

# Thoughts From The Top: TPO

## What Are You Really Getting?

Thermoplastic Polyolefin, more commonly known as TPO, first came to the market in the early nineties as an attempt to correct the deficiencies of Polyvinyl Chloride (PVC). Today, there are a half dozen manufacturers, and even more marketers. It has become the most widely used single-ply membrane on the market. TPO (typically) has a white, reflective surface, is puncture resistant, is easy to install and has a high tensile strength. On paper, TPO sounds like the perfect roof, but what are you really getting? The most common misconception is that all TPO membranes are the same. In reality, every manufacturer has a different chemical formulation. In fact, the current formulations, depending on the manufacturer, are in their second, third or fourth generation. Having the right formulation is crucial for the membrane to achieve longevity. When purchasing TPO it is important to ask these questions:

- How long has the manufacturer been making the membrane?
- How many different formulations has the manufacturer used?
- Has the manufacturer reformulated because of reflective heat degradation?
- Does the contractor have a good relationship with the manufacturer?

And most importantly...

## What is the Thickness Above the Scrim?

Single-ply membranes come in three different thicknesses: 0.045", 0.060" and 0.080" (commonly abbreviated as 45-mil, 60-mil, and 80-mil). Like anything, you get what you pay for. The thicker the membrane, the longer it will last. TPO has three components: the base layer, the scrim and the polymer above the scrim. All three layers are measured to achieve the *overall* thickness; the roach in the pudding being that not all are designed to keep water out of your building. The scrim is a fabric that is rolled in between the base layer and the top layer to create additional reinforcement to enhance the membrane's puncture resistance and tensile strength. The polymers above and below the scrim have different formulations. The base layer does not prevent moisture from infiltrating the system, only the polymer above the scrim does. So how much polymer is above the scrim? The answers vary depending on the manufacturer, but all are similar:

- 45-mil = 15 - 17 mils of polymer above the scrim
- 60-mil = 21 - 27 mils of polymer above the scrim
- 80-mil = 33 - 35 mils of polymer above the scrim

## Why Does the Polymer Breakdown?

Some of the biggest factors that cause the breakdown of TPO membranes are oil, grease, fatty acids, jet fuel and ponding water. Long-term exposure to these chemicals will soften the membrane and increase the deterioration of the polymer. Ponding water is a result of improper drainage and can be detrimental to roofing systems. As a kid, did you ever grab a magnifying glass, go outside and try to light ants on fire? Ponding water acts in the same way. It magnifies ultraviolet light, which will more rapidly breakdown the TPO compound. These environmental factors are generally excluded from manufacturers' warranties.

Research and history have shown that UV rays have a dramatic effect on the deterioration of all roofing systems, especially the top layers of TPO membranes. As soon as the top polymer degrades down to the scrim, the entire roofing system will begin to fail. Typically, the polymer above the scrim breaks down at a rate of 1 - 2 mils every year with some variance depending on the region it is installed. As a result, a 45-mil TPO membrane will last only twelve years on average, while an 80-mil TPO roof may last over thirty years if properly designed and maintained. Unlike other membranes on the market, TPO provides a small percentage of actual weather protection. As a relatively young product, there is limited research into the historical performance of TPO, and TPO has no standard specification. It can be a good membrane, if you have limited foot traffic, few penetrations and when short-term cost considerations take precedence over long-term performance. There are plenty of other membranes and roofing systems that outperform TPO, but are less popular due to being both more difficult to install and more expensive.



The top layer of polymer on this TPO roof has broken down to the point where the scrim is clearly visible to the unaided eye.