

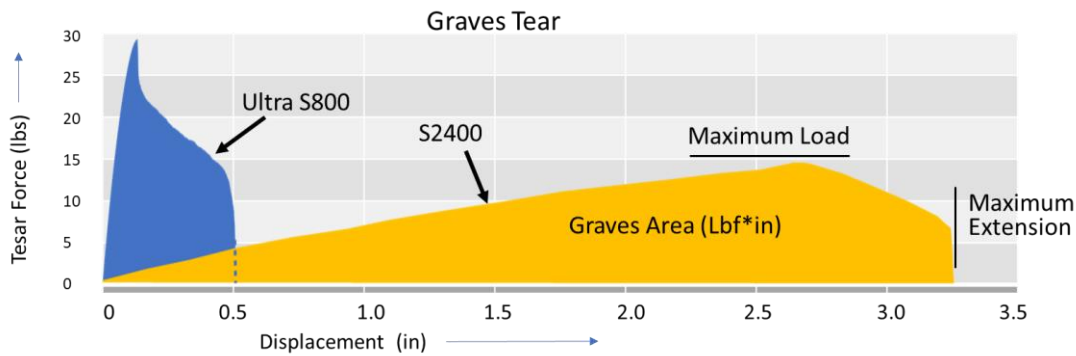
Properties of 3M™ Scotchshield™ Security Window Film S2400

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 PET-based window films. These key differences are shown and explained below.

Overall, the S2400 film will function differently by absorbing energy as the film stretches much farther than PET-based films. Individual blows from an intruder will be less able to extend the S2400 beyond its breaking point, providing greater delay to entry. In addition to being urethane based, S2400 is the thickest 3M Window Film available at 24mils (0.024-inch thick).

Graves Tear, a key measure of tear strength performance

The Graves Tear test (ASTM D1004) 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 film's **ability to resist a force while tearing** is exactly what makes a good security film. 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 much higher elongation (See "Elongation" section below). Overall, the "area under the curve" for S2400 is nearly 3Xs that of Ultra S800. (ASTM D1004, gap 1.5", speed 12 in/min)

	Graves Tear Resistance	Compared to Ultra S800
3M™ Scotchshield™ Security Window Film S2400	24.6 lbf*in	290 %
3M™ Scotchshield™ Safety and Security Window Film Ultra S800	8.4 lbf*in	100%

Elongation, a key measure of energy absorption

A large difference in elongation of the films shown is expected, as urethane is softer and more flexible than PET. For break and entry situations where an intruder is applying a force into the window, higher elongation will help absorb more energy of the blow. Elongation of S2400 is 4Xs that of Ultra S800. (ASTM D882)

	Maximum Elongation	Compared to Ultra S800
3M™ Scotchshield™ Security Window Film S2400	560%	415%
3M™ Scotchshield™ Safety and Security Window Film Ultra S800	135%	100%

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 like Ultra S800, but much greater elongation is required before the S2400 will break.

	Break Strength	Compared to Ultra S800
3M™ Scotchshield™ Security Window Film S2400	77 lbs/in	30%
3M™ Scotchshield™ Safety and Security Window Film Ultra S800	253 lb-force	100%

Tensile Strength, a physical property test for materials

Tensile Strength measures the maximum stress or force that a material (e.g. PET) can withstand before breaking when being stretched or pulled in opposite directions. This is used to compare relative strengths of materials and does not consider product thickness. Since urethane is a softer material than PET, the Maximum Tensile Strength value for S2400 will be much lower than for a PET-based film like Ultra S800.

	Tensile Strength	Compared to Ultra S800
3M™ Scotchshield™ Security Window Film S2400	3,200 psi	10%
3M™ Scotchshield™ Safety and Security Window Film Ultra S800	31,500 psi	100%

If you have questions regarding 3M™ Scotchshield™ Security Window Film S2400, please contact your local 3M sales or technical representative.

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