

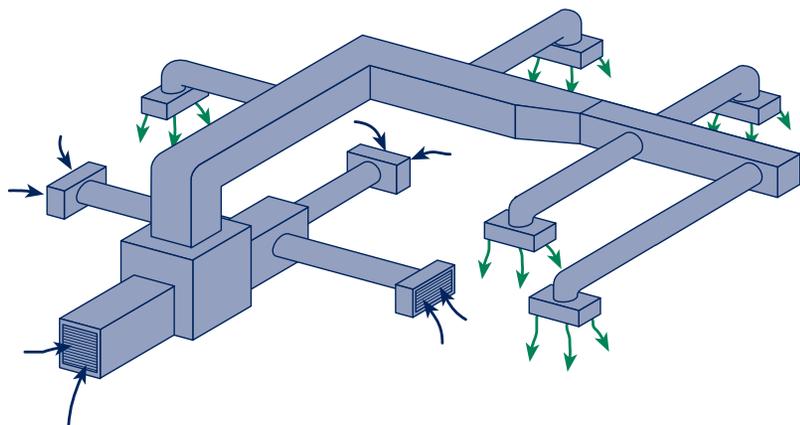


Fibrous Glass HVAC Duct Systems

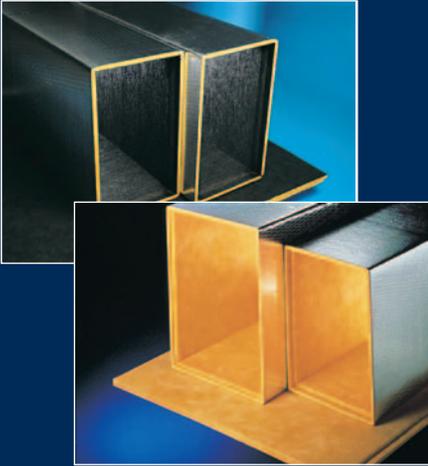
**PROVEN
PERFORMANCE**

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For almost 50 years, fibrous glass thermal and acoustical duct systems have been a key option for well designed HVAC systems. Providing cost-effective delivery of indoor environmental quality, fibrous glass duct systems offer a wide range of benefits for both commercial and residential buildings. This brochure reviews these benefits and provides information on the broad range of proven performance characteristics of fibrous glass duct systems.



FIBROUS GLASS DUCT SYSTEMS



Fibrous glass ducts are fabricated from 1", 1½" or 2" thick boards of insulation material manufactured from resin bonded inorganic glass fibers. The outside surface of the board is a factory-applied reinforced aluminum air barrier and water vapor retarder. Fibrous glass duct systems can be easily fabricated, either in the contractor's shop or at the job-site, and eliminate the extra fabrication steps required when applying thermal and/or acoustical insulation to sheet metal ducts.

Fibrous glass duct systems can easily accommodate all normal duct system components.

BENEFITS

Fibrous glass duct systems provide a wide range of benefits for both commercial and residential buildings, including:

Energy Conservation

Fibrous glass duct systems reduce HVAC system operating costs by controlling heat loss or gain through duct walls. Because joints are virtually air tight when properly assembled and sealed, the amount of energy waste due to duct leakage is greatly reduced.

Noise Control

Fibrous glass duct systems distribute air quietly. The built-in thermal/acoustical insulation absorbs noise generated by central air handling equipment and air movement through the ducts. The insulation also reduces noise transfer, such as cross-talk, from one room to another through the ducts.

Condensation Control

The fibrous glass duct's outer jacket helps control moisture condensation in the air handling system, thus reducing the opportunity for water damage, or for microbial growth and amplification. The good thermal insulation properties of fibrous glass minimize condensation on the exterior of the duct.

Indoor Environmental Quality (IEQ)

The focus of Indoor Environmental Quality (IEQ) is human comfort. Fibrous glass ducts help enhance the comfort level of building occupants by providing quiet, efficient air delivery and improved indoor air quality with adequate ventilation. Increased ventilation requirements, which mandate a specific cubic foot rate of air per occupant, place more demands on a building's energy source. By maintaining a consistent air temperature throughout the HVAC system, fibrous glass duct systems allow air flow to be supplied at the designed temperatures.

PERFORMANCE TESTED

In order to qualify as a Class 1 duct system, fibrous glass duct systems have to pass a series of 17 rigorous Underwriters' Laboratories tests, 13 of which are applicable to rigid Class 1 Air Ducts, the category applicable to fibrous glass duct systems. These tests cover a broad range of important performance characteristics including fire safety, long term durability, structural integrity and closure system performance.



The UL label is your assurance that the performance standard will be met for fire safety, long-term durability and structural integrity.

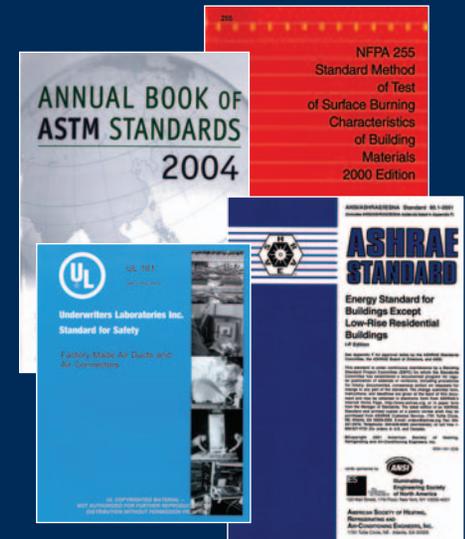
UL Test Program

Tests	Air Ducts			
	Rigid	Flexible	Air Connectors	Joining Materials
Surface Burning Characteristics	✓	✓	✓	n/a
Flame Resistance	n/a	n/a	n/a	✓
Flame Penetration	✓	✓	n/a	n/a
Burning	✓	✓	✓	n/a
Corrosion*	✓	✓	✓	✓
Mold Growth and Humidity	✓	✓	✓	✓
Temperature	✓	✓	✓	n/a
Puncture	✓	✓	n/a	n/a
Static Load	✓	✓**	✓**	n/a
Impact	✓	✓	n/a	n/a
Erosion	✓	✓	✓	n/a
Pressure	✓	✓	✓	n/a
Collapse	✓	✓	✓	n/a
Tension	n/a	✓	✓	n/a
Torsion	n/a	✓	✓	n/a
Bending	n/a	✓	✓	n/a
Leakage	✓	✓	✓	n/a

* Applicable to parts of metals not inherently corrosion resistant.

** Test applicable for flexible air ducts and air connectors that incorporate vapor barriers supported by grommets or other means of field support.

FIBROUS GLASS DUCTS MUST MEET STRINGENT REQUIREMENTS



All fibrous glass products used in air handling systems must meet the stringent requirements and/or recommendations of the following organizations, testing laboratories and agencies:

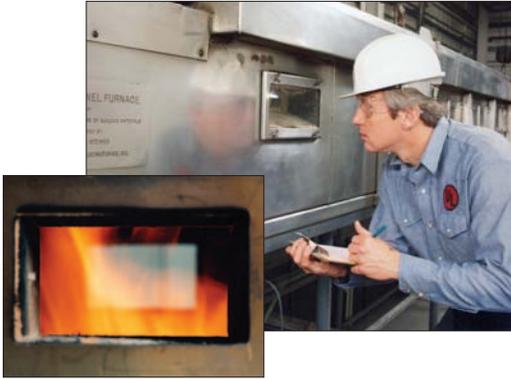
- ASTM
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- National Fire Protection Association (NFPA)
- North American Insulation Manufacturers Association (NAIMA)
- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- Underwriters' Laboratories, Inc. (UL)

These organizations determine performance criteria for duct system construction, installation, and safety. These criteria are adopted as part of building codes at local, state, and Federal levels.

TEST SUMMARIES

UL 181 Tests for Fire Safety

Surface Burning Characteristics Test



Test Procedure: The UL Surface Burning Characteristics test, recognized as a standard test for evaluating all types of building materials as to their performance when exposed to heat and flame, is conducted in a 25-foot tunnel, with fiber glass duct — including closure system forming the ceiling. When a gas flame impinges on the duct material, it must not exceed a flame spread rating of 25. Smoke developed must not exceed a rating of 50.

✓ *Test Results: Fibrous glass duct systems are resistant to flame spread from external or internal fire sources and are classified as Class 1 materials.*

Flame Penetration Test



Test Procedure: The exterior surface of the fibrous glass duct material is subjected to a gas flame from a furnace. It must resist penetration of the test flame for 30 minutes while supporting a concentrated load of 2 pounds per square inch.

✓ *Test Results: Fibrous glass ducts withstand the flame penetration test without collapse or evidence of perforation which would allow direct passage of flame or gases, and without combustion on the exterior surface of the sample.*

Burning Test



Air ducts should not continue to burn progressively, and exterior surfaces of the material should not drop particles that are capable of igniting combustible materials such as cotton.

UL Test Procedure: Finished duct sections mounted in horizontal, vertical and 45-degree positions are exposed to the flame of a Bunsen burner for two 60-second periods. Duct sections shall not flame or glow longer than 60 seconds after the flame is removed, and the duct shall not drop any materials capable of igniting a layer of cotton which is placed one foot below the exposed duct sections.

✓ *Test Results: Fibrous glass ducts cannot be ignited by small, low-energy flames, like those from a burning wastebasket, and spread the fire.*

UL 181 Tests For Long-Term Durability

Mold Growth and Humidity Test



High humidity conditions can lead to mold growth, causing not only unpleasant odors but also possible health hazards.

UL Test Procedure: Duct samples containing mold mycelia and bread spores are placed in a dark chamber with high humidity for 60 days. Duct samples must neither sustain mold growth nor show any evidence whatever of deterioration or delamination.

✓ *Test Results: Fibrous glass duct insulations do not support microbial growth.*

Temperature Test

Specifiers of duct systems must be assured that the temperatures common to normal service will not cause deterioration over a period of time, including any deformity or delamination. Nor should joints separate.

UL Test Procedure: Sample duct sections are exposed for 60 days to an exterior temperature of 125°F and an interior temperature of 265°F — far higher than the normal temperatures encountered in an operating system. No deterioration may occur in the wall structure.

✓ *Test Results: No deterioration occurs in the wall structure of the fibrous glass duct board or to the closure materials.*

UL 181 Tests for Structural Integrity

Puncture Test

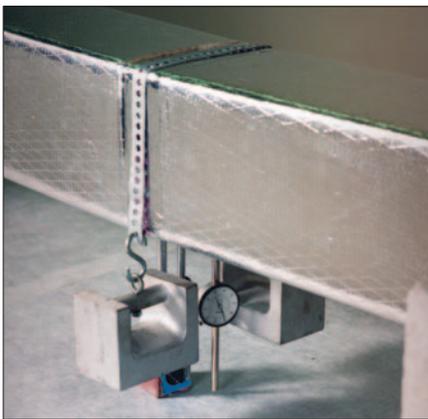


During fabrication and installation, unintentional mishaps such as a dropped tool can occur and the duct must be able to withstand them. Even in routine service, air ducts may encounter abuse. This test indicates just how well the duct will resist damage during and after installation.

UL Test Procedure: Duct sample is subjected to the impact of a two-pound rod dropped in several locations, including joints. The fact that the duct wall resists complete penetration gives assurance that its integrity will remain intact under normal operating conditions.

✓ *Test Results: Fibrous glass duct is puncture-resistant.*

Static Load Test



UL Test Procedure: A duct span is subjected to static load. After a ten-pound weight has been suspended from the span's center for 24 hours, deflection must be no more than one percent of span length.

✓ *Test Results: The structural integrity of fibrous glass duct — as determined by this test — exceeds that required in actual installations.*

Pressure and Collapse Tests



Two tests measure a duct system's ability to function under excessive positive or negative pressures, without signs of collapse, damage or undue deformation.

UL Test Procedures: Sealed duct sections are subjected to 2 ½ times rated positive and negative pressures. Positive pressure ducts must not rupture or show slippage of closure materials; negative pressure ducts must not lose more than 20% cross-sectional area.

✓ *Test Results: Fibrous glass ducts successfully withstand positive and negative test pressures 2½ times higher than rated operating pressures. This far surpasses the fifty percent margin required in most installations.*

Impact Test



Fibrous glass ducts are designed and engineered to withstand normal shipping and construction site handling and abuse.

UL Test Procedure: A 15-pound sandbag is dropped from a 10-inch height onto the duct's surface to determine the effect of impact upon a duct.

✓ **Test Results:** After testing, fibrous glass duct returns to its original shape, without damage that could make it unsuitable for use.

Leakage Test

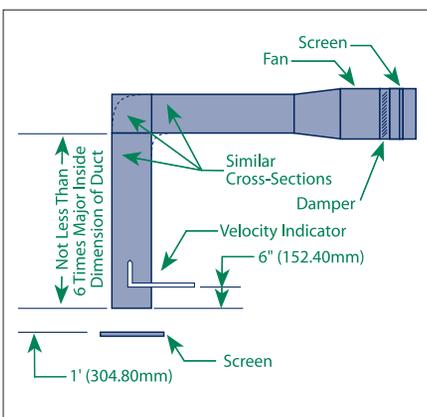


Leakage of conditioned air out of supply ducts or non-conditioned air into return ducts can severely compromise the overall energy efficiency of an HVAC system. Fibrous glass duct systems, when installed according to manufacturers' recommendations, are virtually leak-free.

UL Test Procedure: A flow meter measures leakage under positive pressure in an eight-foot fiber glass duct section with both ends capped. Test is conducted on duct samples already exposed to static load, impact, pressure or collapse tests.

✓ **Test Results:** Leakage in fibrous glass ducts does not exceed 20 times the static volume of the duct in a one-hour period, the maximum permitted by the UL standard.

Erosion Test



This test is important because of the concern that, under operating air flow conditions, airborne fibers may erode, resulting in exposure to building occupants.

UL Test Procedure: A fabricated duct sample that has passed the impact test is subjected to an air stream. The velocity of the air stream in the four-hour test is $2\frac{1}{2}$ times that of the maximum operating velocity recommended by the manufacturer. For example, a maximum operating velocity recommendation of 2,400 feet per minute (fpm) would be tested to 6,000 fpm in this test. By comparison, typical low pressure commercial duct systems operate in the range of 1,500 fpm.

Other Tests: In tests of much longer duration, the Kettering Laboratory at the University of Cincinnati tested seven separate fiber glass duct systems for erosion, with an air velocity of 3000 fpm — for 136 continuous hours.

✓ **Test Results:** Fibrous glass duct material, under elevated velocity, does not break away, flake off or show any other evidence of erosion or structural damage.

Standards for Fibrous Glass Duct Closure Systems

The performance of duct closure systems for rigid Class 1 Air Ducts is tested according to standards established by Underwriters' Laboratories UL 181A. These standards require closure systems (pressure sensitive tape, heat activated tape or glass fiber and mastic) to perform satisfactorily under rigorous tests which simulate actual installation and in-service use. These include:

Temperature/Pressure Cycling Test

This test series subjects the closure system to a series of temperature/pressure tests after it has been used to make up a duct section from duct board.

Test Procedure: The test series evaluates a 32" x 8" duct cycled from 0" to 3" w.g. under the following conditions:

- 165°F for 30,000 cycles
- 90°F and 90% RH for 15,000 cycles
- 0°F for 5,000 cycles

Test criteria is 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.

Shear Adhesion Test

In actual duct installations, the closure system is subjected to shear loads and must not allow slippage on the duct board. This test measures the system's ability to sustain such loads.

Test Procedure: When subjected to loads up to ten pounds per inch width during extended test periods, under several temperature and humidity levels, the closure system must not fail.

Peel Adhesion Test

Peel adhesion is the ability of a closure system to retain its bond to the duct board surface. It is fundamental to successful long-term performance.

Test Procedure: The closure system must support a load of two pounds per inch width for a period of 24 hours when subjected to the 20° peel adhesion test.

Surface Burning Characteristics Test

The low combustibility of fibrous glass duct board means 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.

Test Procedure: When a gas flame impinges on the closure system, it must not exceed a flame spread rating of 25. Smoke developed must not exceed a rating of 50. These are the same low ratings required for the fibrous glass duct itself under UL 181 tests.

Shear Adhesion Test Conditions (for pressure-sensitive tapes)

Application Conditions ^a	Dwell Time ^b	Test Conditions ^a	Test Load	Test Duration
40°F (4.4°C) dry substrate	15 minutes	40°F (4.4°C)	5 pounds (22.2N)	6 hours
73.4°F (23°C) 50 percent RH	24 hours	73.4°F (23°C) 50 percent RH	10 pounds (44.5 N)	120 hours
73.4°F (23°C) 50 percent RH	15 minutes	150°F (65.6°C)	5 pounds (22.2 N)	6 hours

a. Application conditions and test conditions shall be controlled within ±3.6°F (2°C) and ±5 percent RH, where specified.

b. Dwell time is the time that the test specimen is in contact with the test panel, at test conditions, after rolling but prior to the application of the test load.

Additional Requirements for Closure Materials

The three types of closure systems listed to the right have specific requirements relating to the particular products being used to make up the closure system. For example, all closures have minimum strength properties based on the requirements for the duct system but these may be modified according to what the product type actually exhibits. All have requirements for marking, although with the mastic-based system, it is impossible to have the information imprinted on the installed product.

Because of these basic differences between the products, different specifications were developed where necessary. Review the closure system manufacturer's product literature for these facts and follow their recommendations carefully to achieve the full benefit of each of these product types.

What Closure System Manufacturers Must Do to Retain Approval Status

One of the key features of UL 181A is that the quality control procedures and materials requirements established by the closure system manufacturer at the time of listing must be maintained in order to retain closure system approval status. This is accomplished through a factory follow-up by the listing agency. These regular, unannounced visits assure continuing quality.

Closure System Application

Detailed application instructions supplied with the closure system materials must be followed closely to achieve specified performance. Information is also provided on controlled storage conditions which are essential to proper closure system performance.

Summary

Fibrous glass duct board systems conserve energy, control noise and control condensation, providing cost-effective delivery of indoor environmental quality. They are approved for use by key governmental agencies and must meet the requirements of nationally recognized standards-making bodies.

About NAIMA

NAIMA is the association for North American manufacturers of fiber glass, rock wool, and slag wool insulation products. Its role is to promote energy efficiency and environmental preservation through the use of fiber glass, rock wool, and slag wool insulation, and to encourage the safe production and use of these materials.

Closure Systems

Longitudinal and transverse joints of fibrous glass duct modules are sealed using one of three UL listed closures:

- UL listed pressure-sensitive aluminum foil tape (UL 181A-P)
- UL listed heat-activated aluminum foil tape (UL 181A-T)
- UL listed fiber glass fabric and mastic (required when the fibrous glass duct system is part of a fire-rated assembly) (UL181A-M).

Note: Stapling is required with all three closure types.

Use of non-listed closure materials or techniques voids the UL 181 Class 1 Air Duct rating.



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