant heat flow rates from top and bottom surfaces when the glass is hot. This can cause some concave up shape, or edge curl, if the low-e coating is facing up as the top surface will be slower to cool. Normal air flow adjustments may be required to prevent bowing (increase top surface air

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quench flow for Low-E coating facing up) and obtain an acceptable break pattern if the glass surfaces are not at the exact same temperature as uncoated glass of the same thickness.

Optical distortions such as bow, warp, ripple, or roller wave are inherent in all heat treated glass products. Reflective glass accentuates these distortions. Care must be taken not to overheat Pilkington **Eclipse Advantage™** Low-E Glass. Overheating the product will cause excessive visible distortion and could damage the coating. If excessive distortion or coating damage is experienced, a cooler glass temperature during the heat treating process will be required. This is best achieved by shortening the furnace cycle time rather than changing top and bottom furnace temperature settings. Note that at no time should the glass temperature exceed 640°C (1185°F).

Sample lights of Pilkington **Eclipse Advantage™** glass should be tested to ensure compliance with applicable safety standards and inspected for distortion prior to starting production.

Confirmation that Pilkington **Eclipse Advantage™** glass will meet or exceed all applicable safety glazing standards is the responsibility of the fabricator.

Note that heat-treated (tempered or heat strengthened) glass can often show a soft dappled shadow pattern from the furnace quench air when viewed in polarized (blue sky) light (see ATS #157 for details). The higher daylight transmitting glasses (Clear, Blue-Green, EverGreen and Arctic Blue), with a reflective coating, will show this phenomenon more readily.

OPACIFICATION

Samples must be viewed for change of coating reflectivity and color when opacified on the coated surface.

Water based spray silicone materials, in a wide variety of colors, have been successfully used on the Pilkington **Eclipse Advantage™** Low-E coating as opacifiers. As with all construction products, the material supplier should be asked to supply adequate proof of long term durability.

Pilkington **Eclipse Advantage™** Low-E glass can have fluorine-free ceramic frits or enamels applied to the glass side, or the Low-E coated side. A test piece should be run with the desired frit to ensure satisfactory results. The glass can be successfully processed with the coating facing down provided the furnace rollers are clean and there is no sliding or skidding of the glass on the rollers due to excessively rapid speed changes or travel direction reversals.

SPANDREL GLASS

Pilkington recommends that, in general, glass be heat-treated when used in spandrel applications.

In double glazed spandrels the type of heat treatment required can vary depending on whether the glass is used as an inner or outer lite. Heat Strengthened (HS) glass will generally supply

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adequate resistance to thermal stress in the outer lites of an IG spandrel, even though it is only half as strong as Fully Tempered (FT) glass. HS glass is often recommended over FT because of the reduced risk of spontaneous breakage which is occasionally seen in FT glass. HS glass may also show less reflective distortion, though it will probably not have any less quench pattern (visible in polarized light). Note that HS glass is not a "Safety Glass" and, if broken, its pattern resembles that of ordinary annealed glass.

Fully tempered glass may be required for the inner lite of an IG spandrel. This is because the added insulation behind a spandrel panel will mean that the inner lite is more severely stressed by solar radiation than the outer lite, plus it will be somewhat weakened by the addition of a ceramic frit opacifier. FT inner lites are generally recommended when a relatively high solar transmitting outer glass, such as Pilkington **Eclipse Advantage™** Clear, is used with a low emissivity coating on surface #2 or #3. This combination can readily create inner glass temperatures well over 100 °C (212 °F) in still air conditions, even with outside air temperatures at freezing or lower.

For optimum uniformity between vision and spandrel glass, Pilkington **Eclipse Advantage™** spandrels should be fabricated by constructing an insulating glass (IG) unit similar to the vision unit, with the reflective coating on the same surface (typically #2) as the vision units, and with a medium or dark grey color ceramic opacifier applied to the #4 surface of the IG unit.

Using heat-treated insulating glass with opaque ceramic enamel on the #4 surface (room-side) will eliminate read-through, minimize banding effects, and ensure a stable spandrel design. In order to withstand the high temperatures in spandrel panels the insulating glass sealants used should at least meet a high performance standard such as IGCC Level "A". See: ATS Bulletin #124.

Pilkington acknowledges that a number of factors make it impossible to achieve complete visual uniformity between vision and spandrel glass areas. See mock-up recommendations below.

INSULATING GLASS

When Pilkington **Eclipse Advantage™** glass is used on the #2 surface of insulating glass units, no edge deletion of the reflective coating is required. Test results to date indicate that Pilkington **Eclipse Advantage™** is compatible with typical polysulfide, urethane and silicone IG sealants. The fabricator of Pilkington **Eclipse Advantage™** has the ultimate responsibility of testing to ensure that the proper sealant is used for each application. Specific questions concerning compatibility should be directed to, and confirmed with, the individual sealant manufacturers.

STRUCTURAL SEALANT GLAZING

Structural sealant glazing allows for a clean, unobstructed, exterior building appearance when compared to traditional glazing methods which capture the glass edges in a frame. Because Pilkington **Eclipse Advantage™** Clear, Blue-Green, EverGreen and Arctic Blue have higher daylight transmittances, some "read through" of the insulating glass sealant and the structural seal may be visible under certain lighting conditions when structural sealant glazing systems are used.

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GLAZING CONSIDERATIONS

Pilkington **Eclipse Advantage™** Solar Control Reflective Low-E products are not intended for use in #1 surface installation. It is preferable to glaze Pilkington **Eclipse Advantage™** products with the coating on the #2 surface.

If the high reflectivity of a #1 surface coating is desired, it can be readily achieved by using Pilkington **Eclipse Advantage™** Clear glass with the coating on the #2 surface. This gives the required polished silver appearance, because the coating is on a clear glass rather than a tinted one, while having the ease of normal glass maintenance.

Pilkington **Eclipse Advantage™** glasses have a higher solar reflection and a lower solar absorption than many competitive glasses, therefore, all the Pilkington **Eclipse Advantage™** tints can usually be annealed glass when single glazed, provided deep, permanent shadows are not partially covering the glass (see ATS #139 for thermal stress analysis), and the glass is properly glazed with clean-cut and undamaged edges. This is unlike most competitive pyrolytic coated products that absorb more solar energy and are usually recommended by their manufacturers to be heat-treated in #2 surface reflective installations. It will often be necessary to heat treat the outer glass in an IG unit with Pilkington **Eclipse Advantage™** Blue-Green, Bronze, and Grey Glass. Please see the Pilkington website Thermal Stress calculator for details.

Pilkington **Eclipse Advantage™** Arctic Blue and EverGreen are very high performance glasses and will typically need heat treatment in most installations to prevent thermal stress breakage when installed in IG units.

MOCK-UP CONSTRUCTION

The construction of a full-scale mock-up is recommended, where the glass can be examined, from both sides, in transmission and reflection. A full-size mock-up, including both vision and spandrel glass, should be constructed and viewed on site, representing the proposed building location and viewing geometry, and should be approved prior to final glass product selection and production. This will show the final installed appearance of the glass far better than viewing small hand held samples under interior lighting conditions.

ECLIPSE ADVANTAGE LOW-E GLASS COATING QUALITY SPECIFICATIONS

Uniformity

When viewed in reflection or transmission, as described above, from a distance of 10 feet (3 m), the coating will not have objectionable, bands, streaks or color differences as detailed in ASTM C 1376-03. "Specification for...Coatings on Glass".

Pinholes

There shall be no single visible spots on the coating greater than 3/32" (2.4 mm) diameter in the outer area, or greater than 1/16" (1.6 mm) dia. in the central area.

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Scratches

There shall be no more than 2 readily apparent blemishes in a 3" (75 mm) dia. circle, or no more than 5 in a 12" (300 mm) dia. circle.

Quality Standard of Base Glass

The base glass shall meet the requirements for "glazing select" quality in the ASTM C 1036 01. Optical Properties of Pilkington **Eclipse Advantage™** Solar Control Reflective Low-E Glass may be found in the current edition of the Product Brochure available on our website at: www.pilkington.com/na

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