**Warranty for Polycarbonate – Yellowing**

The main reasons to use polycarbonate sheets:

1. High Impact Resistance (in a wide range of temperatures: \(-40^\circ F \text{ to } +250^\circ F\))
2. Clarity – allows a high percentage of light to pass through
3. High Fire Resistance

All polycarbonate manufacturers offer a warranty for their sheets. How to read and understand these warranties and compare the differences from one to the other is what is important.

When used as a glazing material, polycarbonate sheets are commonly exposed to the sun and they are constantly attacked by the sun’s UV wavelength. While the UV rays do not “penetrate” the polycarbonate sheet, to the naked eye these intense rays will constantly attack the outer layer of the sheet and thereby destroy the sheet and its inherent properties. This attack manifests itself in turning the outer layer of the sheet yellow which indicates a general degradation of the sheet. How the sheet’s surface is protected from these UV rays, and therefore, how they are warranted, is what differentiates the various sheets in the market.

The most common procedure used to protect the sheet is a microscopic layer of UV polycarbonate inhibitor. This “co-extruded protection layer” blocks the UV wavelength before it gets to the outer most layer of the polycarbonate sheet. During the life of the panels, some of the UV does get through the protection layer but most of it is stopped on the outside. Over time, however, the UV breaks down this protective layer thereby rendering the polycarbonate sheet defenseless against its attack. The different warranties for polycarbonate product on the market reflect the effectiveness of the different methods used to protect the outer layer from UV attack. The LEXAN™ THERMOCLEAR™ Plus warranty clearly shows the relative effectiveness of their protective layer is much better than any other one on the market.

When the polycarbonate is attacked by the UV, it changes color and starts to become yellow. This phenomenon happens because the connections between the polycarbonate molecules lose their strength. The color turning “yellow” is just the “visual symptom” of the loss of the sheets mechanical properties; namely LT (Light Transmission) and impact resistance.

The industry standard is to measure “yellowing” in terms of “Delta YI”. The essence of this test is to measure the difference in the color of the sheet at any point in time when comparing it to its original color. The difference as measured by “Delta YI” (i.e.: change in the Yellowness Index between “new product” and “old product”) denotes that change. These results also correlate with a proportionate amount of loss of the sheets ability to transmit light (light transmission).
Transmission of Light

Spectral Transmission of Polycarbonate Sheeting:
Polycarbonate sheet is transparent to wavelengths of light between 385nm at the lower limit and approximately 5000nm at the upper limit. Importantly, polycarbonate is opaque to infra-red radiation: light in the visible spectrum entering a building is absorbed by the interior contents and re-radiated as long wave infrared radiation, which cannot be re-transmitted back through the polycarbonate sheet.

Yellowing Index:
The number calculated from spectrophotometric data that describes the change in color of a test sample from clear or white toward yellow. This test is most commonly used to evaluate color changes in a material caused by real or simulated outdoor exposure.

Yellowness is a property important to many industries for several reasons. First, processing of various materials may cause yellowing. Next, the purity of some products may be determined based on the amount of yellowness present. Also, some products degrade and yellow with exposure to sunlight, temperature, or other environmental factors during use. Thus, yellowness has become an important variable to measure in industries such as textiles, paints, and plastics. There are different types of yellowness indices available, depending on the type of products being measured. Two of the most common are:


ASTM D1925 has been withdrawn, but its yellowness index is still used in many industries. Samples measured by method E313 must be nearly white and opaque. When items are being compared using YI E313, they must be similar in gloss, texture, translucency, and other physical attributes. If these criteria are not met, the yellowness values will not be meaningful. Products such as paints, textiles, and plastics are often measured by this method.

The D1925 method requires samples that are nearly colorless transparent plastics or nearly white translucent or opaque plastics. When items are being compared using YI D1925, they must be similar in transparency, translucency, opacity, thickness, shapes, and other physical attributes. As with method E313, if these criteria are not met, the yellowness index values are not meaningful.