

## REQUIREMENTS FOR LISTING UL 181A CLOSURE SYSTEMS

Pressure Sensitive Tape  
Heat Activated Tape  
Fiber Glass Fabric & Mastic



# INTRODUCTION

**T**he performance of a fiber glass duct system depends on the performance of the individual components as well as the fabricator and installer.

One of the most critical performance considerations is the closure system which provides structural strength and seals the duct system joints. These closure systems are tested by Underwriters Laboratories (UL) and duct board manufacturers to meet UL 181A requirements and are designed to be used with the overlapping duct system jacket and outward clinch staples. Where stapling flaps are not available, cross tabs approximately 8" (200 mm) in length and 12" (300 mm) on center are used to secure the joint before a closure system is applied. The three closure systems are:

- Pressure Sensitive Tape
- Heat Activated Tape
- Fiber Glass Fabric and Mastic

## UL 181A CLOSURE SYSTEMS

Underwriters Laboratories, in cooperation with NAIMA and leading manufacturers of closure systems, developed test requirements to simulate actual operating conditions. This resulted in the following UL testing standards for each closure system:

UL 181A, Part I (P): Pressure Sensitive Aluminum Tape for use with Rigid Fiber Glass Air Ducts

UL 181A, Part II (H): Heat Activated Aluminum Tape for use with Rigid Fiber Glass Air Ducts

UL 181A, Part III (M): Fiber Glass Reinforced Mastic Closure Systems for use with Rigid Fiber Glass Air Ducts

### Pressure Sensitive Tape

The pressure sensitive tape method of closure is the most widely used and will produce strong, airtight seams and joints in fabricated fittings, between duct sections, or to seal the connection between duct sections and sheet

metal where system pressure permits adhesion to metal. Not all pressure sensitive tape is the same. Since the performance of the closure system is critical to trouble-free duct systems, the tape must be able to withstand the stresses, temperatures, and humidity present in long-term HVAC system service. UL 181A tests help assure these performance requirements are met.

After stapling and, when required, a thorough cleaning of the duct surface, the tape is installed by centering it over the edge of the staple flap and rubbing it firmly in place. Installers should follow the manufacturer's instructions for proper cleaning and sealing procedures. If temperatures at the time of installation are below 50°F (10°C), additional heat will be required along with pressure to achieve a good seal.

## Heat Activated Tape

Heat activated tape has a scrim reinforcement providing additional strength to the closure. Because there is no release liner, there are more feet of tape per roll of the same diameter and there is nothing to throw away. Under most conditions, there are no storage or shelf life problems associated with heat activated tapes.

Heat activated tape is applied in almost the same manner as pressure sensitive tape, but must be ironed with a duct board sealing iron set at approximately 500°F (260°C) to achieve the bond to the duct surface. For added assurance for the fabricator and installer, the heat activated tapes are designed with green dots that darken when the bonding temperature has been reached. Because the bonding temperature cannot be reached easily, this closure method is not recommended for bonding to sheet metal because the sheet metal acts as a heat sink and makes it difficult to achieve the necessary bonding temperature. The heat activated closure method eliminates the need for stapling when used with the Closemaster™ closure machines.

## UL Listed Fiber Glass Fabric and Mastic

The fiber glass fabric and mastic sealing system, while not as quick and easy as either pressure sensitive or heat

activated tape methods, is the only acceptable system if the duct is to be part of some fire-rated assemblies or when making connections to equipment or sheet metal ducts which are subjected to pressures over ½" W.G. (125 Pa).

After stapling and, if required, cleaning of the duct surface, mastic is brushed onto the joint and the glass fabric is embedded in the mastic. A second coat of mastic is applied to fill the fabric texture. Joints should be allowed to dry for 24 hours before being pressurized.

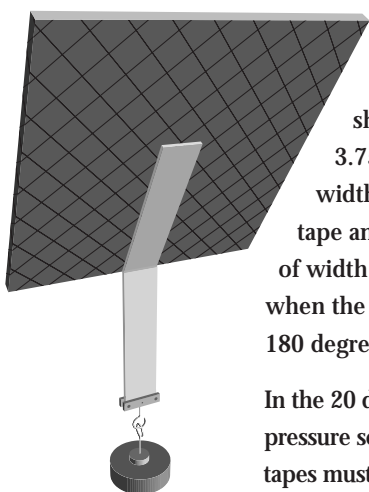
## TESTING

### Tensile Strength Test

The closure system is tested in both the machine and cross-machine directions of the roll. The average tensile strength in both directions should not be less than 25 pounds per inch of width.

### Adhesion Tests

Peel adhesion—the ability of any closure system to retain its bond on the duct board surface—is fundamental to successful long-term performance. In the 180

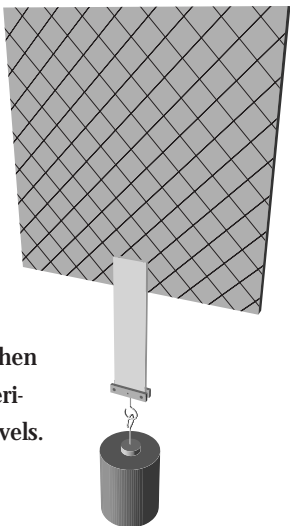


degree angle test, the average peel adhesion strength should be not less than 3.75 pounds per inch of width for pressure sensitive tape and 4.5 pounds per inch of width for heat activated tape when the test load is applied at a 180 degree angle.

In the 20 degree angle test, both pressure sensitive and heat activated tapes must support a load of two pounds for a period of 24 hours at a 20 degree angle. The comparable adhesion test for the mastic closure system is an adhesion strength not less than 2 pounds per inch of width.

## Shear Adhesion Test

In actual duct installations, closure systems are subjected to shear loads and must not allow slippage of the closure system on the duct board. The shear adhesion test measures the system's ability to sustain such loads. To pass, the closure system must not fail when subjected to various loads, time periods, temperatures and humidity levels.



## Surface Burning Characteristics Test

The low combustibility of fiber glass duct board means that it will not contribute to the spread of flame and smoke during a building fire. And, as part of the duct system, neither should the closure system. The UL Surface Burning Characteristics test is performed on the composite of duct board and closure. The flame spread rating of the closure system and the board composite must not exceed 25, and the smoke-developed rating must not exceed 50.

## Mold Growth & Humidity Test

Fiber glass duct board does not support mold growth or deteriorate under normal humidity conditions, and the duct closure system must also resist mold and humidity problems.<sup>1</sup> All three closure systems are tested for resistance to humidity as well as mold growth and mold spread tests.

## Temperature/Pressure Cycling Test

This test series represents the ultimate in end-use evaluation by subjecting the tape to a series of temperature/pressure tests using three 32" x 8" x 46" (800 mm x 200 mm x 1150 mm) long duct sections having one horizontal joint section and end joints secured with the candidate closure system. The duct assembly is cycled

1. Knauf Insulation 1998 ASTM C-1338-96 Test Results.

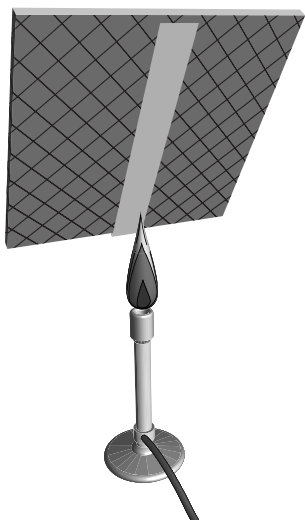
50,000 times from 0" to 3" W.G. (750 Pa) under the following conditions:

- 165°F (74°C) for 30,000 cycles
- 90°F (32°C) and 90% RH for 15,000 cycles
- 0°F (-18°C) for 5,000 cycles

Test criteria are based on leakage from the duct system. The test apparatus is constructed to terminate the test when a closure problem results in leakage above the predetermined criteria.

## Burning Test

The burning test simulates the closure system's contribution to an existing fire. The system shall not flame or



glow for more than 60 seconds after withdrawal of a test flame. Flaming or glowing shall not travel from the point of application to the far end of the test sample during application of the flame or within 60 seconds of removal of the flame. Any particles dropping from the tape shall not ignite untreated surgical cotton.

## OTHER REQUIREMENTS

The pressure sensitive tape stock used is to be mill-finish, dead-soft aluminum foil. The tape adhesive must be non-toxic. Tape must be evenly and uniformly wound on cores that are rigid enough to prevent distortion during normal transportation and use.

Heat activated tapes must be coated on one side with heat activated adhesive. The bond indicators must be located no more than 2 inches apart on the uncoated foil side.

The mastic closure system is supplied in containers and should be installed in a minimum width of 3 inches using fiber glass fabric for reinforcement.

The name of the manufacturer, product number, and UL listing mark must be clearly imprinted for permanent identification after installation on both types of tape. The same information must be imprinted on the mastic containers since imprinting of the installed mastic closure is impossible.

## FACTORY FOLLOW-UP SERVICE

One of the key features of UL 181A is that the manufacturers of tapes and mastics are under UL factory follow-up service. This means the quality control procedures and material requirements established by the manufacturer at the time of listing must be maintained in order to retain listing status.

## APPLICATION

All listed closure systems are supplied with detailed application instructions, which should be followed closely to achieve specified performance. Also, controlled storage conditions are essential to proper performance and are included with the manufacturer's instructions.

## UL 181A IS THE RIGHT CLOSURE SYSTEM

Tapes and mastics that carry the UL marking and manufacturer's name have passed the rigorous UL 181A test procedures and are an assurance of a trouble-free duct closure system when installed according to the manufacturer's instructions.

UL 181A test requirements are the companion test procedure to UL 181, which calls for 17 tests of a fiber glass duct system's performance and longevity. Fibrous glass ducts which pass UL 181 are listed as Class 1-Air Ducts, Rigid by UL. Use of a non-listed closure system voids the

UL 181 system qualification. Such a system will not meet model energy, local building or mechanical codes.

Look for the UL listing marks on duct board products and on closure systems when buying, specifying, or inspecting a fiber glass duct system job.

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