



Tip: Tensile Strength Explained

Reference: TMT 013 Revision 001

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I have always been bothered by the misrepresentation of the Tensile Strength numbers on Security Film; I was pleasantly surprised recently when the IWFA agreed with me.

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 these films. 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 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, but nowhere did they state these are the numbers on the raw materials.

I have always thought this to be a highly misleading representation of tensile strength, as 2 mil polyester itself has a rating of 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 data; 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 also extremely dangerous.

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. In layman's terms when the product is manufactured the DNA of the raw materials changed and now it is a new species, related to the raw materials yes, but no longer exactly the same.

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. In order to present the square inch number a mathematical equation is performed, but it is not perfect as it assumes a certain number for the thickness.

However, within D882 "Breaking Factor" (item 11.2) states it shall be expressed in force per unit of width, pounds per inch of width. Under this section is an additional footnote #14 which 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.

This note indicates to me 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 and not disclosing this very important piece of information.

I feel much better now that I got this off my chest; refer to our dealer site for even more information.



Best Regards,

THE TINT MAN

