

1.0 GENERAL

1.1 Contents

1.1.1 This Section specifies the requirements for the furnishing of all labour, material and equipment for supply and installation of seismic safety window film and structural adhesive, where required, on specified glass windows.

1.2 Scope

1.2.1 This specification provides the requirements for the supply and installation of a shatter resistant and abrasion resistant window film that will greatly enhance the safety of both building occupants and pedestrians outside the building in an earthquake.

1.2.2 The objective of the installation of the window film is to enhance life safety by minimizing the potential for glass pieces projecting or falling in a hazardous manner during or as a result of an earthquake.

1.2.3 This specification is for the application of window film on the interior window surfaces only.

1.2.4 The product requirements in this specification are twofold. First, the product must comply with minimum technical requirements. Secondly, the product must meet certain earthquake-related performance-based requirements that must be verified by laboratory testing at an approved research facility.

1.2.5 These specifications do not address non-seismic window film issues including optical properties and energy-efficiency. Such issues are addressed in other Sections of these specifications.

1.2.6 Locations of glass windows requiring application of seismic safety window film are given on the Drawings. Locations of glass windows requiring both window film and window film structural adhesive are separately identified on the Drawings.

1.3 Reference Standards

1.3.1 ASTM D-1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test)

1.3.2 ASTM E-84 Standard Method of Test for Surface Burning Characteristics of Building Material

1.3.3 ANSI Z97 Specification for Safety Glazing Material used in Buildings

1.3.4 ASTM D-2582 Standard Method of Test for Puncture-Propagation Tear Resistance of Plastic Film and Sheeting.

1.4 Manufacturer's Recommendations

1.4.1 The manufacturer's recommended methods of installation, when accepted by the Consultants, shall be the basis for acceptance or rejection of the actual installation methods used in this work.

1.5 Qualifications

- 1.5.1 Names and qualifications of proposed independent research facilities who have been engaged to verify the performance-based requirements of this Section are to be submitted to the Consultant within the first week of tendering. The Consultant will distribute the list of approved independent research facilities within the second week of tendering.
- 1.5.2 The applicator shall provide documentation that he/she is certified by the manufacturer of the window film to install said window film according to the manufacturer's specifications and in accordance with specific requests as to be determined and agreed to by the Owner.
- 1.5.3 Upon request, the applicator will provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film Manufacturer.

1.6 Warranty

- 1.6.1 The installation shall have a warranty period of ten (10) years during which the film shall maintain its integrity without cracking, crazing, delaminating or peeling. In the event that the product is found to be defective under warranty, the film manufacturer shall replace such quantity of the film proved to be defective, and shall additionally provide the removal and reapplication labour free of charge.
- 1.6.2 The installation shall have a warranty period of five (5) years against glass failure due to thermal shock fracture of the glass.
- 1.6.3 Proof of the above warranties shall be provided in writing.

2.0 PRODUCTS

2.1 Product Types

- 2.1.1 The two products included in this Section are window film and window film structural adhesive.

2.2 Acceptable Window Film

- 2.2.1 FTI Glass-Gard Safety & Security Window Film GGL 400 CL PS SCR for the following applications:
 - 2.2.1.1 Hazard mitigation and safety enhancement for 6 mm annealed glass;
 - 2.2.1.2 Hazard mitigation and safety enhancement for 6 mm tempered glass.
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2.3 Acceptable Window Film Structural Adhesive

- 2.3.1 Dow Corning 995 Silicone Structural Adhesive.
- 2.3.2 Alternative window film structural adhesives that meet the technical requirements of Section 2.6 and the performance-based requirements of Section 2.7.

2.4 Window Film Performance-Based Requirements

- 2.4.1 The purpose of these performance-based requirements is to verify that the window film will meet or exceed minimum life safety levels of performance during an earthquake.
 - 2.4.2 The minimum film thickness of 0.1 mm (0.004 inches) as given in Section 2.4.1.4 can be reduced to a minimum thickness of 0.05 mm (0.002 inches) if all of the performance-based requirements given in Section 2.5 have been met.
 - 2.4.3 Verification of conformance with the performance-based requirements given in this Section is to be conducted by an approved independent research facility prior to the tendering of this project.
 - 2.4.4 Research facilities are to perform the following tests to verify the earthquake performance of the proposed window film:
 - 2.4.4.1 All tests to be reverse cyclic static tests;
 - 2.4.4.2 Minimum of two specimens to be tested for each of the following window parameters included in the project:
 - (a) Glass thickness
 - (b) Single or double glass pane
 - (c) Annealed or tempered glass
 - (d) Maximum height of window between horizontal mullions
 - (e) Type of window frame material (eg: vinyl, aluminum)
 - (f) Presence or absence of film structural adhesive
 - 2.4.4.3 Each specimen is to be subjected to a test protocol comprising two identical cycles for each of the following maximum drifts of 0.25%, 0.5%, 1.0%, 2.0%, 4.0%, 5.0%, 6.0% and 8.0%;
 - 2.4.4.4 Each test specimen is to have the window film installed on the interior face of an exterior window or either face of an interior window;
 - 2.4.4.5 During the testing of interior window specimens, no piece of glass larger than 1000 mm² in area shall fall from the window and no piece of glass shall project more than 300 mm horizontally from the window surface;
 - 2.4.4.6 During the testing of exterior window specimens, no piece of glass larger than 1000 mm² in area shall fall from the window and no more than 1.0% of the total glass area shall fall from the window.
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2.5 Window Film Structural Adhesive Technical Requirements

2.5.1 The film structural adhesive material is utilized for anchoring the film/glass combination to the window frame. Typical details, procedures, drawings with dimensions of the installation must be provided. The overall system shall meet the following test requirements:

2.5.1.1 Factory Mutual Research Standards 4350 (1995) requirement for Windstorm Resistant Fenestration and Walls.

2.5.1.2 Dow Corning® 995 Silicone Structural Adhesive or approved equal.

2.6 Window Film Structural Adhesive Performance-Based Requirements

2.6.1 The purpose of these performance-based requirements is to verify that the window film structural adhesive will meet or exceed minimum life safety levels of performance during an earthquake.

2.6.2 Verification of conformance with the performance-based requirements given in this Section is to be conducted by an approved independent research facility prior to the tendering of this project.

2.6.3 The number of test specimens and the test protocol are detailed in Section 2.5.

2.6.4 During the testing of those window specimens with structural adhesive, the structural adhesive must maintain stability of the glass and must provide direct adhesion between the glass and the window frame along at least two sides of the window frame.

3.0 EXECUTION

3.1 Installation

3.1.1 Examine glass surfaces to receive new film and verify that they are free from defects and imperfections that will affect the final appearance. Correct all such deficiencies before starting film application.

3.1.2 The window glass and window framing shall be cleaned thoroughly with a neutral cleaning solution. The inside surface of the window glass shall be bladed with industrial razors to insure the removal of any foreign contaminants.

3.1.3 Towelling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

3.1.4 The window film shall be applied as follows:

3.1.4.1 Installation of film to conform to manufacturer's specifications;

3.1.4.2 Film to be cut to specification using a vertical dispenser with film edges cut neatly and square at a uniform distance of between 1-3 mm from window sealing device;

3.1.4.3 Clear, clean water is to be used to remove water soluble overcoat that protects the pressure sensitive adhesive;

- 3.1.4.4 Water and film slip solution only to be used on window glass to facilitate proper positioning of the film;
 - 3.1.4.5 Use polyplastic bladed squeegees to insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive;
 - 3.1.4.6 Upon completion, the film may appear cloudy (or contain small bubbles) due to residual moisture that shall dry flat with no moisture present within 30 calendar days when viewed under natural daylight conditions as described in Section 2.4.2.4.
- 3.1.5 The window film structural adhesive shall be applied as follows:
- 3.1.5.1 Adhesive to be applied as bead around perimeter of the glass/frame interface on the film side of the glass;
 - 3.1.5.2 Bead to be installed with a minimum overlay of 9 mm (3/8 inch) on both the frame and filmed glazing.

3.2 Cleanup

- 3.2.1 Premises are to be kept in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of dust, cuttings and debris.
 - 3.2.2 At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.
 - 3.2.3 Remove left over material from the work area and from the site. Use all necessary means to protect the film before, during and after the installation.
 - 3.2.4 Thoroughly broom clean all surfaces upon completion of this portion of the work.
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