

3M™ Solar Acrylic Foam Tapes for Junction Box Bonding

Overview

3M™ Solar Acrylic Foam Tapes technology enables the rapid attachment of junction boxes on solar modules. The easy, no-mess application of junction boxes with die-cut 3M™ Solar Acrylic Foam Tape allows for faster fabrication and can result in a cleaner look, compared to liquid adhesives and mastics. 3M™ Acrylic Foam Tapes are UL certified.

About 3M Solar Acrylic Foam Tapes

For more than 30 years, industries worldwide have been using 3M™ Solar Acrylic Foam Tapes to permanently bond and seal many substrates for increased productivity, high strength, long term durability, and improved appearance. 3M™ Solar Acrylic Foam Tapes are made with acrylic foam, which is viscoelastic in nature. This gives the foam energy absorbing and stress relaxing properties. The acrylic chemistry provides outstanding durability.

Advantages and Benefits

Attaches and seals junction boxes on solar panels quickly, and with no mess on crystalline and thin film modules

- Proven outdoor weatherability
- Provides immediate holding strength – with no cure time
- Can be applied manually or with automated equipment
- Consistent bond thickness – no “squeeze-out”
- Closed cell foam construction seals against moisture intrusion
- Can be custom die-cut into virtually any shape
- Modules using 3M Solar Acrylic Foam Tapes tapes have passed IEC, UL and TÜV testing

Recommended Products

3M™ Solar Acrylic Foam Tape 2110 and 2155

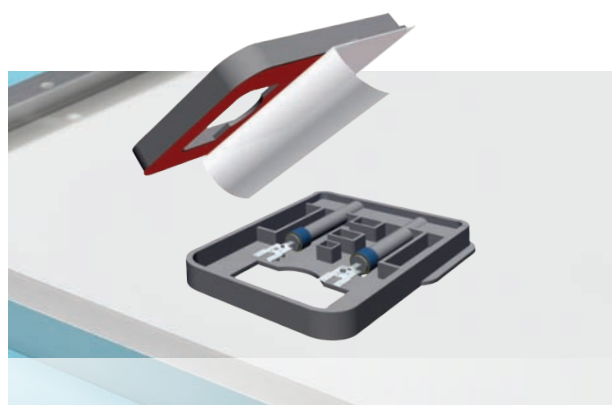
For surfaces with high surface energy, such as glass

- Excellent damp heat performance
- Optimal adhesive strength in combination with adhesion promoter

3M™ Solar Acrylic Foam Tape 4110 and 4155

For surfaces with low surface energy, such as 3M™ Scotchshield™ Film and other junction box materials.

- Better adhesion characteristics to the broadest range of substrates
- Softer foam tape levels out possible unevenness of the surface



Over 1GW of cumulative applications to date!

Adhesion Testing

Tape selection considerations

3M Solar Acrylic Foam Tapes enable intimate contact with the substrate (“Wet-Out”). This is required to allow molecular interaction to build to maximum adhesion.



Pressure sensitive adhesive flows over time

Because the surface energy of the substrate will impact wet-out, 3M Solar Acrylic Foam Tapes are available in various adhesive formulations optimized for different substrate materials. The use of the adhesion promoters* will improve initial adhesion. Generally:

- 3M™ Adhesion Promoter AP111 will optimize adhesive to metals, paints and plastics.
- 3M™ Adhesion Promoter 4298UV allows for improved adhesion to multiple substrates.
- 3M™ Adhesion Promoter AP115 will improve moisture durability on glass.

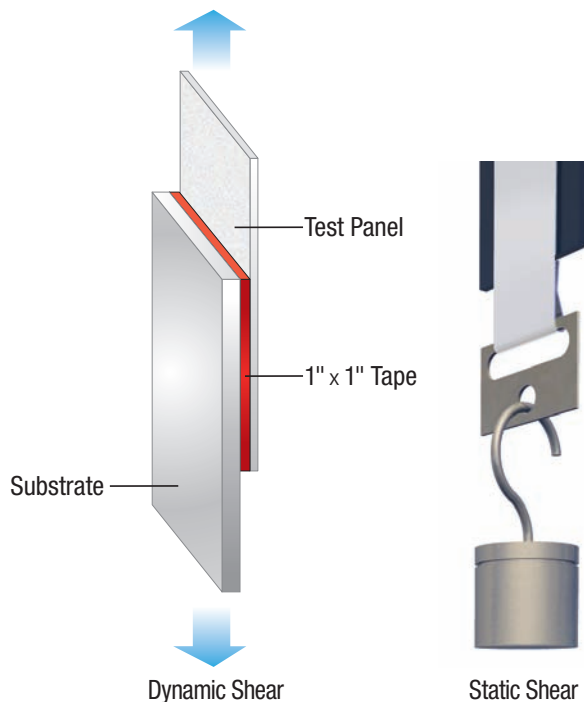
3M uses a number of industry-standard tests to determine tape bond strength and durability on various substrates and under different environmental conditions.

Static Shear Test

This test records the time required to shear a defined area of tape from a test panel at a constant load under a number of variable conditions, including sample size; substrate material; load; heat and humidity.

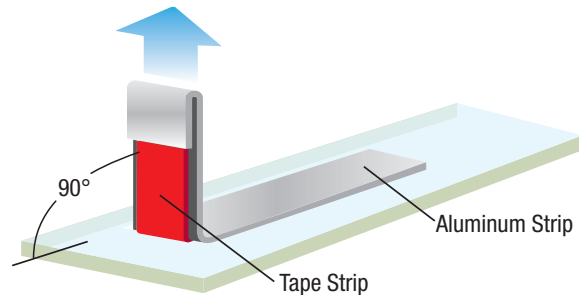
Dynamic Shear Test

This test measures the force required to shear a defined area of tape from a test panel at a constant load pulling in both directions. Variables include load; sample size; substrate material; heat and humidity.

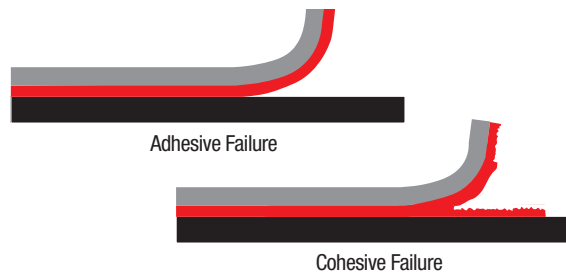


90° Peel Test

The following tests measured tape adhesion on various substrates after sitting for 20 minutes at room temperature; after 1000 hours at room temperature; and after 1000 hours at 85°C/85% relative humidity. This particular series was conducted using a test called the 90° Peel.



The 90° peel test records the amount of force required to achieve tape failure, by peeling a standard width of tape from a test panel on a moving constant 90° fixture. In this test, adhesive strength is measured in two ways: *Cohesive Failure* is when the foam backing fails within itself; *Adhesive Failure* is when the adhesive completely de-bonds from the substrate. For Junction Box applications it is preferable for a tape to fail as a result of cohesive failure, which indicates a stronger adhesive bond to the substrate.



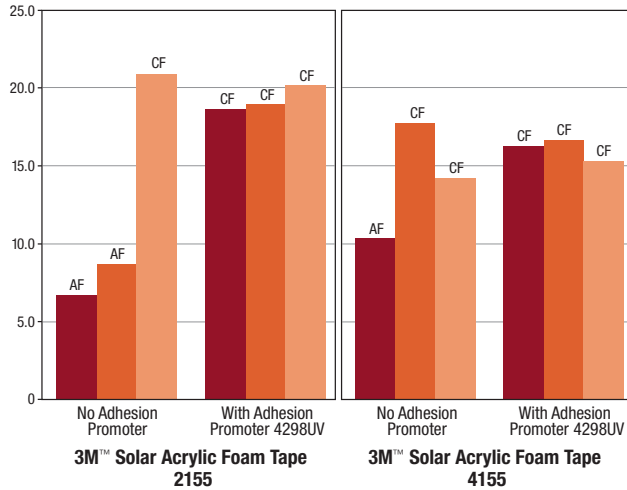
*Consult local air quality regulations before use.

Adhesion on typical junction box substrates

Note that in almost all cases the use of an adhesion promoter significantly improved bonding performance.

3M™ Solar Acrylic Foam Tape Adhesion to Modified PPE/PPO

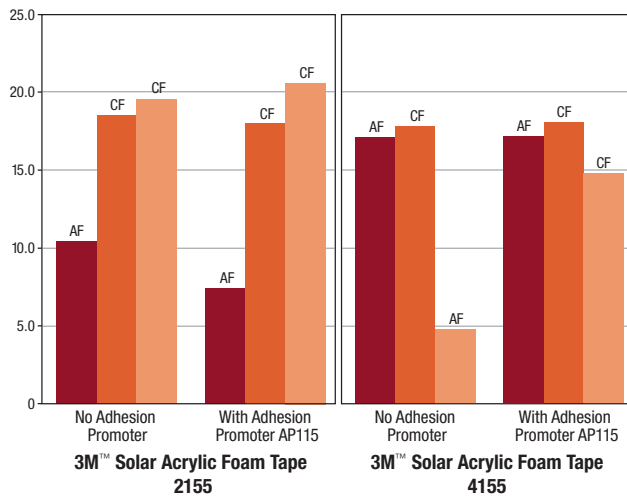
90° Peel (lbs./0.5" width) CF=Cohesive Failure AF=Adhesive Failure MF=Mixed Failure
 20 Min RT 1000 Hrs RT 1000 Hrs 85°C/85% R.H.



Adhesion on typical module substrates

3M™ Solar Acrylic Foam Tape Adhesion to Float Glass (Sn Side)

90° Peel (lbs./0.5" width) CF=Cohesive Failure AF=Adhesive Failure MF=Mixed Failure
 20 Min RT 1000 Hrs RT 1000 Hrs 85°C/85% R.H.



Application

The following are general recommendations for manual and automated application that have proven most successful. Please contact your local 3M representative for details.

1. Clean the back side of the module

The module should be cleaned with an IPA and water solution – and wiped dry. The module surface must be clean, dry and free of grease. Even minor contaminations can impair the adhesive strength.

2. Prepare surface with 3M™ Adhesion Promoter (optional)

The recommended application temperature for adhesion promoter and substrate is between +15°C and +50°C. Shake adhesion promoter well before use and apply it evenly and as thin as possible (approximately .05 mm, to allow for a quick evaporation of the solvent).

Allow adhesion promoter to dry thoroughly, depending on temperature, humidity, air circulation and porosity. We recommend a drying time of approximately 5 minutes. The evaporation of the solvent can be accelerated with an increased air flow at temperatures between 20° and 40°C, generated by a fan. Drying times can be reduced to approximately 10 seconds with a thin coat of adhesion promoter and good ventilation. **Important: make sure that the solvent has completely evaporated.**

3. Bonding

After placing the junction box in position, it should be pressed in place briefly and with high pressure (example: 15 psi for 5 seconds). The bond strength will build with time. The rate of build will depend on the substrate. Normal handling (transportation, etc.) is possible shortly after the application; however, avoid exposure to humidity or cleaning processes until the bond is complete.

For specific questions about your application, please contact 3M for testing and sample product.

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Other Areas

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For more information on our solar manufacturing product line, contact 3M Renewable Energy at 800-755-2654 or visit us at www.3M.com/solar.

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