IMPORTANT: This Technical Bulletin provides an overview of the specified performance of 3M™ Scotchshield™ Security Window Film S2400. Prior to product selection, always refer to the current 3M Technical Specifications for more detailed product information and specifications. All technical data and information in this data sheet should be considered representative or typical only and should not be used for specification purposes.

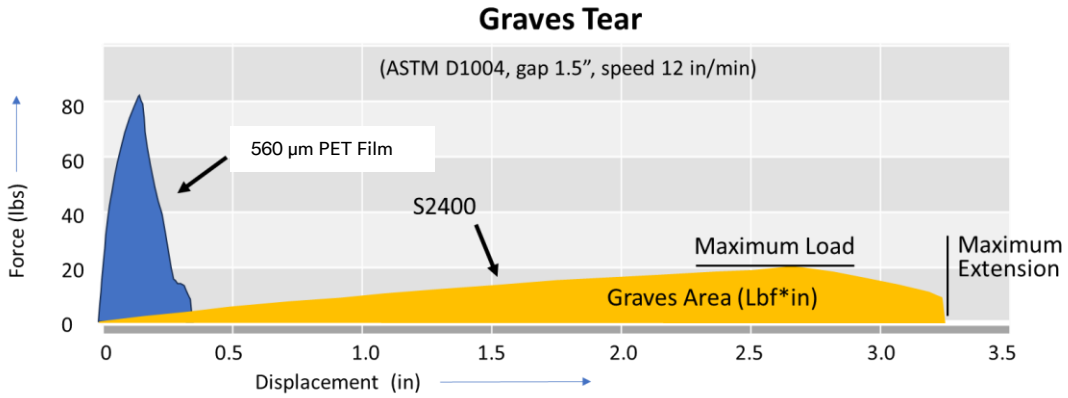
Physical Properties of 3M™ Scotchshield™ Security Window Film S2400

This Technical Bulletin was prepared to assist you in understanding some of the key differences in product performance between 3M™ Scotchshield™ Security Window Film S2400 (urethane-based) and polyethylene terephthalate (PET) resin-based window films of similar thickness. These key differences are shown and explained below.

Overall, the S2400 film will function differently than PET-based window films by absorbing energy as the film stretches farther than PET-based films. In addition to being urethane-based, S2400 is the thickest 3M Window Film available at 610 µm (24 mils). In this bulletin, S2400 is compared to a PET film of similar thickness (560 µm or 22 mils).

Graves Tear, a key measure of tear strength performance

The Graves Tear test (ASTM D1004, Standard Test Method For Tear Resistance (Graves Tear) Of Plastic Film And Sheeting) measures the force to propagate tearing in the film using a film sample with a stress concentration point. As the sample is elongated (displacement), the resisting force is measured. The recorded value considers both force and amount of stretch. This is sometimes referred to as the “area under the curve.”



The general shape of the Graves Tear curve for urethane-based S2400 is different from that of PET-based films, as urethane has a much higher elongation (see “Elongation” section below). Overall, the “area under the curve” for S2400 is 2/3rds higher than that of a 560 µm PET film of a similar thickness, thus enabling S2400 to better absorb energy from an impact.

	Graves Tear Resistance	Relative Values
3M™ Scotchshield™ Security Window Film S2400 (610 µm)	2779 N*mm (24.6 lbf*in)	166%
PET-based window film (560 µm)	1672 N*mm (14.8 lbf*in)	100%

Elongation, a key measure of energy absorption

A large difference in elongation of the films is shown in the chart below and is expected since urethane is softer and more flexible than PET. For wind-borne debris, impact, explosion, or break and entry incidents where force is applied to the glass of a window or door, higher elongation will help absorb more energy from the force of the impact.

Elongation of S2400 is 4 times (4x) that of a 560 µm PET film (ASTM D882, Standard Test Method For Tensile Properties Of Thin Plastic Sheeting). Refer to the chart and diagrams below for test results and methodology.

	Maximum Elongation	Relative Values
3M™ Scotchshield™ Security Window Film S2400 (610 µm)	560%	430%
PET-based window film (560 µm)	130%	100%

Elongation: Film at Break Position

560 µm PET-based film

610 µm S2400

Break Strength, a physical property test for films

Break Strength measures the maximum stress or force that a film can withstand before breaking when being stretched or pulled in opposite directions. This is used to compare specific products. Since urethane is a softer material than PET, the Break Strength value for S2400 will be lower than for a PET-based film, but much greater elongation is required before the S2400 will break.

	Break Strength	Relative Values
3M™ Scotchshield™ Security Window Film S2400 (610 µm)	13.5 N/mm (77 lbs/in)	16%
PET-based window film (560 µm)	82 N/mm (469 lbs/in)	100%

Tensile Strength, a physical property test for materials

Tensile Strength measures the maximum stress or force that a material can withstand before breaking when being stretched or pulled in opposite directions. This is used to compare the relative strengths of materials and does not consider product thickness. Since urethane is a softer material than PET, the Tensile Strength value for S2400 will be much lower than for a PET-based film.

	Tensile Strength	Relative Values
3M™ Scotchshield™ Security Window Film S2400 (610 µm)	22 MPa (3,200 psi)	15%
PET-based window film (560 µm)	152 Mpa (22,000 psi)	100%

Important Product and Application Limitations
Many factors can contribute to potential hazards and damages arising from wind, impact, seismic, explosion, or break and entry incidents, including the window film selected, type and thickness of glass, building construction, exterior pressure, proximity of impact occurrence, quality of window or door frames, intruder size and strength, and type of tools used to gain entry. Certain 3M™ Window Films require the use of 3M™ Impact Protection Attachment (IPA) Sealant on glass window and door frames for windstorm, break and entry, and explosion mitigation applications and for spontaneous glass breakage applications on single pane tempered glass. The sealant may also be recommended for certain other spontaneous glass breakage, safety glazing, and seismic applications. Always refer to the 3M Technical Data Sheets and 3M Technical Specifications to determine whether these combinations are required.

⚠ WARNING
While 3M™ Window Films, when applied in accordance with 3M instructions, may help reduce the impact of flying glass shards under certain conditions and potentially delay intruders, these films do not prevent property damage, personal injury, or death.

⚠ CAUTION
Window films are not bulletproof and are not designed to stop intruders. Always consult with security professionals and a 3M Authorized Window Film Dealer prior to selecting any window films to determine suitability for the intended application.

Health and Safety

⚠ WARNING
To help reduce the risk of personal injury and/or property damage associated with glass breakage, when working on or near glass surfaces, always use appropriate personal protective equipment.

⚠ CAUTION
When using any equipment, tools, or cleaning solutions in connection with the processing and application of this Product, always follow the manufacturer's container labels and/or instructions for safe operation.

Tools and Equipment Usage
When using any equipment, always follow the manufacturer's instructions for safe operation.

Chemicals
When handling any chemical products, read the manufacturers' container labels and the Safety Data Sheets (SDS) for important health, safety, and environmental information.

Follow this link to obtain SDS sheets for 3M products.

Follow this link to obtain information about substances of very high concern (SVHC) for EU products.

Warranty Information

Technical Information

Technical information, guidance, and other statements provided by 3M are based upon records, tests, or experience that 3M believes to be reliable, but the accuracy, completeness, and representative nature of such information is not guaranteed. Such information is intended for people with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license to any intellectual property rights is granted or implied with respect to this technical information.

Product Selection and Use

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment, reviewing all applicable regulations and standards, and reviewing the product label and use instructions. Failure to properly evaluate, select, and use a 3M product in accordance with instructions or to meet all applicable safety regulations may result in injury, sickness, death, and/or harm to property.

Warranty, Limited Remedy, and Disclaimer

Unless a different warranty is specifically stated on the applicable 3M product packaging or product literature (in which case such warranty governs), 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. If a 3M product does not conform to this warranty, the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability

All questions of warranty and liability relating to this product are governed by the terms and conditions of the sale, subject, where applicable, to the prevailing law. 3M Commercial Branding and Transportation products are not tested against automotive manufacturer specifications!

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