

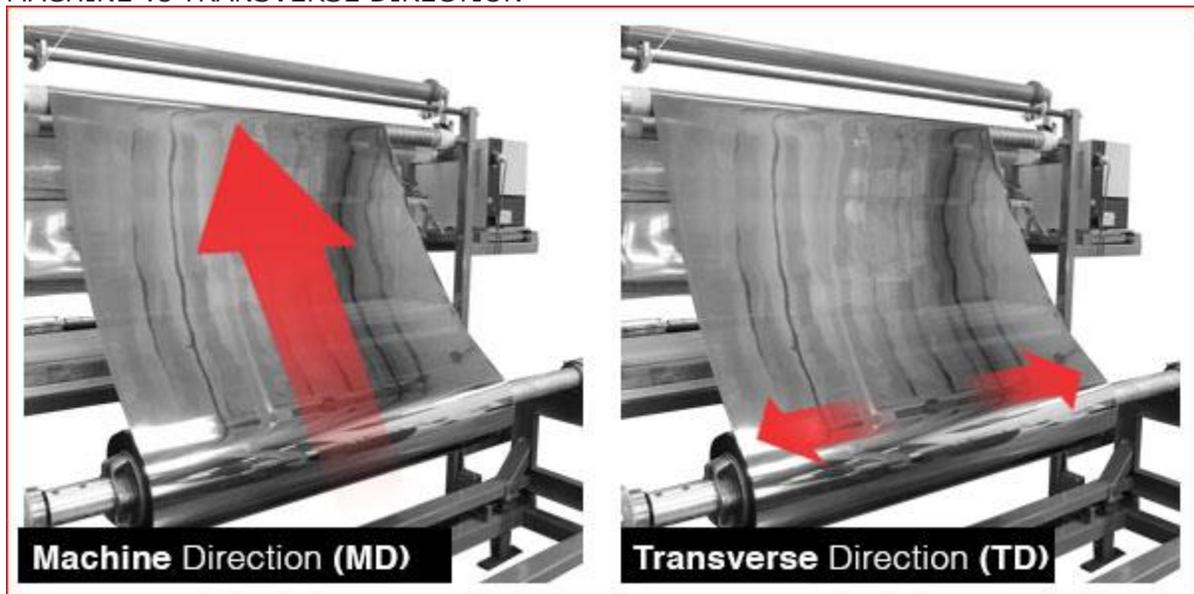
The Truth about Tensile Strength

For some unknown reason the tensile strength as related to safety and security film has become the most important number used to evaluate the protective attributes of Security film. These numbers are often reported in a false and misleading manner. The IWFA recently adopted a new set of policies and procedures, where they make the following statement "The testing that supports that particular product or advertising claim must be conducted on the product that is actually being sold and which the focus of the particular claim. For example, the tensile strength of a product must be the actual window film, not just the polyester used to produce the window film.

On the very specific topics of tensile strength, break strength and elongation at break, the IWFA further calls out the appropriate method of advertising test results. They state that in order to be acceptable the data must be reported as the results of ASTM D882 in both machine (MD) and transverse direction (TD). Until the issuance of these new standards most window film producers reported the Tensile Strength as > 25,000 PSI average, nowhere do they state that the numbers they are publishing are those on the raw material only.

This number is highly misleading as the tensile strength of 2 mil polyester is approximately 27,500 PSI (MD) and 31,000 PSI (TD) while the tensile strength of 7 mil polyester is 22,000 PSI (MD) and 26,000 PSI (TD). The empirical evidence presented above highlights the misleading nature of the application of raw material reports; if the above is to be believed the 2 mil product is stronger than the 7 mil. When presenting the information in this matter, you can understand why using the plain polyester as the tensile strength on any given Safety or Security film, is not only misleading but extremely dangerous.

MACHINE vs TRANSVERSE DIRECTION



Three primary tests are performed under the umbrella of ASTM D882; each one is a unique set of data points. Any single one or all of them could be of interest to you, dependant upon your needs.

11.2 Tensile Break – Breaking Factor: (PLI)

Breaking strength is that force which is required to break the specimen. The appropriate reporting unit for this number is pounds per lineal inch. This number is not normally reported in the window film industry even though it is the true reporting unit for the test. Tensile Strength is calculated from this number.

11.3 Tensile Strength: (PSI)

The tensile strength of a material is the maximum amount of stress that it can take before failure, such as breaking or permanent deformation. It is calculated by dividing the maximum load by the original minimum cross-sectional area of the specimen. Calculated from Tensile Break.

11.5 Elongation at break:

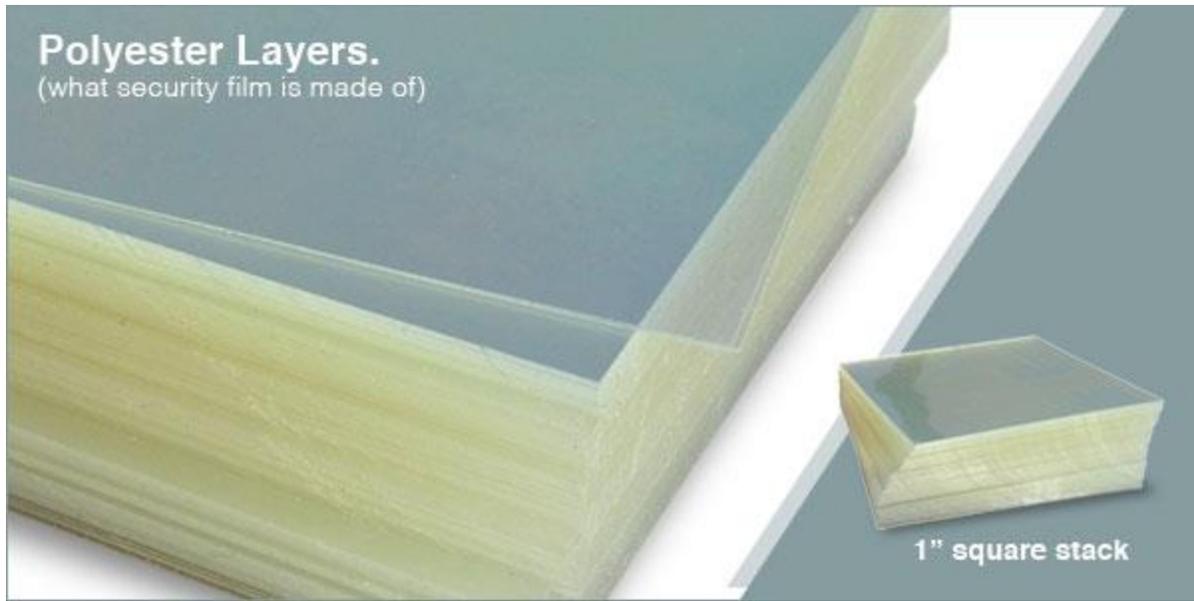
Elongation at break is presented as a percentage in relation to the initial length before the elongation. It is calculated by dividing the extension at the moment of rupture in the specimen multiplied by 100. In other words, it represents the amount of stretch exhibited by the sample prior to the break. Material with a higher percentage of elongation can stretch more before breaking.

The process to manufacture window film involves the lamination of multiple layers, using various adhesives and coatings. These coatings and adhesives require the application of heat in order to ensure solid bonding of the layers and curing of the coatings. The application of heat during the process changes the attributes of the raw polyester, the original strength in the 1"square of polyester (used for the PSI calculation) from which the layers are made no longer has any relevance to the overall strength or break of any given finished product.

Another point of importance on Tensile Strength is the units that the results are presented in. A review of ASTM 882 shows that the "Tensile Strength" (item 11.3) states the results shall be expressed in force unit area, pounds of force per square inch. The problem is that the sample cannot be accurately measured per square inch.

But within D882 "Breaking Factor" (item 11.2) states it shall be presented in force per unit of width, pounds per inch. Under this section is a footnote # 14 that states this method of reporting is useful for very thin film, for which the breaking load may not be proportional to cross sectional area and whose thickness maybe difficult to determine with precision.

DETAIL LOOK AT POLYESTER COMPONENTS



The footnote found within 11.2 "Breaking Factor", seems to indicate that the PSI numbers are not reliable with respect to finished window film and should be looked at with some concern. Historically very few manufacturers provided the test results in their purest form of pounds per inch (width). Further complicating the issue by publishing numbers for raw materials only, not disclosing that these numbers have no relevance to the completed product.

While the industry will continue to publish these numbers, they should not be the sole piece of information that you base your decision on. If tensile strength is part of your final decision, confirm that you are getting the true numbers. If you examine a specification on these products from any manufacturer confirm the presence of both machine direction and transverse direction results. If you have questions or concerns contact your manufacturer and ask that they send you the test reports from an independent laboratory on the finished product. All manufactures whom are members of the IWFA, must supply you with these reports if you ask.

The overall protective nature of Safety and Security film is not limited to tensile strength. There are many aspects that make the film what it is. Safety and Security films are made from multiple layers of clear or metallized polyesters with the addition of laminating adhesives, coatings and mounting adhesives. The protection offered by these products is the combined affect of the polyester working in conjunction with the adhesives and coatings. A lot more than just tensile strength.
