SECTION 08 87 16

SAFETY AND SECURITY WINDOW FILM

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\*\* NOTE TO SPECIFIER \*\* 3M Commercial Solutions; sun control window films, safety and security window films, architectural window films.  
This section is based on the products of 3M Commercial Solutions, which is located at:3M Center, Bldg. 223St. Paul, MN 55144-1000Toll Free Tel: 888-650-3497Tel: 651-737-1081Fax: 651-737-8241Email: [request info (apeters2@mmm.com)](https://arcat.com/rfi?action=email&company=3M%252BCommercial%252BSolutions&message=RE%253A%2520Spec%2520Question%2520(08873mmm)%253A%2520&coid=47922&spec=08873mmm&rep=&fax=651-737-8241)  
Web: [http://www.3m.com/3M/en\_US/architectural-design-us/?utm\_medium=redirect&amp;utm\_source=vanity-url&amp;utm\_campaign=www.3M.com/AMD](http://www.3m.com/3M/en_US/architectural-design-us/?utm_medium=redirect&utm_source=vanity-url&utm_campaign=www.3M.com/AMD) | <http://www.3m.com/3M/en_US/building-window-solutions-us>   
 [ [Click Here](https://arcat.com/company/3m-commercial-solutions-47922) ] for additional information.  
As an industry leader in both adhesive and film manufacturing, 3M combines these technologies to provide state of the art Safety and Security Window Films to residential, commercial, and government sectors. 3M Safety and Security Window films help provide an added measure of protection for a variety of purposes including safety glazing applications, blast mitigation, building envelope protection, to help deter forced entry, and fragment retention for spontaneous glass breakage and seismic events. 3M Safety and Security films provide up to 99% protection against the sun's destructive ultraviolet rays, helping to protect valuable furnishings from fading. 3M Safety and Security Films are also available with sun control properties to help reduce glare, improve comfort, add privacy, and save on energy costs. 3M Safety and Security Window Films provide a practical, cost effective solution to help protect people, property, and provide continuity of operations that would otherwise be at a higher risk with conventional glass.  
3M Impact Protection Systems enable a total systems solution with safety and security film. By anchoring the film to the frame, they help keep the broken glass secured in the window opening which helps provide and increased level of safety and security for helping to deter smash and grab, blast hazard mitigation, building envelope protection, seismic preparedness, and when film is applied to tempered glass.  
3M Anti-Graffiti films help protect the glass surface against the most common methods of vandalism, such as glass etchants, gauging, abrasion, while reducing the ultraviolet light that normally would enter through the window by up to 99%. They have a durable abrasion resistant hardcoat on the outer surface and an adhesive that is designed to not leave residue on the glass when replacement of the film is needed due to vandalism.

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Safety and security window film.
    2. Anti-graffiti window film.
    3. Film attachment systems.
  1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 08 50 00 - Windows (08 54 13) - Fiberglass Windows.
    2. Section 08 60 00 - Roof Windows and Skylights (08 60 00) - Roof Windows and Skylights.
    3. Section 08 83 00 - Mirrors (08 83 13) - Mirrored Glass Glazing.
    4. Section 08 44 23 - Structural Sealant Glazed Curtain Wall (08 44 23) - Structural Sealant Glazed Curtain Wall.
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
       1. Handbook of Fundamentals.
    2. ASTM International (ASTM):

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Film Attachment Systems, 3M Impact Protection Attachment Sealant. Delete if not required.

* + - 1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
      2. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
      3. ASTM D2240 - Standard Method for Rubber Property - Durometer Hardness.
      4. ASTM D5895 - Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Clear Microlayered Safety and Security Window Films, Ultra S800. Delete if not required.

* + - 1. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to all products except Film Attachment Systems. Delete if not required.

* + - 1. ASTM D1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
      2. ASTM D4830 - Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing.
      3. ASTM E84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
      4. ASTM E903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
      5. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Clear Microlayered Safety and Security Window Films, Ultra S800. Delete if not required.

* + - 1. ASTM D2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.

\*\* NOTE TO SPECIFIER \*\* The following two paragraphs apply only to Safety and Security Film with Sun Control: Safety Neutral S35 and Safety Silver S20; Clear Safety and Security Film Safety S140; and Film Attachment Systems: 3M Impact Protection Attachment Sealant. Delete if not required.

* + - 1. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
      2. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

\*\* NOTE TO SPECIFIER \*\* The following two paragraphs apply only to Safety and Security Film with Sun Control: Safety Neutral S35 and Safety Silver S20; Clear Safety and Security Film Safety S70, Safety S80 and Safety S140; and Film Attachment Systems: 3M Impact Protection Attachment Sealant. Delete if not required.

* + - 1. ASTM F1642 - Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings.
      2. ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings.

\*\* NOTE TO SPECIFIER \*\* The following two paragraphs apply only to all products except Anti-Graffiti and Film Attachment Systems. Delete if not required.

* + 1. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
    2. Consumer Products Safety Commission (CFR):
       1. 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.

\*\* NOTE TO SPECIFIER \*\* The following two paragraphs apply only to Clear Microlayered Safety and Security Window Films, Ultra S800; Safety and Security Film with Sun Control: Safety Neutral S35 and Safety Silver S20; Clear Safety and Security Film Safety S70, Safety S80 and Safety S140; and Film Attachment Systems: 3M Impact Protection Attachment Sealant. Delete if not required.

* + 1. United States General Services Administration (GSA):
       1. GSA-TS01-2003 - Standard Test for Glazing and Glazing Systems Subject to Airblast Loadings.
    2. International Standards Organization (ISO):
       1. ISO 16933, International Standard for Glass in Building: Explosion-resistant security glazing - Test and classification for arena air-blast testing.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Clear Safety and Security Film: 3MSafety S140.

* + 1. Underwriters Laboratories Inc. (UL):
       1. UL 972 - Burglary Resisting Glazing Material.
  1. PERFORMANCE REQUIREMENTS

\*\* NOTE TO SPECIFIER \*\* Edit performance requirements as necessary depending on project requirements or film specified. Coordinate with product data in Section 2.

* + 1. Safety Glazing Impact Performance:

\*\* NOTE TO SPECIFIER \*\* Impact Resistance is a performance based test for safety glazing. Manufacturer shall demonstrate compliance with the performance requirements through submittal of 3rd party test reports. Testing shall be provided on 1/4 inch annealed glass, although reports on other glass substrates may be additionally provided if representative of project conditions. The test report shall state compliance with both ANSI Z97.1 and 16 CFR 1201 standards, and show that the film has successfully met 400 ft-lbs impact requirements on at least 4 test specimens. The 400 ft-lbs impact force is generated from a 100-lb impactor drop height of 48-inches, which is required for ANSI Z97.1 Class A (Unlimited) and 16 CFR 1201 Category 2 impact ratings, as referenced in building code.  
\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films: Ultra S800 Clear Microlayered Safety and Security Window Films. Delete if not required.

* + - 1. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass.
      2. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/8 inch annealed glass.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films, 3M Safety S40 and Safety S70. Delete if not required.

* + - 1. 150 ft-lbs impact resistance, meeting ANSI Z97.1 (Class B, Unlimited) and 16 CFR 1201 (Category 1) impact requirements with film applied on 1/4 inch annealed glass.
      2. 150 ft-lbs impact resistance, meeting ANSI Z97.1 (Class B, Unlimited) and 16 CFR 1201 (Category 1) impact requirements with film applied on 1/8 inch annealed glass

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films, 3M Safety S80 and Safety S140. Delete if not required.

* + - 1. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) or 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass.
      2. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) or 16 CFR 1201 (Category 2) impact requirements with film applied on 1/8 inch annealed glass.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films, 3M Safety Exterior Series, S40 and S70. Delete if not required.

* + - 1. 150 ft-lbs impact resistance, meeting ANSI Z97.1 (Class B, Unlimited) and 16 CFR 1201 (Category 1) impact requirements with film applied on 1/4 inch annealed glass.
      2. 150 ft-lbs impact resistance, meeting ANSI Z97.1 (Class B, Unlimited) and 16 CFR 1201 (Category 1) impact requirements with film applied on 1/8 inch annealed glass.
    1. Blast Hazard Mitigation Performance:

\*\* NOTE TO SPECIFIER \*\* High explosive arena blast testing and shock tube testing are performance based methods for evaluating safety and security films for blast hazard mitigation. Manufacturer shall provide 3rd party test reports or a data sheet summary with specific reference to a 3rd party test report showing the product complies with the referenced standards. The submittal shall indicate the blast load tested (blast pressure and impulse), film product tested, film attachment method, glass substrate tested, and performance rating achieved.

* + 1. Frequently specified blast performance standards are GSA TS01 and ASTM F1642. GSA TS01 performance conditions are as follows: Level "3B" = Low Hazard; Level "3A" = Very Low Hazard; and Level "2" = No Hazard. A common minimum specified level of protection is "3B"; therefore in comparison, products with GSA "3A" or "2" ratings exceed this level.
    2. DELETE any of the following paragraphs not applicable for the project.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films, Ultra S800. Delete if not required.

* + - 1. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1/4 inch annealed single pane glass and 3M Impact Protection Attachment Sealant.
      2. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1/4 inch tempered single pane glass with 3M Impact Protection Attachment Sealant.
      3. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1 inch annealed double pane glass with 3M Impact Protection Attachment Sealant.
      4. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 9 psi and 60 psi\*msec blast impulse, on 1 inch annealed double pane glass with 3M Impact Protection Attachment Sealant.
      5. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 9 psi and 60 psi\*msec blast impulse, on 1 inch" tempered double pane glass with 3M Impact Protection Attachment Sealant.
      6. GSA Rating of "3a" / ASTM F1642 "Minimal Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1 inch" tempered double pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only).
      7. GSA Rating of "3b" with blast pressure of 9.4 psi and 55 psi\*msec blast impulse, on 1/4 inch annealed single pane glass and 3M Impact Protection Attachment Sealant.
      8. GSA Rating of "2" with blast pressure of 7.8 psi and 55 psi\*msec blast impulse, on 1 inch tempered double pane glass with 3M Impact Protection Attachment Sealant.
      9. GSA Rating of "3a" with blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1/4 inch tempered single pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only).

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Film: 3M Safety S80. Delete if not required.

* + - 1. GSA Rating of "3B" / ASTM F1642 "Minimal Hazard" with minimum blast load of 6 psi and 41 psi\*msec, on 1/4 inch (6 mm) single pane glass and film attachment system.
      2. GSA Rating of "3B" with minimum blast load of 4 psi and 29 psi\*msec, on 1/4 inch (6 mm) pane glass without film attachment system.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Film: 3M Safety S140. Delete if not required.

* + - 1. GSA Rating of "3B" with minimum blast load of 15 psi and 59 psi\*msec, on 1 inch (25 mm) double pane glass without film attachment system.

\*\* NOTE TO SPECIFIER \*\* IMPORTANT NOTICE: These products are not approved in the State of Florida for use as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. In compliance with Florida Statute 553.842, these products may not be advertised, sold, offered, provided, distributed, or marketed in the State of Florida as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. DELETE this section if project is located in the State of Florida.

* + - 1. Impact and pressure cycling are performance based tests for building envelope protection. Manufacturer shall provide 3rd party test reports showing the product complies with the impact and pressure cycling requirements of ASTMs E1886 / E1996. Glazing systems vary, contact Manufacturer for more information.
    1. Impact Resistance and Pressure Cycling:

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films, Ultra S800. Delete if not required.

* + - 1. ASTM E1996 / E1886: Large Missile "C", +/- 75 psf Design Pressure.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Safety and Security Window Films with Sun Control: Safety Silver S20. Delete if not required.

* + - 1. ASTM E1996 / E1886: Small Missile "A", +/- 60 psf Design Pressure.
    1. Tear Resistance:

\*\* NOTE TO SPECIFIER \*\* Tear resistance is an important property for most safety and security window film applications, as it relates to the film's ability to absorb energy prior to failure. Manufacturer shall submit tear resistance data meeting the full testing and reporting requirements of ASTM D1004. Data shall be submitted for BOTH film orientations so as to indicate balance for tear resistant properties. The following tear resistance values shall be reported, per the requirements of ASTM D1004: peak load or maximum force (lbf, or N); the maximum extension (in, or mm); and the Total Graves Area Tear resistance (lbs%, or N%), which represents total energy absorbed.  
\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films, Ultra S800. Delete if not required.

* + - 1. Minimum Graves Area Tear Resistance of 1,050 lbs% as measured on coated film product, without liner, per ASTM D1004.
    1. Adhesion to Glass:

\*\* NOTE TO SPECIFIER \*\* Adhesive properties relate to the film's ability to retain broken glass fragments - critical for wide range of safety film applications. Verify the peel strength of the film through submittal of 3rd Party Test reports.  
\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films, Ultra S800. Delete if not required.

* + - 1. Minimum 9 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Film: 3M Safety S40. Delete if not required.

* + - 1. Nominal 4 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Film: 3M Safety S70. Delete if not required.

* + - 1. Nominal 5 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films: 3M Safety S80 and Safety S140. Delete if not required.

* + - 1. Minimum 2 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films: 3M Safety Exterior S20. Delete if not required.

* + - 1. Nominal 4 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films: 3M Safety Exterior S40. Delete if not required.

* + - 1. Nominal 4 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films: 3M Safety Exterior S70. Delete if not required.

* + - 1. Nominal 5 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Safety and Security Window Films with Sun Control: 3M Safety Silver S20 and Safety Neutral S35. Delete if not required.

* + - 1. Minimum 3 lbs/in peel strength per ASTM D3330 (Method A).

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Anti-Graffiti Films: 3M AG4 and AG6. Delete if not required.

* + - 1. Nominal 1 lbs/in peel strength per ASTM D3330 (Method A).
    1. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:

\*\* NOTE TO SPECIFIER \*\* Flammability properties are important to ensure the film is properly rated for interior use. Class A rated for Interior Use requires a Flame Spread Index no greater than 25; and Smoke Developed Index no greater than 450. Verify Flammability properties through submittal of 3rd Party Test reports.

* + - 1. Flame Spread Index: No greater than 25.
      2. Smoke Developed Index: No greater than 55.
    1. Abrasion Resistance:

\*\* NOTE TO SPECIFIER \*\* Abrasion Resistance relates to the durability and scratch resistance of the film. Verify Abrasion Resistance through 3rd Party testing, per ASTM D1044.  
\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films, S800Clear Microlayered Safety and Security Window Films: 3M Ultra S800. Delete if not required.

* + - 1. Film shall have a surface coating that is resistant to abrasion such that less than 5% increase of transmitted light haze will result when tested in accordance with ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films: 3M Safety S40, Safety S70, Safety S80, and Safety S140. Delete if not required.

* + - 1. Film shall have a surface coating that is resistant to abrasion such that less than 5% increase of transmitted light haze will result when tested in accordance with ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films: Safety Exterior S20, Safety Exterior S40, and Safety Exterior S70. Delete if not required.

* + - 1. Film shall have a surface coating that is resistant to abrasion such that a nominal 5% increase of transmitted light haze will result when tested in accordance with ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Safety and Security Window Films with Sun Control: 3M Safety Neutral S35 and Safety Silver S20. Delete if not required.

* + - 1. Film shall have a surface coating that is resistant to abrasion such that a nominal 3% increase of transmitted light haze will result when tested in accordance with ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Anti-Graffiti Films: 3M AG 4 and AG6. Delete if not required.

* + - 1. Film shall have a surface coating that is resistant to abrasion such that less than 2% increase of transmitted light haze will result when tested in accordance with ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.
    1. UV Light Rejection:

\*\* NOTE TO SPECIFIER \*\* UV Light Rejection relates to the durability of films, especially those applied to exterior windows and glass. Review Manufacturer's technical information on amount of UV Light Rejection.  
\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Microlayered Safety and Security Window Films, Ultra S800 Clear Microlayered Safety and Security Window Films: 3M Ultra S800. Delete if not required.

* + - 1. Minimum of 99% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films: 3M Safety S40, Safety S70, Safety S80, and Safety S140. Delete if not required.

* + - 1. Minimum of 99% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Clear Safety and Security Window Films: Safety Exterior S20, Safety Exterior S40, and Safety Exterior S70. Delete if not required.

* + - 1. Minimum of 99% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies to Safety and Security Window Films with Sun Control: 3M Safety Neutral S35 and Safety Silver S20. Delete if not required.

* + - 1. Minimum of 99% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.
  1. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's current technical literature on each product to be used, including:
        1. Manufacturer's Data Sheets.
        2. Preparation instructions and recommendations.
        3. Storage and handling requirements and recommendations.
        4. Installation methods.

\*\* NOTE TO SPECIFIER \*\* DELETE Test Report submittal requirement when proprietary specification is used and can be held. MAINTAIN Test Report submittal requirement when other products may be submitted for substitution.

* + 1. 3rd Party Test Report Submittal Requirements. Submit the following 3rd Party test reports indicating compliance with the test values listed in this section.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films: Safety S40, Safety Exterior S20, Safety Exterior S40. Delete if not required.

* + - 1. Flammability Testing, ASTM E84.
      2. Film Properties Testing, ASTM D882.
      3. Abrasion Resistance Testing, ASTM D1044.
      4. Peel Strength Testing, ASTM D3330
      5. Safety Glazing Impact Testing, ANSI Z97.1 or 16 CFR 1201.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films: Safety S70, Safety S80, Safety Exterior S70. Delete if not required.

* + - 1. Flammability Testing, ASTM E84.
      2. Film Properties Testing, ASTM D882.
      3. Abrasion Resistance Testing, ASTM D1044.
      4. Peel Strength Testing, ASTM D3330.
      5. Puncture Strength Testing, ASTM D4830.
      6. Safety Glazing Impact Testing, ANSI Z97.1 or 16 CFR 1201.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Clear Safety and Security Window Films: Safety S140. Delete if not required.

* + - 1. Flammability Testing, ASTM E84.
      2. Film Properties Testing, ASTM D882.
      3. Abrasion Resistance Testing, ASTM D1044.
      4. Peel Strength Testing, ASTM D3330.
      5. Puncture Strength Testing, ASTM D4830.
      6. Burglary Resistance Glazing, UL 972.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Safety and Security Films with Sun Control: Safety Neutral S35 and Safety Silver S20. Delete if not required.

* + - 1. Flammability Testing, ASTM E84.
      2. Safety Glazing Impact Testing, ANSI Z97.1 and 16 CFR 1201.

\*\* NOTE TO SPECIFIER \*\* The following paragraphs apply to Anti-Graffiti Films: AG4 and AG6. Delete if not required.

* + - 1. Flammability Testing, ASTM E84.
      2. Film Properties Testing, ASTM D882.
      3. Abrasion Resistance Testing, ASTM D1044.
      4. Peel Strength Testing, ASTM D3330.
      5. Puncture Strength Testing, ASTM D4830.

\*\* NOTE TO SPECIFIER \*\* DELETE the following paragraph if project is located in the State of Florida or if intended product use is not for wind borne debris protection.  
\*\* NOTE TO SPECIFIER \*\* IMPORTANT NOTICE: These products are not approved in the State of Florida for use as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. In compliance with Florida Statute 553.842, these products may not be advertised, sold, offered, provided, distributed, or marketed in the State of Florida as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. DELETE this section if project is located in the State of Florida.  
\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to: Clear Microlayered Safety and Security Window Films, Ultra S800; Safety and Security Films with Sun Control: Safety Silver S20 and Safety Neutral S35. Delete if not required.

* + - 1. Impact Resistance and Pressure Cycling, ASTMs E1886 and E1996.

\*\* NOTE TO SPECIFIER \*\* DELETE the following paragraph if project if intended product use is not for blast hazard mitigation.  
\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Clear Microlayered Safety and Security Window Films, Ultra S800; Safety and Security Films with Sun Control: Safety Silver S20 and Safety Neutral S35; Clear Safety and Security Window Films, S70, S80, and S140. Delete if not required.

* + - 1. Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003.
    1. Other Product Submittals:

\*\* NOTE TO SPECIFIER \*\* DELETE any of the following submittals if primary product use is not for blast protection and/or forced entry resistance.  
\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Safety and Security Films with Sun Control: Safety Silver S20 and Safety Neutral S35; Clear Safety and Security Window Films, S70, S80, and S140. Delete if not required.

* + - 1. Manufacturer's summary of 3rd Party Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003.

\*\* NOTE TO SPECIFIER \*\* The following paragraph applies only to Clear Safety and Security Window Film, 3M Safety S140. Delete if not required.

* + - 1. 3rd Party test reports from Forced Entry Resistance evaluations.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Verification Samples: For each film specified, two samples representing actual film color and pattern.

\*\* NOTE TO SPECIFIER \*\* Retain the next paragraph if Sun Control Film is specified.

* + 1. Performance Submittals: Provide laboratory data of emissivity and calculated window U-Factors for various outdoor temperatures based upon established calculation procedure defined by the ASHRAE Handbook of Fundamentals, Chapter 29, or Lawrence Berkeley Laboratory Window 5.2 Computer Program.
  1. QUALITY ASSURANCE
     1. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

\*\* NOTE TO SPECIFIER \*\* Pressure Sensitive Adhesives (PSA) physically bond to the glass, allowing for the film to be removed at the end of life. Clear Dry Adhesives (CDA) chemically bond to the glass. These may require the use of toxic chemicals to remove, or the complete replacement of the existing glass, significantly increasing end of life costs.

* + - 1. Provide documentation that the adhesive used on the specified film is a Pressure Sensitive Adhesive (PSA).
    1. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
       1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
       2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
          1. Name of building.
          2. The name and telephone number of a management contact.
          3. Type of glass.
          4. Type of film and/or film attachment system.
          5. Amount of film and/or film attachment system installed.
          6. Date of completion.

\*\* NOTE TO SPECIFIER \*\* RETAIN the following paragraph only for Safety and Security Films with Sun Control: 3M Safety Silver S20 and Safety Neutral S35. Delete the next paragraph if a Glass Stress Analysis is not required.

* + - 1. Provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film manufacturer.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if an Energy Savings Calculation is not required.

* + - 1. Provide an EFilm application analysis to determine available energy cost reduction and savings.

\*\* NOTE TO SPECIFIER \*\* Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project.

* + 1. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
       1. Finish areas designated by Architect.
       2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
       3. Refinish mock-up area as required to produce acceptable work.
  1. DELIVERY, STORAGE, AND HANDLING
     1. Follow Manufacturer's instructions for storage and handling.
     2. Store products in manufacturer's unopened packaging until ready for installation.
     3. Store and dispose of any hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.
  2. PROJECT CONDITIONS
     1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
  3. WARRANTY
     1. At project closeout, provide to Owner's Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.
     2. In order to validate warranty, installation must be performed by an Authorized 3M dealer. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: 3M Commercial Solutions, which is located at:3M Center, Bldg. 223St. Paul, MN 55144-1000Toll Free Tel: 888-650-3497Tel: 651-737-1081Fax: 651-737-8241Email: [request info (apeters2@mmm.com)](https://arcat.com/rfi?action=email&company=3M%252BCommercial%252BSolutions&message=RE%253A%2520Spec%2520Question%2520(08873mmm)%253A%2520&coid=47922&spec=08873mmm&rep=&fax=651-737-8241);Web: [http://www.3m.com/3M/en\_US/architectural-design-us/?utm\_medium=redirect&amp;utm\_source=vanity-url&amp;utm\_campaign=www.3M.com/AMD](http://www.3m.com/3M/en_US/architectural-design-us/?utm_medium=redirect&utm_source=vanity-url&utm_campaign=www.3M.com/AMD) | <http://www.3m.com/3M/en_US/building-window-solutions-us>

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

\*\* NOTE TO SPECIFIER \*\* Delete the entire next article if not required.

* 1. CLEAR MICROLAYERED SAFETY AND SECURITY WINDOW FILM

\*\* NOTE TO SPECIFIER \*\* Micro-layered films refer to two or more dissimilar materials that are co-extruded into one film, as opposed to monolithic or monolayered films (single layer), or multi-layered films (typically 2- 3 layers) that are laminated together with an adhesive.

* + 1. 3M Scotchshield Ultra S800 Safety and Security Window Film. Optically clear microlayered polyester film, nominally 8 mils (0.008 inch) thick, with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is clear and does not contain dyed polyester. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film is microlayered with both plastic and ductile polyester layers for tear resistance.
       1. Physical / Mechanical Performance Properties (nominal):

\*\* NOTE TO SPECIFIER \*\* While performance testing of film on glass is preferred approach for evaluating a safety film product, film tensile and mechanical properties are frequently specified. Where specified, it is important to note that results depend on several factors, including film orientation and tested product construction (i.e, with or without film coatings). Bi-directionally balanced film properties are important for safety and security applications because product failure in any one direction could have catastrophic effects. Therefore a film's strength properties are governed by the lower of two values in either direction: machine direction (MD); or transverse direction (TD).

* + - 1. Product Submittals shall meet the full testing and reporting requirements of ASTM D882, with data reported separately for both film directions, so the balance of film properties can be determined. Tested product construction should be noted; properties of the coated film are most relevant since this is the product form installed in the field. Singularly reported values for film mechanical properties (tensile & break strength, or elongation) do NOT meet reporting requirements of ASTM D882 and are not indicative of the balance of properties.
         1. Film Color: Clear.
         2. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils.
         3. Tensile Strength (ASTM D882):

Coated Film: 33,000 psi (MD) / 30,000 psi (TD).

* + - * 1. Break Strength (ASTM D882):

Coated Film: 265 lb/in (MD) / 240 lb/in (TD).

* + - * 1. Percent Elongation at Break (ASTM D882):

Coated Film: 140% (MD) / 130% (TD).

* + - * 1. Yield Strength:

Coated Film: 15,000 psi (MD).

* + - * 1. Percent Elongation at Yield (ASTM D882):

Coated Film: 8% (MD).

* + - * 1. Graves Tear Resistance (ASTM D1004):

Maximum Force (lbs):

Coated Film: 37 (MD) / 37 (TD).

Maximum Extension (in):

Coated Film: 0.50 (MD) / 0.51 (TD).

Graves Area Tear Resistance (lbs%):

Coated Film: 1,100 (MD) / 1,050 (TD).

* + - * 1. Puncture Propagation Tear Resistance (ASTM D2582):

Coated Film: 9 lbf (MD) / 11 lbf (TD).

* + - * 1. Puncture Strength (ASTM D4830):

Material Properties (as supplied).

Coated Film: 190 lbf.

* + - 1. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
      2. Variation in Total Transmission across the width: Less than 2% over the average at any portion along the length.
      3. Identification: Labeled as to Manufacturer as listed in this Section.
      4. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 87%.
         2. Visible Reflection (ASTM E 903): Not more than 10%.
         3. Ultraviolet Transmission (ASTM E 903): Less than 1%.
         4. Solar Heat Gain Coefficient (ASTM E 903): 0.80
      5. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass and on 1/8 inch (3mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
         2. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
      6. Impact Resistance and Pressure Cycling: Film shall pass impact of Large Missile "C" and withstand subsequent pressure cycling (per ASTMs E1996 and E1886) at +/ 75 psf Design Pressure with use of 3M Impact Protection Attachment Sealant. Film applied to 1/4-inch tempered glass.

\*\* NOTE TO SPECIFIER \*\* IMPORTANT NOTICE: These products are not approved in the State of Florida for use as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. In compliance with Florida Statute 553.842, these products may not be advertised, sold, offered, provided, distributed, or marketed in the State of Florida as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm.

* + - 1. Impact Resistance and pressure cycling are performance based tests for Building Envelope Protection. Manufacturer shall provide 3rd party test reports showing the product complies with the impact and pressure cycling requirements of ASTMs E1886 / E1996.
      2. Blast Hazard Mitigation:

\*\* NOTE TO SPECIFIER \*\* High explosive arena blast testing and shock tube testing are performance based methods for evaluating safety and security films for blast hazard mitigation. Manufacturer shall provide 3rd party test reports or a data sheet summary with specific reference to a 3rd party test report showing the product complies with the referenced standards. The data submittal shall indicate the blast load tested (blast pressure and impulse), film product tested, film attachment method, and performance rating achieved.  
\*\* NOTE TO SPECIFIER \*\* Select one or more of the following paragraphs, based on glazing types relevant for the project and film attachment method desired. DELETE any paragraphs not required.

* + - * 1. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1/4 inch annealed single pane glass and 3M Impact Protection Attachment Sealant
        2. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1/4 inch tempered single pane glass with 3M Impact Protection Attachment Sealant
        3. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1" annealed double pane glass with 3M Impact Protection Attachment Sealant
        4. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 9 psi and 60 psi\*msec blast impulse, on 1" annealed double pane glass with 3M Impact Protection Attachment Sealant
        5. GSA Rating of "2" / ASTM F1642 "No Hazard" with target blast pressure of 9 psi and 60 psi\*msec blast impulse, on 1" tempered double pane glass with 3M Impact Protection Attachment Sealant
        6. GSA Rating of "3a" / ASTM F1642 "Minimal Hazard" with target blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1" tempered double pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only)
        7. GSA Rating of "3b" with blast pressure of 9.4 psi and 55 psi\*msec blast impulse, on 1/4 inch annealed single pane glass and 3M Impact Protection Attachment Sealant
        8. GSA Rating of "2" with blast pressure of 7.8 psi and 55 psi\*msec blast impulse, on 1" tempered double pane glass with 3M Impact Protection Attachment Sealant
        9. GSA Rating of "3a" with blast pressure of 6 psi and 42 psi\*msec blast impulse, on 1/4 inch tempered single pane glass with 3M Impact Protection Attachment Sealant (on 2 sides only)

\*\* NOTE TO SPECIFIER \*\* Delete the entire next article if not required.

* 1. CLEAR SAFETY AND SECURITY WINDOW FILM

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if Safety S40 (SH4CLARL) film is not required.

* + 1. 3M Safety S40 (SH4CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 4.0 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Elongation: 130%.
          5. Break Strength (ASTM D 882): 100 lbs/in.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 87%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 1%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).
         2. Safety Rating (ANSI Z97.1): Class B, Unlimited Size.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if Safety S70 (SH7CLARL) film is not required.

* + 1. 3M Safety S70 (SH7CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 7.0 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882): 175 lbs/in.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 87%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 1%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if Safety S80 (SH8CLARL) film is not required.

* + 1. 3M Safety S80 (SH8CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 8 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882): 200 lbs/in.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 87%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 1%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
         2. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.

\*\* NOTE TO SPECIFIER \*\* Contact 3M for specific test details. Delete the next paragraph if not required.

* + - 1. Blast Hazard Mitigation:
         1. GSA Rating of "3B" / ASTM F1642 "Minimal Hazard" with minimum blast load of 6 psi and 41 psi\*msec, on 1/4 inch (6 mm) single pane annealed glass and 3M Impact Protection Attachment Sealant film attachment system.
         2. GSA Rating of "3B" with minimum blast load of 4 psi and 29 psi\*msec, on 1/4 inch single pane annealed or tempered glass without use of film attachment system.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if Safety S140 (SH14CLARL) film is not required.

* + 1. 3M Safety S140 (SH14CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 14 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882) (Per Inch Width): 350 lbs.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 85%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 1%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).

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* + - * 1. Impact Resistance and pressure cycling are performance based tests for Building Envelope Protection. Manufacturer shall provide 3rd party test reports showing the product complies with the impact and pressure cycling requirements of ASTMs E1886 / E1996. Contact 3M for specific test details.

\*\* NOTE TO SPECIFIER \*\* Contact 3M for specific test details. Delete the next paragraph if not required.

* + - 1. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.
         1. GSA level 3B rating with minimum blast load of 15 psi overpressure and 58 psi\*msec blast impulse on 1 inch double pane annealed glass without use of film attachment system.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Forced Entry Protection: Independent lab testing according to UL 972 protocol (Multiple Impact Test).
         1. Annealed Glass (1/4 inch) - Pass.
         2. Tempered Glass (1/4 inch) - Pass.

\*\* NOTE TO SPECIFIER \*\* Delete the entire next paragraph if Safety Exterior S20 if not required.

* + 1. 3M Safety Exterior S20: Optically clear polyester film with an exterior durable abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 2 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Elongation: 88%.
          5. Break Strength (ASTM D 882): 50 lbs/in.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 88%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 0.5%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if Safety Exterior S40 film is not required.

* + 1. 3M Safety Exterior S40. Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 4 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882): 100 lbs/in.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 89%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 0.5%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if Safety Exterior S40 film is not required.

* + 1. 3M Safety Exterior S70. Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 7 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882): 140 lbs/in.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 88%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 0.5%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).

\*\* NOTE TO SPECIFIER \*\* Delete the entire next article if not required.

* 1. SAFETY AND SECURITY WINDOW FILM WITH SUN CONTROL
     1. 3M Safety Neutral S35. Dual reflective polyester film, nominally 8 mils (0.008") thick, with a durable abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is comprised of an optically clear safety film laminated to a metallized film layer for reflective and sun control properties. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass.
        1. Physical / Mechanical Performance Properties (nominal):

\*\* NOTE TO SPECIFIER \*\* While performance testing of film on glass is preferred approach for evaluating a safety film product, film tensile and mechanical properties are frequently specified. Where specified, indication shall be made as to product construction tested (with or without coatings) for fair comparison between products. Break, Tensile, and Elongation properties shall also be specified bi-directionally (MD / TD).

* + - * 1. Film Color: Neutral.
        2. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils.
        3. Tensile Strength 33,000 psi (MD) / 23,000 psi (TD).
        4. Break Strength: 170 lb/in (MD) / 280 lb/in (TD).
        5. Percent Elongation at Break: 100% (MD) / 80% (TD).
        6. Yield Strength: 23,000 psi.
        7. Percent Elongation at Yield: 80%
      1. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
      2. Variation in Total Transmission across the width: Less than 2% over the average at any portion along the length.
      3. Identification: Labeled as to Manufacturer as listed in this Section.
      4. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass (NFRC 100/200).
         1. Visible Light Transmission: 39%
         2. Visible Reflection: 23% exterior / 13% interior
         3. Ultraviolet Transmission: Not more than 1%.
         4. Solar Heat Gain Coefficient: 0.43
      5. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category 2 (400 ft.-lbs).
         2. Safety Rating (ANSI Z97.1): Class A, Unlimited (400 ft.-lbs).

\*\* NOTE TO SPECIFIER \*\* IMPORTANT NOTICE: These products are not approved in the State of Florida for use as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. In compliance with Florida Statute 553.842, these products may not be advertised, sold, offered, provided, distributed, or marketed in the State of Florida as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm.

* + - * 1. Impact Resistance and pressure cycling are performance based tests for Building Envelope Protection. Manufacturer shall provide 3rd party test reports showing the product complies with the impact and pressure cycling requirements of ASTMs E1886 / E1996. Contact 3M for specific test details.
    1. 3M Safety Silver S20. Highly reflective polyester film, nominally 8 mils (0.008") thick, with a durable abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is comprised of an optically clear safety film laminated to a metallized film layer for reflective and sun control properties. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass.
       1. Physical / Mechanical Performance Properties (nominal):

\*\* NOTE TO SPECIFIER \*\* While performance testing of film on glass is preferred approach for evaluating a safety film product, film tensile and mechanical properties are frequently specified. Where specified, indication shall be made as to product construction tested (with or without coatings) for fair comparison between products. Break, Tensile, and Elongation properties shall also be specified bi-directionally (MD / TD).

* + - * 1. Film Color: Silver reflective.
        2. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils.
        3. Tensile Strength: 20,000 psi (MD) / 30,000 psi (TD).
        4. Break Strength: 160 lb/in (MD) / 247 lb/in (TD).
        5. Percent Elongation at Break: 95% (MD) / 76% (TD).
        6. Yield Strength: 15,000 psi.
        7. Percent Elongation at Yield: 7%.
      1. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
      2. Variation in Total Transmission across the width: Less than 2% over the average at any portion along the length.
      3. Identification: Labeled as to Manufacturer as listed in this Section.
      4. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass (NFRC 100/200).
         1. Visible Light Transmission: 18%.
         2. Visible Reflection: 61%.
         3. Ultraviolet Transmission: Not more than 1%.
         4. Solar Heat Gain Coefficient: 0.25.
      5. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
         1. Safety Rating (CPSC 16 CFR, Part 1201): Category 2 (400 ft-lbs).
         2. Safety Rating (ANSI Z97.1): Class A, Unlimited (400 ft-lbs).

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* + - * 1. Impact Resistance and pressure cycling are performance based tests for Building Envelope Protection. Manufacturer shall provide 3rd party test reports showing the product complies with the impact and pressure cycling requirements of ASTMs E1886 / E1996. Contact 3M for specific test details.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Impact Resistance and Pressure Cycling:
         1. Film shall pass impact of Small Missile "A" and withstand subsequent pressure cycling (per ASTMs E1996 and E1886) at +/- 60 psf Design Pressure with use of 3M Impact Protection Attachment Sealant attachment system. Tested on 1/4 inch (6 mm) tempered glass.
  1. ANTI-GRAFFITI WINDOW FILM

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if AG-4 film is not required.

* + 1. 3M Anti-Graffiti 4 (AG-4): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 4.0 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882) (Per Inch Width): 136 lbs.
          5. Elongation at Break (ASTM D 882): Greater than 100%.
          6. Peel Strength: 1 lb/inch.
          7. Puncture Strength (ASTM D 4830): 90 lbs.
          8. Abrasion Resistance (ASTM D1044): Less than 2% increase in haze.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 81%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 1%.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if AG-6 film is not required.

* + 1. 3M Anti-Graffiti 6 (AG-6): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
       1. Physical / Mechanical Performance Properties:
          1. Film Color: Clear.
          2. Thickness: Nominal 6.0 mils.
          3. Tensile Strength (ASTM D 882): 25,000 psi.
          4. Break Strength (ASTM D 882): 150 lbs/in.
          5. Elongation at Break (ASTM D 882): Greater than 100%.
          6. Peel Strength: 1 lb/inch.
          7. Puncture Strength (ASTM D 4830): 125 lbs.
          8. Abrasion Resistance (ASTM D 1044): Less than 2% increase in haze.
       2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
       3. Variation in Total Transmission across the Width: Less than 2% over the average at any portion along the length.
       4. Identification: Labeled as to Manufacturer as listed in this Section.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if not required.

* + - 1. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
         1. Visible Light Transmission (ASTM E 903): 87%.
         2. Ultraviolet Transmission (ASTM E 903): Less than 1%.
  1. 3M IMPACT PROTECTION FILM ATTACHMENT SYSTEMS

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if 3M Impact Protection Attachment Sealant is not required.

* + 1. 3M Impact Protection Attachment Sealant (IPA): Weatherable, UV-resistant, moisture curable structural sealant wet glaze.
       1. Color:

\*\* NOTE TO SPECIFIER \*\* Select one of the following paragraphs

* + - * 1. Black.
        2. White.
      1. Material Properties (as supplied):
         1. Typical Cure Time: 3 - 7 days (25 degrees C, 50% RH).
         2. Full Adhesion: 7 - 14 days.
         3. Tack-Free Time (ASTM D 5895): 21 minutes (25 degrees C, 50% RH).
         4. Flow, Sag or Slump (ASTM D 2202): 0 inches.
         5. Specific Gravity: 1.4.
         6. Working Time: 10 - 20 minutes (25 degrees C, 50% RH).
         7. VOC Content: 16 g / L.
      2. Material Properties (as cured - 21 days at 25 degrees C, 50% RH):
         1. Ultimate Tensile Strength (ASTM D412): 380 psi (2.62 MPa).
         2. Ultimate Elongation (ASTM D412): 640 psi.
         3. Durometer Hardness, Shore A (ASTM D2240): 38-39 points.
         4. Tear Strength, Die B (ASTM D624): 72 ppi.
      3. Uniformity: Product shall have uniform consistency and appearance, with no clumping.

\*\* NOTE TO SPECIFIER \*\* IMPORTANT NOTICE: These products are not approved in the State of Florida for use as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm. In compliance with Florida Statute 553.842, these products may not be advertised, sold, offered, provided, distributed, or marketed in the State of Florida as hurricane, windstorm, or impact protection from wind-borne debris from a hurricane or windstorm.

1. EXECUTION
   1. EXAMINATION
      1. Film Examination:
         1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
         2. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
         3. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
         4. Commencement of installation constitutes acceptance of conditions.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if 3M Impact Protection Adhesive is not required.

* + 1. Impact Protection Attachment Sealant Examination:
       1. If application of window film is/was the responsibility of another installer, notification in writing shall be made of deviations from manufacturer's recommended installation tolerances and conditions.
       2. Filmed glass surfaces receiving new attachment should first be examined to verify that they are free from defects and imperfections, and that the film edges extend sufficiently to the frame edges.
       3. Do not proceed with installation until film and frame surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
       4. Conduct an adhesion test to the frame surface may be conducted by applying a 4 - 6 inch long bead, approximately 0.5 - 1 inch in width, masking one side of the frame surface underneath the strip with tape. Allow the Impact Protection Attachment Sealant to cure for 7 days and test adhesion by pulling up on the masked end and a 90 degree angle. If cohesive failure is observed (adhesive residue left behind on the frame surface), adhesion is acceptable; if adhesive failure is observed (clean peel from the frame), adhesion is unacceptable and product is not recommended.
  1. PREPARATION
     1. Clean surfaces thoroughly prior to installation.
     2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
     3. Refer to Manufacturer's installation instructions for methods of preparation for Impact Protection Attachment Sealant film attachment systems.
  2. INSTALLATION
     1. Film Installation:
        1. Install in accordance with manufacturer's instructions.
        2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
        3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
        4. Apply film to glass and lightly spray film with slip solution.
        5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
        6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
        7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

\*\* NOTE TO SPECIFIER \*\* Delete the next paragraph if 3M Impact Protection Attachment Sealant is not required.

* + 1. Impact Protection Attachment Sealant Installation:
       1. The film attachment system shall be applied according to the specifications of the Manufacturer by an Authorized Dealer/Applicator. Refer to 3M publication, 70-0709-0322-7, 3M Impact Protection Attachment Sealant Attachment System Installation Instructions.
          1. For blast hazard mitigation: minimum 1/2 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).
          2. For impact resistance and building envelope protection: minimum 3/8 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).
       2. To ensure a straight and consistent bead width is achieved, masking tape may be applied to film and frame surfaces prior to application.
       3. With prior approval of the building owner or property manager, existing compression gaskets may be partially removed or trimmed to allow for a thinner bead and stronger anchorage. If removing the gaskets, sections shall be trimmed approximately 3 inches in length and inserted with appropriate spacing along all sides of the window to help secure the glazing during application and curing of the Impact Protection Attachment Sealant.
       4. The Impact Protection Attachment Sealant shall be dispensed with a caulk gun with nozzle opening diameter sized to match the approximate size of the desired bead width.
       5. A plastic putty knife or other tool with a clean straight edge shall be used to trowel and smooth out the adhesive. The completed adhesive bead shall be relatively triangular in shape.
       6. Any masking tape used shall be carefully removed within 10 minutes after applying the wet glaze.
  1. CLEANING AND PROTECTION
     1. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
     2. Touch-up, repair or replace damaged products before Substantial Completion.
     3. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION