

# **THERMAL** **CORPORATION**

*A Division of Nailor International, Inc.*



**Miscellaneous**

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## Agencies

The design, testing and performance of air conditioning equipment is governed by several organizations. Organizations such as Underwriters Laboratories (UL), or Intertek (ETL), Air conditioning, Heating and Refrigeration Institute (AHRI), Air Movement and Control Association International, Inc. (AMCA), and the United States Department of Energy (DOE) all play an individual part in ensuring Thermal Corporation's, air handlers deliver the safety, performance and efficiency demanded.

UL/ETL safety standards for HVAC equipment are often followed by manufacturers even though they may not label their products. These standards have little to do with performance and everything to do with safety. Inspection and testing of a new product for conformance to a standard in an approved facility, is required to determine compliance. If requirements are met, the manufacturer is entitled to show approval on the unit nameplate.

AHRI is governed by participating air conditioning manufacturer members and is dedicated to a uniform means of rating the capacity and efficiency of air conditioning equipment. Certified equipment is listed in the AHRI directory and available for public download. Every year this agency requests a sample selection of listed models to be sent to a third party test laboratory. Testing will determine that the selected units, produce the capacity and the efficiency a manufacturer claims. Penalties are imposed and corrected capacity is required if a model fails a test.

The AMCA Certified Ratings Program (CRP) is allows all manufacturers of air movement and air control devices to obtain an AMCA Seal when their equipment has been tested and rated in accordance with recognized test standards. Only after the product has been tested and the manufacturer's cataloged ratings have been submitted to and approved by AMCA International, can performance seals be displayed in literature and on equipment.

The Department of Energy with the assistance of the American Society of Heating, Refrigeration and Air conditioning Engineers (ASHRAE) has imposed minimum efficiency requirements for unitary air conditioners, chillers and heat pumps.

The American Society for Testing and Materials (ASTM) is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems and services.

The National Electrical Code (NEC) is a regionally adoptable standard for the safe installation of electrical wiring and equipment in the United States. The NEC, while having no legally binding regulation as written, can be and often is adopted by states, municipalities and cities in an effort to standardize their enforcement of safe electrical practices within their respective jurisdiction.

The National Fire Protection Association (NFPA) is an international nonprofit that provides and advocates consensus codes and standards, research, training and education to reduce the overall burden of fire or other hazards to the quality of life. Many of NFPA's standards apply to materials used in the construction of Thermal's air handlers.



## Energistics Laboratory



### Energistics Mission Statement

Energistics Laboratory was designed and built for the purpose of testing both old and new HVAC components and for evaluating air distribution equipment that is to be installed in HVAC systems. Our goal is to ensure these products satisfy industry requirements.

Over twenty years after our founding, our mission remains the same - to ensure high standards in HVAC technology.

### Overview of Services:

#### Reverberation Room Testing

##### What is Reverberant Testing?

Reverberant testing measures the sound made by a piece of equipment. Reverberant rooms are constructed with reflective materials that allow us to measure only the sound created by the equipment. The Energistics' room is constructed to the ANSI S12.51 standard.

Two types of tests are performed in reverberation rooms. They measure "radiated" and "discharge" sound levels.

In a radiated test, the ducts connected to the terminal device are wrapped, preventing any sound from escaping. Therefore, the sound level measurements in the radiated test reflect only the sound emitted from the terminal device.

In a discharge test, the terminal device is placed outside the

way to compare a product's sound power level to industry standards. Reverberant testing may also be used to compare the noise level of different products under the same conditions. This information allows for a parity comparison of noise levels among several pieces of similar equipment.

At Energistics, we primarily test terminal equipment, including variable air volume boxes, fan-powered boxes, grilles, registers and diffusers. Our testing measures the level of noise created by these terminal units. Typically, a product is tested at several different octave bands - usually within a frequency range of 125 to 8,000 Hertz, the bands commonly recognized by the human ear.

##### Successful Reverberation Room Testing:

There are several components to a successful reverberant room test. First, the test product must be constructed exactly as it will be in production. Second, the testing setup must be constructed according to industry standards. These standards specify setup of the test instrumentation that must be used and the specific setup of the room. Finally, the instruments must be calibrated immediately prior to the test and no noise may pervade the test space. If any of these requirements are not met, the test cannot be considered valid. Should the equipment run louder than the manufacturer's specification, Energistics has the ability to work with the product manufacturer to improve the equipment's performance.

#### Mockup Room Testing

##### What is Terminal Mockup Testing?

Energistics is a pioneer of terminal unit mockup testing. Mockup testing measures the sound emitted by the ducts, terminal units and/or the diffusers of an HVAC unit. Acoustical consultants use mockup testing when the same unit is going to be installed in building numerous times. The test results indicate whether or not the equipment will perform as



room in order to measure the level of discharge sound that would be created by the terminal device.

##### When is Reverberant Testing Used?

Reverberant testing is typically used by manufacturers as a



designed. Manufacturers use mockup testing in order to document the performance of their equipment, which can then be used in catalogs or advertisements.

##### How is Terminal Mockup Testing Conducted?

To conduct a terminal mockup test, a room is constructed according to the architect's or manufacturer's design

## Energistics Laboratory

specifications. Using these specifications, the exact design of the space in which the terminal equipment will eventually be installed can be replicated. This replication is so exact that even the lighting fixtures are identical to those in the building.

With the specified construction in place, for any given project, we generally run several test specimens in order to see how that affects the noise level. We often use different sized units and sometimes add or remove added-on components. In addition to interchanging the equipment, we also change the plenum size.

### Case Study:

We conducted one such test for a major manufacturer of air conditioning equipment. We constructed the test room according to specifications, including paint on the wall and carpeting. We ran six different tests in which different elements, such as the size of the inlet, the size of the blower, the power of the fan and the location of the duct were changed. The elements which remained constant were the type of blower, the gauge of the galvanized steel for the ductwork and the fact that each was equipped with a return air boot. In the final analysis, we were able to determine that three of the units could run at their maximum set point and meet the specifications regardless of their construction. The last three units exhibited differences due to construction and set points had to be modified to meet specifications.

Office mockups integrate the project's proposed ceiling, plenum construction, interior architectural requirements, mechanical duct layout and system requirements. Our mockup allows end users, building developers, engineers and architects to "experience" the acoustical environment of a project's design. This experience is not only an evaluation of the mechanical system's performance, but can also be useful for the interior architect and end user to define Speech Privacy requirements for a project's general office space. The tests conducted provide acoustical and airflow data which are critical to the project engineer in ensuring compliance with project specifications.



## Curtainwall Facility

### Curtainwall Evaluation:

Energistics is the only laboratory in the country that mocks up both the curtainwall and office space of each proposed building design. Our curtainwall assembly mockup allows up to 20 feet of the project's proposed exterior building wall to be mocked up. Outdoor temperatures are envisioned at the project location are simulated and can range from -30°F to 120°F. With the proposed air distribution system operating, the perimeter office space temperature, air velocities and air flow patterns can be monitored to evaluate thermal requirements.

### What is a Curtainwall Test?

Energistics was one of the first firms to perform curtainwall tests. We have probably performed more of these tests than any other laboratory in the country.

There is a wide range in the thermal properties of the glass and mullions that form a curtainwall. One of the common uses for a curtainwall test is to ensure that the proposed curtainwall is neither under or over-engineered for the climate in which it will be built. Therefore, it is critical to check thermal performance under actual mockup conditions. As an example, a building in a city with a colder climate would benefit from a curtainwall system that had better thermal properties than a city with a warmer climate. The better the insulating characteristics of the glass and mullions, the easier it is to attain and hold the temperature set point. Another purpose is to allow the clients to "feel" what the space will be like when the heating and air conditioning systems are operating.

### How is a Curtainwall Test Conducted?

In a curtainwall test, we construct both the curtainwall and a typical office space, taking into account room size, ceiling height and the positions and sizes of the diffusers that will be used to distribute the air. To test the efficacy of the proposed curtainwall, we set both the airflow and the temperature to the specified levels and monitor the ability of the diffusers to keep the room at a specific temperature set point.

Curtainwall tests also help us to monitor the flow of air movement as it exits the specified slots or diffusers. As the air enters the space, we actually "map" the movement of the air with smoke generated by a commercial "smoke" machine. As the smoke disburse, we can videotape its movement.

### Successful Curtainwall Testing:

Reference for temperature and airflow are very individual and in some cases, regional. In the northern climates, occupants don't really like to "feel the movement of the air" in the space. In cities like Houston, the preference is just the opposite. For these reasons, we insist that the client actually come to the mockup test and experience the conditions him/herself.

The most common problem we find is that the specified diffusers do not perform as the client wishes. Sometimes "dumping" the air so it literally hits the occupant in the head; other times stratifying, coming down in layers so that it is cooler at the floor than it is higher up. In a recent project we were able to remediate this problem for a client by recommending and then testing different diffusers.

## Energistics Laboratory



### Air Handling Unit Mockup Facility

#### What is an Air Handling Unit (AHU) Mockup Test?

Like a terminal unit mockup test, an air handling unit mockup assembly is designed to measure noise made by mechanical equipment. The mockup enables the owner and project team to experience the noise levels as they would be in the space and if necessary, make refinements to the

architectural and mechanical elements of the design. In high-rise buildings that typically have floor mechanical equipment rooms, it is essential to understand the acoustical ramifications of the proposed design even so far as they relate to compliance with tenant lease agreements.

#### How is an AHU Tested?

The mockup for testing an air handling unit is actually an assembly consisting of one or more offices adjacent to a mechanical room which houses a floor AHU typical to the project. In the test, airflow is delivered both at the design operating conditions and at various percentages of the design-day air flow. To ensure that the testing is accurate, air



quantities are read from air measuring stations. At each test point, peak and average sound pressure levels are noted at each octave band frequency. Test results are then plotted on noise criteria curves to establish the unit's acoustical performance based on noise criteria ratings relative to the project's design criteria.

#### Case Study:

We recently performed an AHU mockup test for one manufacturer in which we tested a 16,500 CFM air handling unit using supply ductwork constructed of five different sheet metal gauges. The ducts were the same overall length, constructed in the same 5 foot lengths with joints and angle reinforcements identically placed. Four were standard unlined ducts in different gauges. For the 5th specimen we used one of the first 4 ducts but enhanced it. We then tested each unit at different airflow and pressure conditions. The results provided the client with a clear indication of which duct achieved the required noise criteria at a specific airflow level.

Energistics is a pioneer in providing a project's typical floor Air Handling Unit in a mockup condition reflective of all the architectural and mechanical conditions of a proposed project. Our AHU mockup assembly is 85 feet long and 53 feet wide, including two adjacent closed plan offices and is capable of accommodating most custom floor air handlers.

#### Miscellaneous Testing

These tests are not normally run in a special test area or test room and we refer to them as table top tests.

Temperature mixing and stratification:

Many project specifications will call for this type of testing. A discharge duct is attached to the test unit and located in that duct are sensors for reading temperature. Once inlet airflow, pressures and temperatures are set, a recording of the discharge sensors is made to see if specified ratios are met. Primarily dual duct and fan powered units are subjected to this type testing.

#### Controls:

Many times, special or different digital control sequences are specified for a building. We have the ability to setup the test equipment to run under these conditions to verify the compliance. However we also test electric or pneumatic, if required.

#### Terminal Retrofit Performance:

Many older buildings are modified to meet today's building codes. In many cases the air distribution equipment is retrofitted, not replaced. This laboratory runs tests on the old equipment and makes suggestions as to what changes need to be made to make that equipment work properly in a modernized building. Most retrofit units are old dual duct and single duct units.

**Notes:**

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