NSG GROUP

Technical Bulletin

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PROTECTING FLAT GLASS SURFACES

Summary

Flat glass must be protected during shipment and storage. Only by proper handling and storage techniques can the integrity and clarity of the glass be assured before installation (see ATS-112 - "Preventing Moisture Stains on Stored Glass"). After installation, appropriate precautions and proper maintenance are needed for long and trouble free service. This bulletin explores the various causes of glass surface damage, means of prevention, and methods of identification and removal of stains.

The specific cause of glass surface damage can be difficult to diagnose, and stain removal is usually costly. Therefore, prevention of such damage is better than any "cure". To prevent glass surface damage, follow the procedures for storage, installation, and maintenance recommended below.

Causes of glass surface damage

Water attack

Once installed, glass can withstand large amounts of water without significant surface damage. However, water can accumulate when there is inadequate separation between lites in storage. Small amounts of water trapped in this way can cause surface deterioration. Glass in contact with water enters into a series of complex chemical reactions which create alkaline solutions. The trapped water reacts slowly initially, but with time the reaction accelerates, resulting in a rapidly increasing alkali concentration. The alkaline solution attacks the glass surface by dissolving away surface ingredients which results in hazing and roughness.

Initial attack may cause only faint whitening of the glass surface due to the changes in the glassy silicate structure. At this stage, a light polishing or special chemical treatment would probably restore the glass surface. However the condition worsens with time and the final stages of attack result in permanent decomposition and a further deterioration of the glass surface which is even more visible.

Chemical air pollutants

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Certain airborne chemicals can also deteriorate glass surfaces. While glass is resistant to most acids, even dilute forms of hydrofluoric and phosphoric acids quickly react with silica in glass. A variety of other chemicals can also attack glass surfaces. These substances, when in the form of airborne sprays and mists, can be carried for some distances, not only in industrial, but also in rural and residential areas. Fine solid particulates can break down into destructive compounds when held against glass surfaces by water condensation.

Even water alone can damage the surface of glass. Certain types of hard water, for instance, may leave harmful deposits if allowed to dry on glass surfaces. These deposits can be formed when washing or rinsing the glass, or accidentally by the evaporation of water from such sources as lawn sprinklers. It is difficult or impossible to remove such residue without excessive polishing.

Alkali attack

Building materials and construction methods can cause surface damage to glass. A very common cause of such problems is alkalis being leached from precast concrete panels by rain, or fluorides in the washoff from concrete floors. These materials will stain or etch the glass if allowed to remain for a few days. When this occurs, there is no practical method of restoring the glass surface.

Other sources of damaging alkalis are some lubricants used during installation of neoprene structural gaskets and locking strips. When using lubricants for such installations avoid those containing high levels of alkaline ingredients. The gasket manufacturer should recommend a suitable lubricant.

Potentially harmful alkalis are also sometimes present in marking materials used on glass installations during construction. Such markings are, of course, useful in making the glass more visible, thus reducing accidental breakage. However, the marking materials may stain the glass if they contain alkalis, or if water vapor is allowed to condense on them.

Physical damage

Glass surfaces can be altered by physical abrasion such as scratches and rub marks. These can come during handling, installation and storage. Such damage may be similar in appearance to chemical deterioration; however, the difference can be determined under microscopic examination and various stain removal tests. Further surface damage is accelerated by the abraded glass powder because any moisture present produces strongly alkaline solutions which attack the glass.

On a job site, the welding of metal close to window areas is often necessary and results in sparks which can damage unprotected glass surfaces. The welding sparks which come in contact with the glass surface cause a thermal shock which results in a pitting of the surface of the glass. As well as detracting from the appearance, this pitting reduces the strength of the glass. The reduction in glass strength may have little relationship to the size of the pits since a smaller pit may have vents originating from it which are not visible to the naked eye. In comparison, a much larger pit may only be a relatively harmless smooth spall. A microscopic examination of each pit would be necessary to determine the effect on the glass. Even with such a detailed but unrealistic examination, an assessment of the glass strength reduction would only be speculative.

Metals which oxidize, weathering steel for example, can leave a stain on the glass which is difficult to remove. This oxidation of the steel stabilizes over a period of time, depending on frequency of rainfall and other climatic conditions. However, the washoff from the steel during the initial oxidation can leave a residue of rust (iron oxide) on adjacent materials including glass. It may be difficult to remove this residue from the glass if it is allowed to accumulate.

Hard setting adhesives including many epoxies and hide glues may cause damage to the surface of glass. This is especially true in exterior applications where low temperatures may be encountered. Hard setting epoxies will contract more than glass at low temperatures. This can cause harmful spalling or chipping of the glass surface. Hard setting epoxies may be used as a joint material for applications of glass in the building interior with little chance of this type of damage. Resilient materials which remain soft at low temperatures may perform satisfactorily when used in exterior installations. The adhesive manufacturer should be consulted when glazing sealants and adhesives are to be used on the exterior of a building.

Protection of glass surfaces

To prevent glass surface deterioration, water and chemicals should not be allowed to dry on the glass. This is especially important in storage. Storage areas for glass should be maintained at temperatures and humidities that will prevent water vapor condensation on the glass. Glass should be stored at a nearly constant temperature sufficiently above the dew point to keep the relative humidity always less than 80%.

On a job site, glass should be stored inside a building and should be protected from driving rain. Outdoor storage is always risky because of the strong chance of moisture condensation. Periods of outdoor storage should be kept to a minimum. Glass subjected to cyclic wetting and drying during storage can become stained or etched. This condition can occur during storage at a job site, warehouse, or a customer's cutting area even while the glass is still in the shipping case. Glass stored out of the case should always be stored with interleaving or spacing between individual lites of glass.

Also, it is a good practice for the glazing contractor to caution the general contractor concerning glass surface damage from welding sparks. The general contractor should make sure that all necessary precautions are followed by subcontractors. For more information on storing glass, refer to Pilkington North America, Inc. technical information ATS-112 - "Preventing Moisture Stains on Stored Glass".

Protection of glass on the job site is usually the responsibility of the general contractor. Therefore, it is a good practice for the glazing contractor to advise him that the glass should be washed during and after construction, or until alkalis are no longer leached from other building materials.

Proper cleaning of glass

Glass should be cleaned with a soft, clean, grit-free cloth and a mild, non-abrasive, non-alkaline cleaning solution. The glass should be rinsed immediately with clean rinse water, and excess rinse water should be removed promptly with a squeegee. Grease and glazing materials should be removed with xylene or toluene, followed by normal washing and rinsing.

For proper instructions on cleaning of pyrolytic, hard coated Pilkington glass by hand, refer to the relevant Pilkington Technical Bulletin.

For glass which exhibits a stain, either iridescent or whitish, other cleaning materials can be tested, such as buffered HF acid: Winsol 550 from Winsol Labs, 1417 NW 51st St., Seattle, Washington 98107. Telephone 206 782 5500, or cerium oxide blocking. Materials, such as volcanic pumice, that scratch the surface of the glass should not be used.

In the case of stained glass problems, a small sample of the damaged glass may be sent to the Architectural Technical Service Department of Pilkington North America, Inc. As a service to our customers and to the users of our glass products, we analyze such samples and subject them to a number of stain removal processes. Our technicians determine:

1. If the stain can be removed.
2. Which stain removal process is most effective.

Stain removal is time consuming and costly. Again, we stress that the original integrity and surface quality of Pilkington North America, Inc. glass products is best maintained by proper storage, handling, installation, and maintenance before damage occurs. If you have problems however, we are at your service.

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