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*Sure-Weld TPO*

# 2009 TPO Competitive Test Program

Summary of Results





## Architectural Testing

All testing was conducted by an independent laboratory.

Carlisle chose to utilize an independent laboratory to conduct all testing to add credibility to the study. Membrane was purchased from various sources but was always acquired through the same channel a roofing contractor would use. One roll of each competitor's membrane was selected and various samples were cut from these rolls.

# The Tests

- Seam Strength
- Breaking Strength
- Tearing Strength
- Overall Thickness
- Thickness Over Scrim
- Puncture Resistance
- Reflectivity

This list represents the actual physical properties that were evaluated. Each of these physical properties affects the service life of the roofing system in some way.



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# Seam Strength

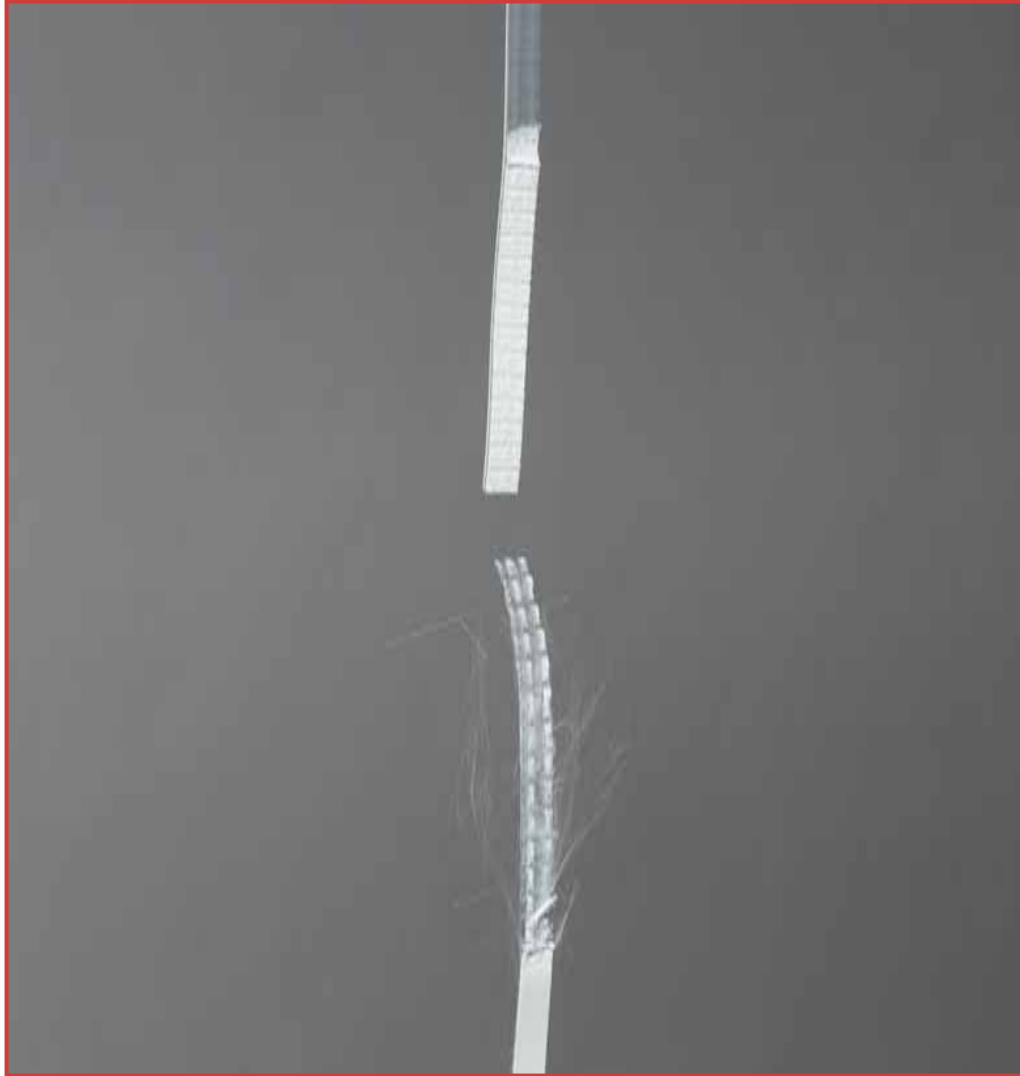


**Seam Peel  
Strength Test**

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# Seam Strength



**Desired Mode of  
Failure During  
Seam Peel  
Strength Test –  
Ply-to-Ply  
Separation**

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# Seam Strength



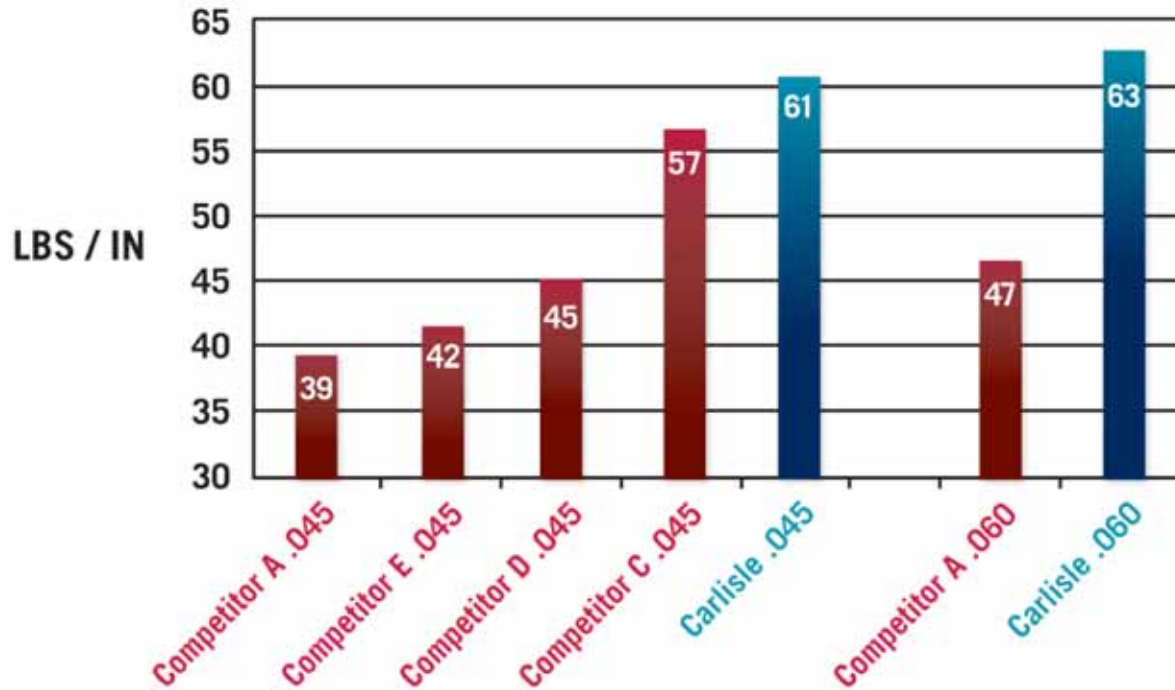
**Simulated Wind Uplift Test - The stronger the seam, the greater the uplift resistance.**



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# Seam Strength



A chain is only as strong as its weakest link. It is extremely important that the seam of a TPO roofing system does not become that weak link. If welded properly the seam areas should be stronger than the sheet itself. It's always a good idea to consult an experienced roofing contractor regarding which TPO membrane they feel has the widest range of weldability. A wide range of weldability will help ensure a solid seam at various temperatures and conditions without adjusting speeds and temperatures of the welder.

\* Product C did not weld well at the typical welder settings for TPO of 12.5 fpm / 1004°F. Sample was washed with soap and water and dried. Settings were changed to a slower speed and a good weld was obtained.  
Carlisle's Sure-Weld TPO was tested as Product B.

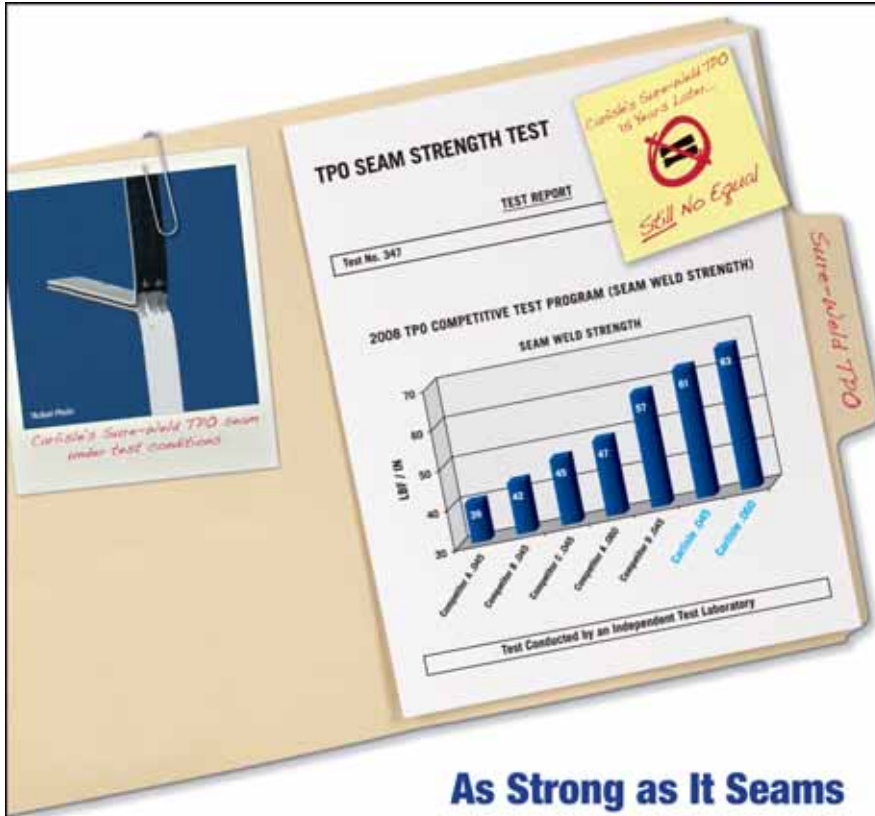




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# Seam Strength



Currently running  
in industry  
publications

## As Strong as It Seams

Not all TPO membranes are created equally, so don't put your reputation on the line with a subpar sheet. Carlisle's Sure-Weld® TPO features the strongest, most dependable heat-welded seams in the industry, providing your customers with the long-term performance and protection that they want and need. **Carlisle's Sure-Weld TPO...Still No Equal.**

### Benefits of Carlisle's Sure-Weld TPO:

- Stronger seams equal fewer leaks and callbacks
- Better wind uplift performance
- No need for special heat-welding equipment
- Faster welding speed and widest window of weldability
- Consistent seams in virtually all weather conditions
- Labor-saving prefabricated accessories save time and improve performance

Investing in Roofing Solutions for Over 45 Years

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# Breaking Strength

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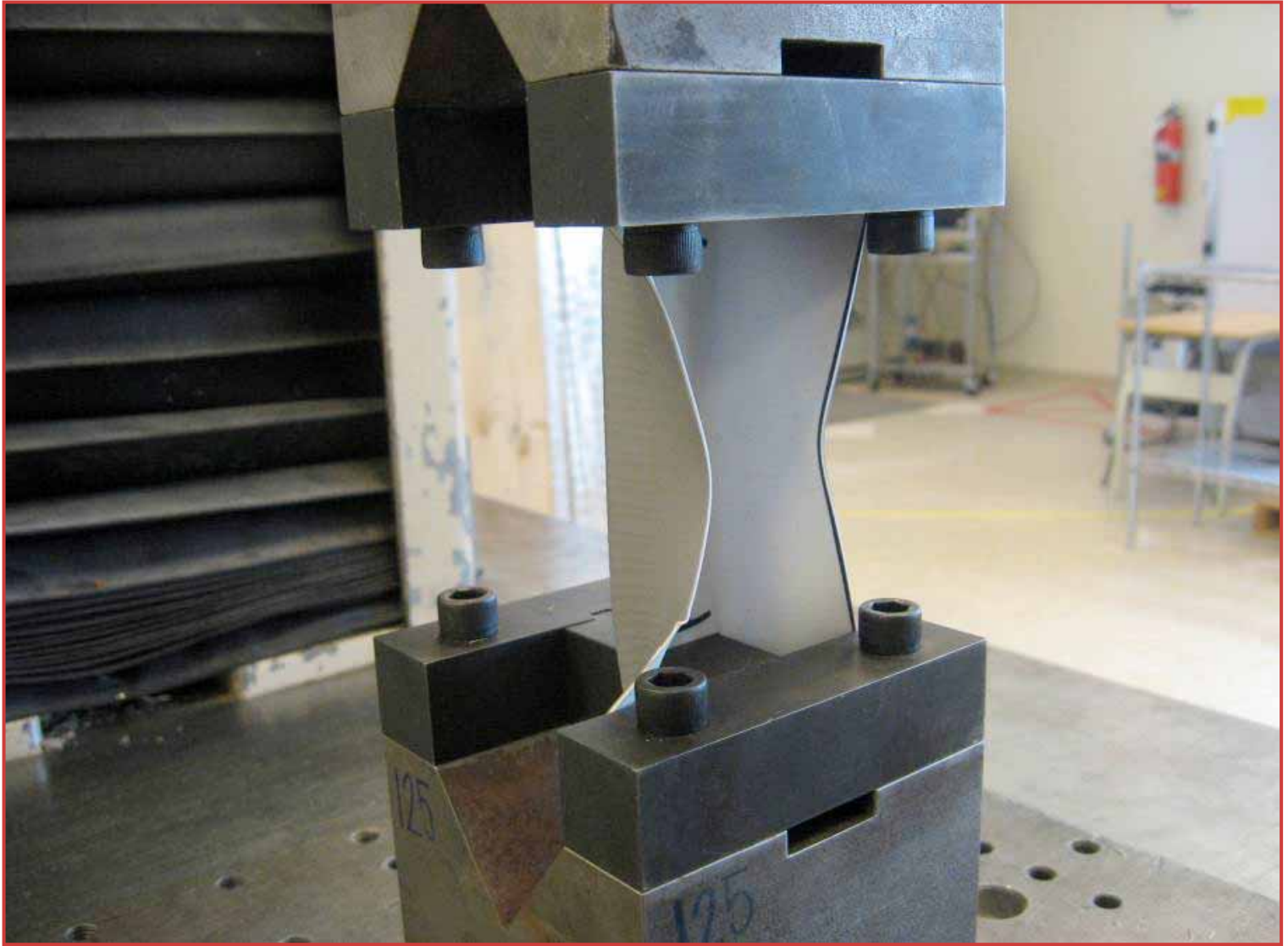
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**Breaking Strength  
Test**

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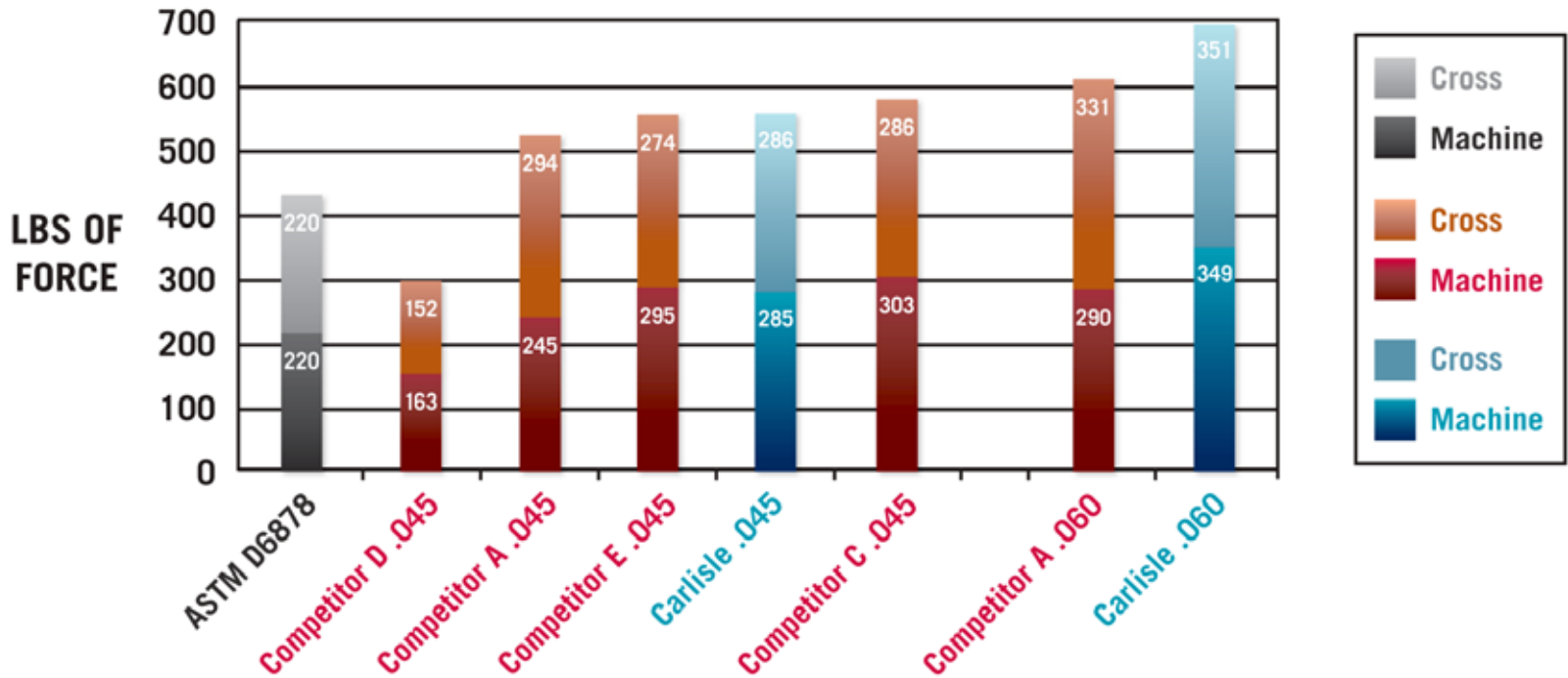


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# Breaking Strength

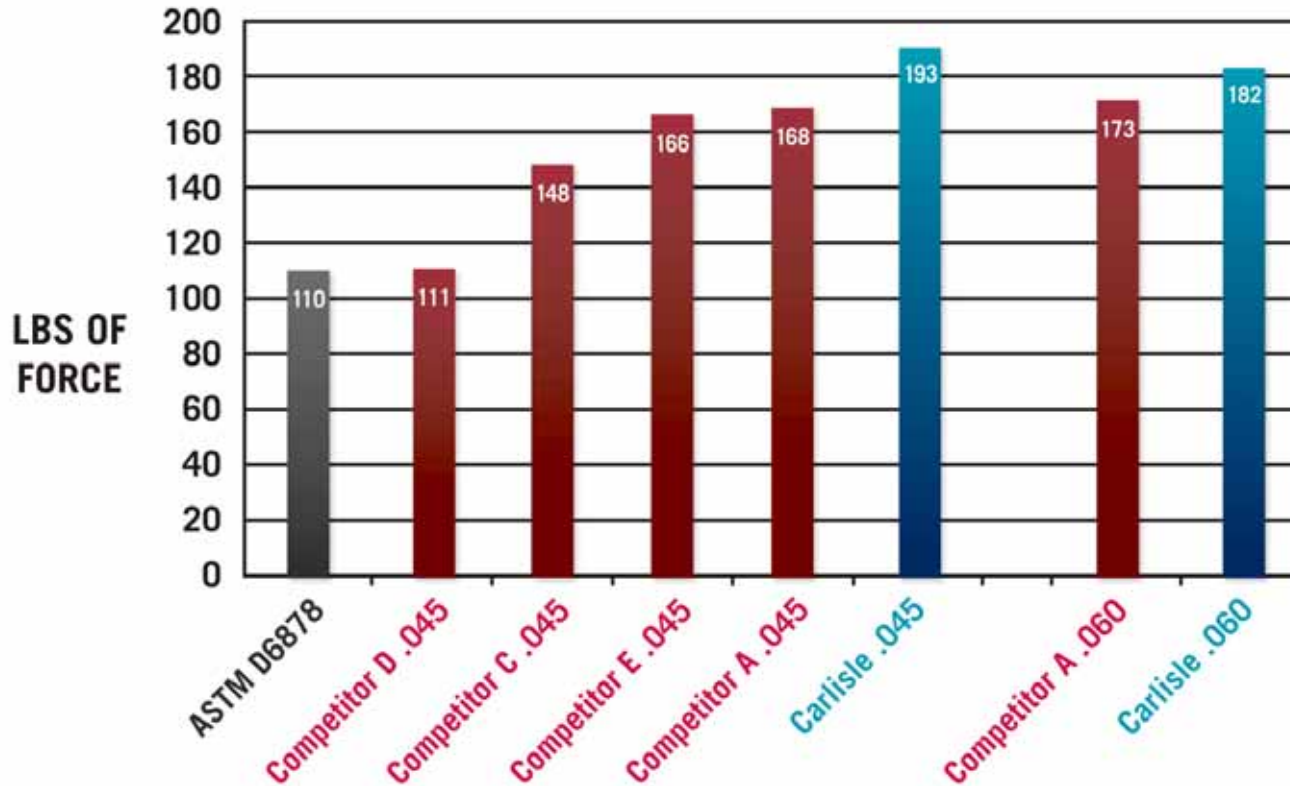


A majority of TPO roofing systems that are installed are mechanically fastened to the roof deck. Breaking strength is a critical measurement of a sheet's strength if the membrane is ever subjected to extreme forces, such as excessive wind, against the fasteners that hold it in place. The ASTM breaking strength test consists of a machine pulling the membrane in opposite directions and recording the amount of force necessary to create membrane failure. This test is performed both across the sheet (cross direction) and lengthwise (machine direction).

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# Tearing Strength



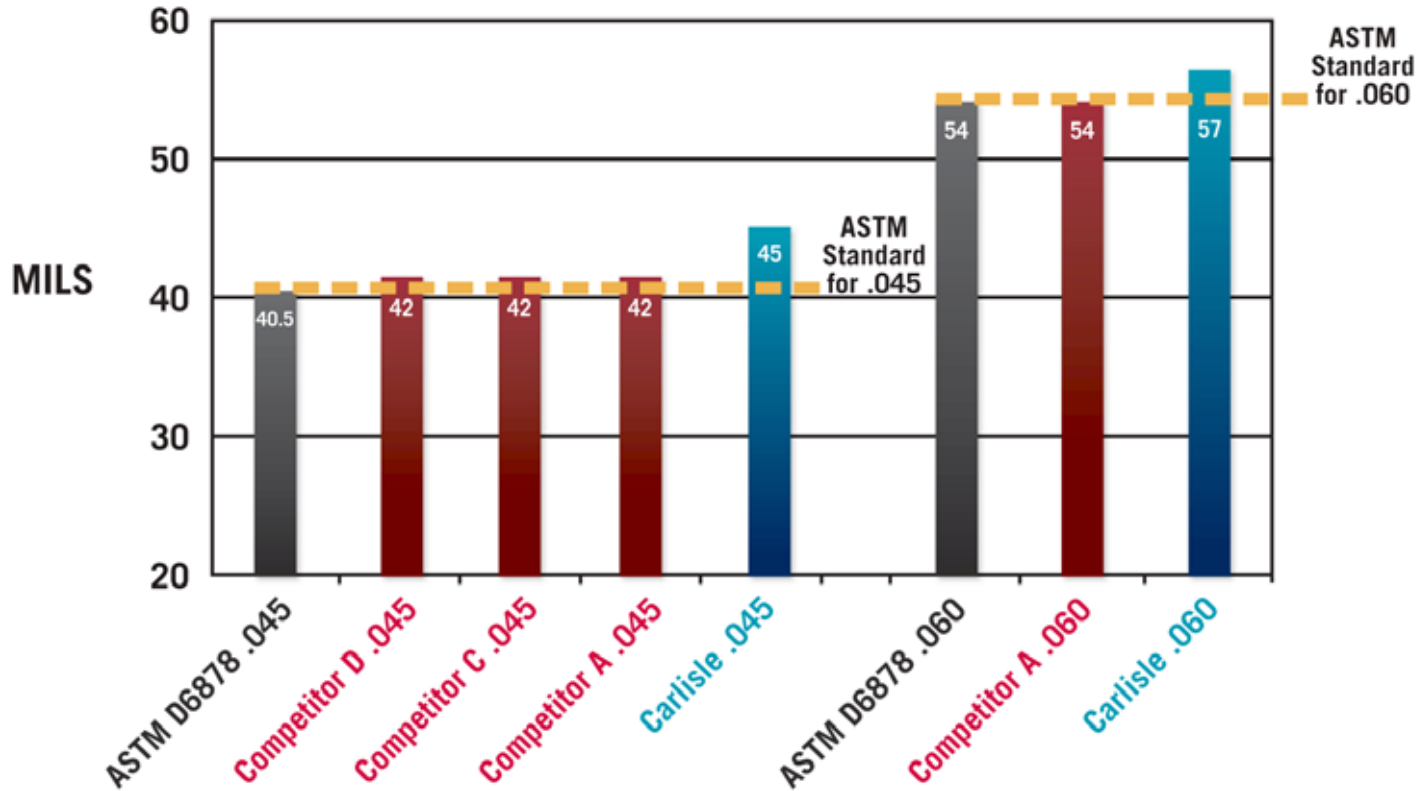
Tearing strength is very similar to breaking strength and its importance is just as critical. Tearing strength is a measurement of how much force is required to rip the membrane from the edge, as opposed to breaking strength which involves pulling opposite ends of the sheet in different directions. Tearing strength results are also measured by adding the results of the force required to tear the sheet both across and down the sheet. The main benefit to a high tearing strength value is experienced when a small cut in the membrane occurs. By having high tearing strength a small cut is less likely to become a large tear, which can lead to excessive damage.



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# Thickness Overall



Roofing systems are constantly under attack from elements, such as wind, hail, snow and rain. The thicker the membrane, the better. Thicker membranes have greater puncture resistance and more material to help withstand the effect of acid rain and deterioration caused by long-term UV exposure. Even between manufacturers it is important to note that not all 45-, 60-, and 80-mil thicknesses are the same. ASTM sets a minimum thickness to be classified as a 45-mil sheet. Carlisle Sure-Weld TPO exceeds those minimums by as much as 10%. When dealing with a 45-mil membrane, the last thing you want to do is buy the thinnest sheet allowed in the industry.

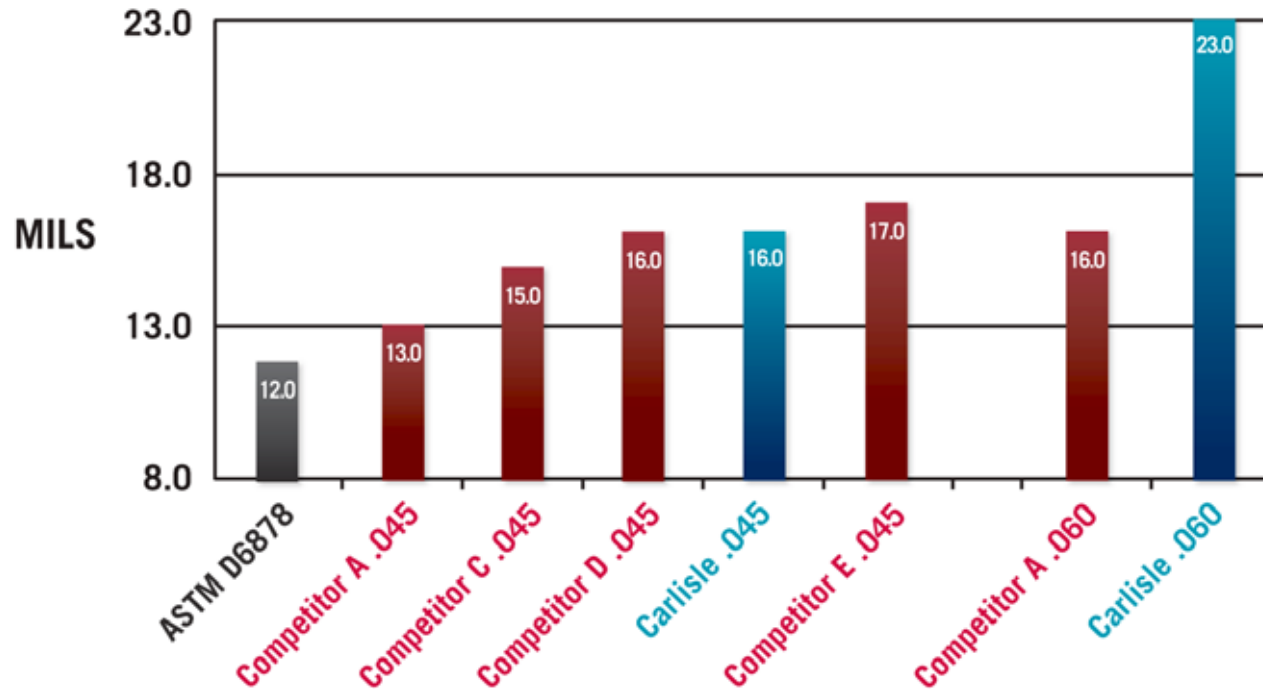




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# Thickness Over Scrim

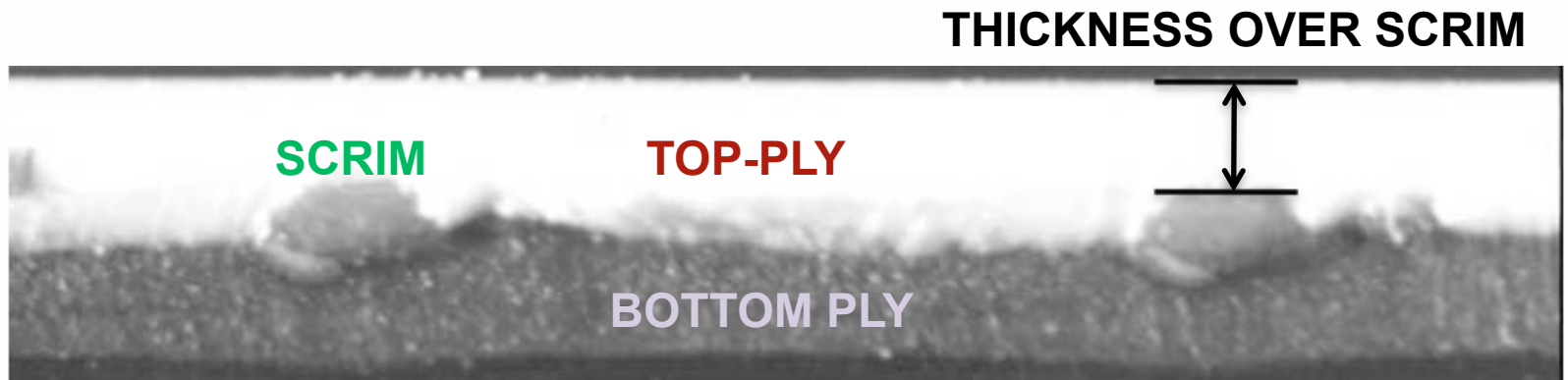


While it's important to have a thick sheet, which is measured in the "Thickness Overall" test, "Thickness Over Scrim" measures the top-ply of the TPO membrane. TPO consists of a top-ply, scrim in the middle and a bottom ply. The top-ply is the front line of defense against the elements and the usable life of the membrane is compromised when the scrim is exposed. Thickness over scrim is a critical measurement when evaluating the potential longevity of a TPO roofing system.

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# Thickness Over Scrim



## Membrane Cross-Section



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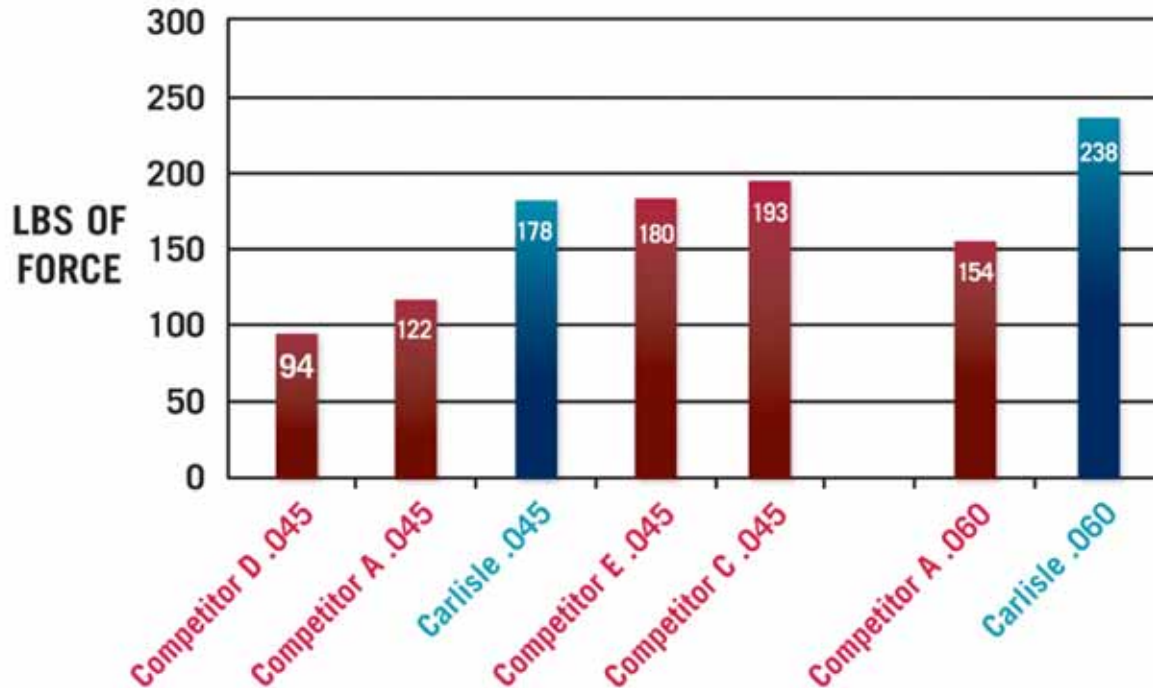
# Puncture Resistance



**There are many reasons to have a membrane with high puncture resistance.**

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# Puncture Resistance



On a properly installed TPO roofing system a common way for leaks to occur is through punctures in the membrane. By ensuring that the membrane installed has high puncture resistance and the manufacturer has the ability to provide an accidental puncture warranty, leaks due to punctures in the membrane can be mitigated and handled in a timely manner

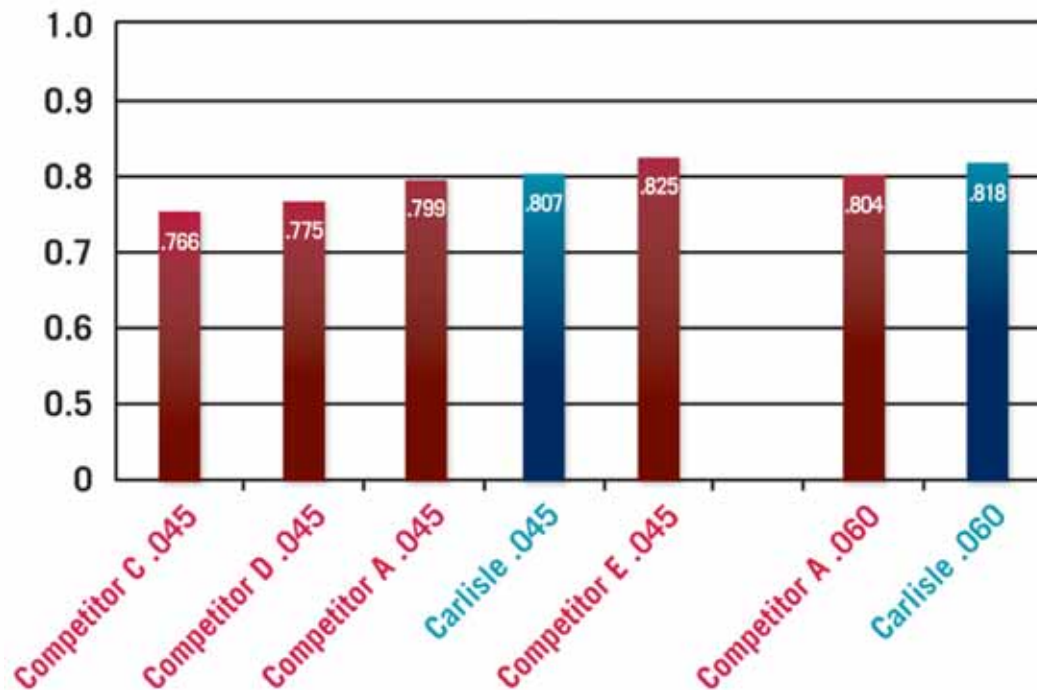


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# Initial Solar Reflectance



The benefits of a "cool roof" or light-colored roof have been widely reported. The more reflective a roof membrane is, the cooler the roof remains. Increased heat generated from a darker roof contributes to the "Urban Heat Island" effect and increases air conditioning bills. Many TPO manufacturers point to their products' initial solar reflectance as a measure of their ability to provide an energy-efficient membrane. In fact a TPO's ability to stay whiter longer is a more important factor. Ensure you are getting the best long-term product by checking 3-year aged values in addition to initial reflectance.



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# Aged Solar Reflectance

Carlisle TPO



Product A

**5-Year Outdoor Exposure**

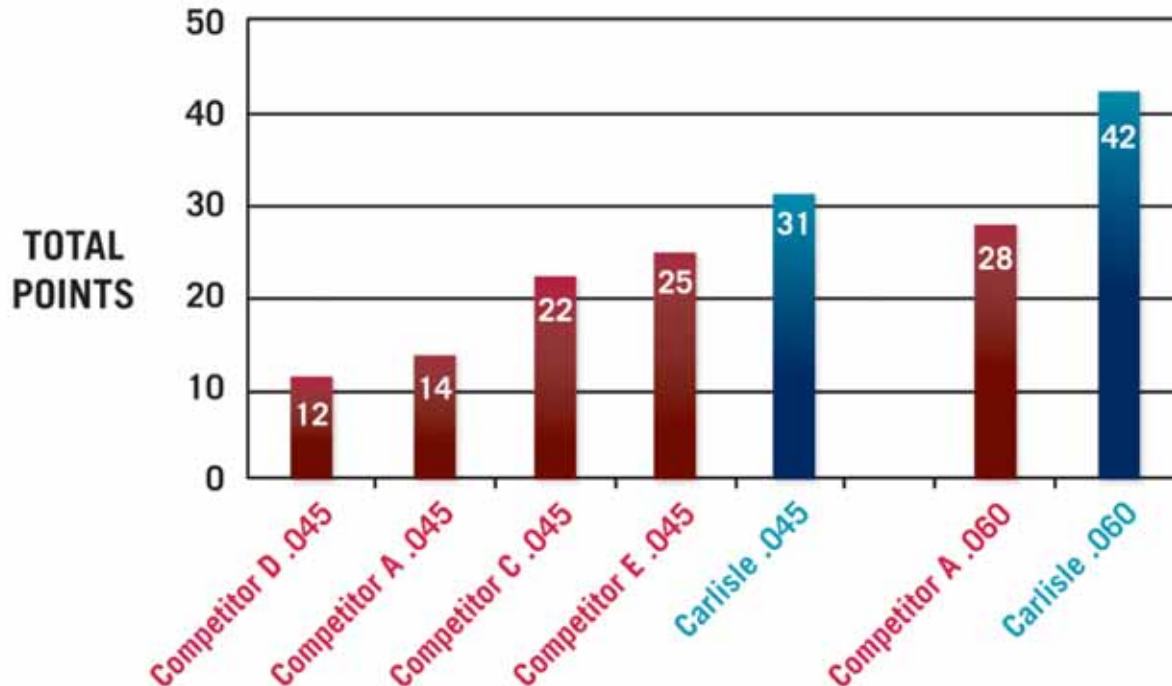
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# Rank By Properties



After compiling all of the test data, a ranking system was applied to each of the TPO membranes. Each test was given the same weight in terms of importance. For each of the tests, the sample that performed the worst was given a score of 1, and the sample that performed the best was given a score of 7. Therefore this table reflects the cumulative score of all the tests.