3M Holding Fast
High Performance Acrylic Foam Tapes for the Automotive Aftermarket
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Options in Acrylic Foam Tape Selection

Acrylic foam tapes have steadily replaced mechanical fasteners for automotive assembly in recent years, in both OEM and aftermarket applications. The selection of the proper tape for each application is important to long-term performance as well as manufacturing economy.

3M™ Acrylic Foam Tape is produced in five primary thicknesses, 0.030", 0.045", 0.060", 0.090 and 0.120". Each has its own performance characteristics with regard to stress relaxation and surface conformability. Generally, the thicker the foam core, the more energy it will absorb and dissipate rather than concentrating stress in the adhesive bond line.

In addition, these tapes are available with several adhesive types depending on the performance required. Overall performance is dependent on both foam core stress relaxation and adhesive properties.

Dale Stewart, 3M senior technical service engineer, explains, "We can usually recommend the best combination of tape properties for a given application, based on our broad experience over many years. However, we frequently confirm that choice with laboratory testing because of the variables that can occur, even with similar applications and substrates."

Stewart explains that as a rule of thumb, 3M suggests a tape area of 1 square inch per pound of attachment for relatively flat, mated surfaces (Figure 1). If the configuration of the mounted component places leverage forces on the tape bond, this weight-to-tape surface ratio may need to be increased. Such decisions are typically confirmed with laboratory tests that measure holding force under varying conditions. All weight-to-tape-surface area ratio adjustments are validated by actual tests to determine "real world" performance.

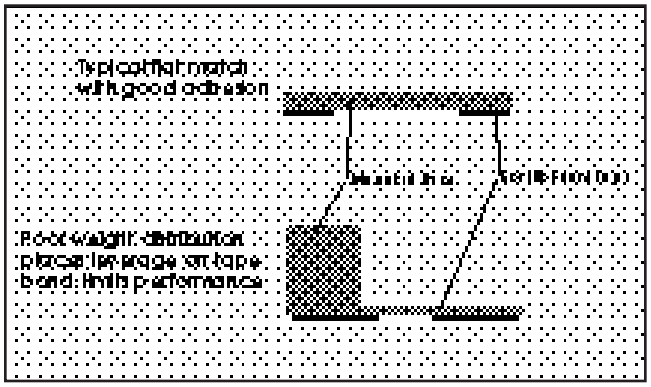

Figure 1 - The surface area of tape required for good aftermarket attachment results is based on total weight as well as weight distribution.

A 0.030" thick, medium density tape is used for most applications, Stewart notes, but in cases where increased tape conformability and improved stress handling properties are desired, the low density foam will be required.

Weight-to-tape-surface area ratio is not the only factor to be considered in selecting the proper tape thickness or optimum tape amount, 3M finds. Other elements include the stresses that might result from material differences and mis-match. For example, significant stress could be caused by a substantial difference in coefficient of expansion between a metal substrate and a plastic part. Stress could also result from the parts not properly matching during assembly. These differences can place extra stress on a tape bond compared to joining similar surfaces, and this stress must be absorbed by the tape's foam core to prevent ultimate failure.

The optimum tape foam thickness for such thermal and physical mis-matched applications will be based

on specific expansion values and assembly stresses as well as part weight and other factors. The best solution can be found by laboratory testing of taped assemblies.

Items such as PVC or TPU claddings can grow substantially with temperature while underlying door or body panels change very little. If tape selection and application are not carefully considered, attachment performance may suffer. This mounting application may call for a thicker tape core with a high performance adhesive for greater forgiveness of thermal displacement and stress relaxation.

Stress may also be created as parts are being mounted with tape. If one surface is compressed or stretched as the tape is applied, permanent stress will be induced into the tape bond line. This will affect both the function of the tape's foam core and adhesive and the permanence of the bond. Both surfaces should be unstressed and reasonably well fitted for good tape assembly.

All pressure sensitive adhesives and tapes will tend to soften and lose some adhesion at elevated temperatures, especially if stressed. Temperature performance limitations are typically not an issue in automotive applications using 3M™ Acrylic Foam Tape. 3M Acrylic Foam Tape functions well at temperatures between -40°F and 300°F, exceeding the requirements of most automotive applications. While each tape attachment application differs, depending on the exact nature of both the attached part and the substrate, specific tape thicknesses are commonly used for various automotive aftermarket applications. Table 1 lists typical materials for common application segments.

Dale Stewart, senior technical service engineer

TechTip

In general, acrylic foam tape users should choose the thinnest tape that will yield the desired performance for their application, including static and dynamic holding strength, appearance, temperature resistance, and overall permanence. Specifiers should concentrate on building a clean application before the tape is applied. This means that tape-mated surfaces should match properly, and that the type and amount of tape to be used suits the needs of the application. It is a mistake to rely on the superior performance of 3M tapes to make up for deficient materials, poorly fitted components, incomplete surface preparation or careless assembly techniques.

Careful engineering and attention to detail will ensure long-term attachment success, with good appearance (minimum bond line), the lowest total applied cost, and highest possible performance. Effective tape attachment requires high quality tape, and careful testing to confirm product selection, attachment details, and ultimate performance.

Application	**Typical Tape Thickness**
Wood Dash Components	0.030" light weight, thin bond line desirable
Body Side Moldings	0.030" typical, some at 0.045" for high performance or to match specific OEM specs
Wind Deflectors	0.030" or 0.045" due to performance or OEM specs
Ground Effects	0.060" or 0.090" may be combined with screws on ends
Stainless-Steel Rockers	0.030" thin bond line desirable, long parts may flex
Stainless-Steel Bed Rails	0.045" to 0.090" depending on surface match and materials
Claddings	0.060" or 0.090" subject to stress, poor surface matching
Bug Deflectors	0.090" (some at 0.060") contend with poor surface matching

Table 1 - Typical 3M Acrylic Foam Tape aftermarket mounting applications.