ENGINEERING UPDATE

AUGUST 2014 - **VOLUME 15**

THIS PACKAGE INCLUDES A COLLECTION OF ARTICLES FROM VOLUME 15 OF THE AUGUST 2014 ENGINEERING UPDATE.

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AIR HANDLING UNIT CABINET LEAKAGE 101

By Hugh Crowther, P. Eng.– Executive Vice President, Product Management and Technology

Cabinet air leakage in an air handling unit (AHU) will lead to parasitic energy losses and degraded building psychrometric performance. Standards such as ASHRAE Standard 90.1 - *Energy Standard for Buildings Except Low-Rise Residential Buildings* call out leakage rate criteria for duct systems so why not the AHUs themselves?

WHERE DO AHUs LEAK?

The two key issues to address in AHU cabinet leakage are cabinet integrity and penetrations. To improve cabinet integrity, all joints need to be sealed with caulk or gasketing, and due to air pressure the cabinet deflection must be minimized to L/240. As the walls and roof flex, gaps open and allow leakage. The current trend is to use foam injected sandwich panels which are extremely rigid.

Leakage around penetrations such as conduit and piping can be solved with gasketing and caulking, however the main culprits are doors.

Figure 1 - Example of standard pressure test for an AHU

SPECIFYING LEAKAGE RATES

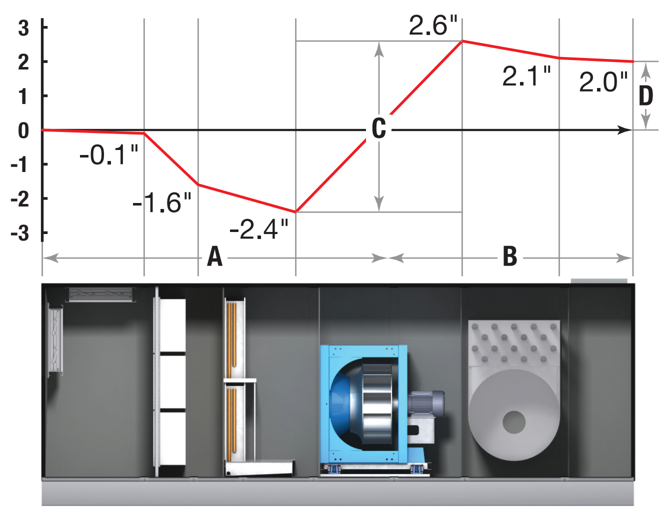
Currently no formal AHU leakage rate standard is used in North America so the challenge falls to the specifier to define acceptable performance. Here are a few common methods.

Leakage Rate as a Percentage of Supply Airflow

One of the most common methods of defining leakage criteria is to base it on a percentage of supply airflow at a given static pressure.

"Units shall have a leakage rate not to exceed 1% of supply airflow rate at 8" w.c."

This form of specification speaks to the quality of cabinetry expected on a project and not to the leakage rate expected from the actual unit. For example, the unit is not likely operating at 8" w.c. and more importantly is the 8" w.c. pressure negative or positive? It will likely be split to part of the unit in negative and part of the unit in positive (see **Figure 2**).



A - Negative Pressure Cabinet
B - Positive Pressure Cabinet
C - 5" w.c. Total Static Pressure
D - 2" w.c. External Static

Figure 2 - AHU with SP Curve

Leakage Rate Based on Design Static Pressure

A few custom AHU manufacturers provide leakage data in the form of percent supply airflow based on a multiplier of design static pressure.

"Units shall have a leakage rate not to exceed 1% of supply airflow at 1.5 times the static pressure."

Some care should be taken on the definition of static pressure. Most would assume static pressure means the supply fan total static pressure (5" w.c. in the above example x 1.5 = 7.5" w.c.), but it is often interpreted as meaning 1.5 times the largest pressure differential (positive or negative) experienced by the AHU. In the example above, the highest will be 1.5 x 2.6" w.c. = 3.9" w.c. This is less than the supply fan design total static pressure of 5" w.c.

EN1886 Leakage Standard

EN1886 is a European standard that covers both negative pressure only AHUs and combination positive and negative pressure AHUs. The class levels are set by the amount of acceptable leakage for a given area. For example the AHU is tested at 1.6" w.c. negative pressure and if the unit has a leakage rate of less than 8.67 cfm/100 ft^2 cabinet area, it is labelled a Class B unit. EN1886 is not commonly used in North America either by specifiers or manufacturers.

SMACNA Standard

SMACNA has set leakage criteria in their *HVAC Air Duct Leakage Test Manual*. While the standard was developed for field installed ductwork, it can also be applied to AHUs. The leakage class is based on the average leakage per 100 ft^2 of cabinet for a given static pressure. The higher the static pressure or the larger the unit (more surface area), the more leakage can be expected in a given class. For a typical AHU, a Class 6 SMACNA unit will be approximately 1% supply air volume at 8" w.c.

CONCLUSION

Leakage rates are important. Analysis by Price Industries for a 100% MUA located in Chicago shows the savings for a low leakage cabinet to be over $600/year with a payback of less than two years. The challenges for the design engineer are that there is no common method of specifying leakage performance, and data from manufacturers comes in many forms. The following specification language is offered to assist the specifier.

Units shall have a leakage rate not to exceed 1% of supply air volume at 8" w.c. [10" w.c.] static pressure in either positive or negative pressure tests. Manufacturer shall provide test data confirming cabinet construction can meet the requirement.

Unit or witness tests have a cost impact to the project and should only be considered for critical applications. If the project does require unit performance testing the following can be included:

Prior to shipment, the manufacturer shall test one unit of the owner's choice. The results shall be signed by an officer of the company. If the unit fails to meet the design criteria, the unit shall be repaired and retested. In addition, the owner shall select one other unit and it shall be tested.

or

Prior to shipment, the manufacturer shall test one unit of the owner's choice. The test shall be witnessed by the owner or their representative and the results shall be signed by an officer of the company. The cost of travel for the test shall be included in the equipment price. If the unit fails to meet the design criteria, the unit shall be repaired and retested. In addition, the owner shall select one other unit and it shall be tested.

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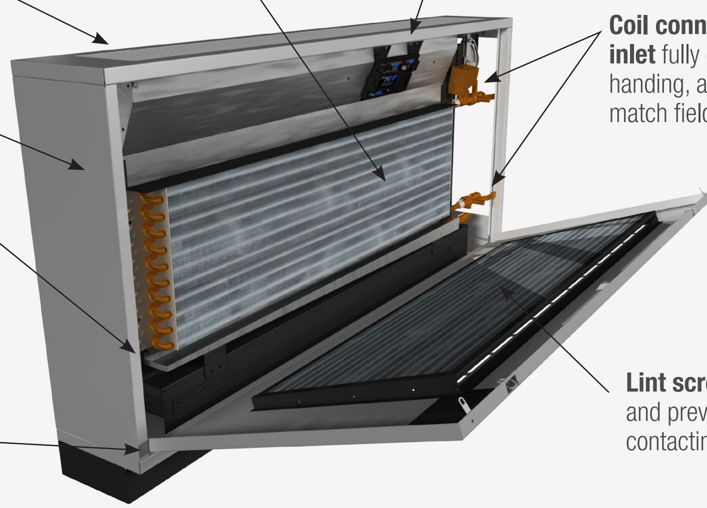
PRODUCT FEATURE: PRICE VERTICAL ACTIVE BEAM (ACBV) FOR INDUCTION UNIT RETROFIT

By Samuel Frenette., P.Eng. – Associate Product Manager, Active and Passive Beams

The compact design of legacy hydronic induction units rose in popularity during the mid-20th century for use in office buildings, schools, hospitals, and hotels. While the technology benefits from an efficient water-based system, the high air pressure design of these decades-old products can be noisy, expensive, and prone to duct leakage. Performance and air quality can also be compromised due to condensation and dust accumulation on the coil.

The Price Vertical Active Beam (ACBV) is the perfect replacement for these dated systems, and can be customized to provide a seamless fit for a variety of induction unit configurations.



AESTHETICS AND DESIGN FEATURES

The Price Design Engineering Team can customize the ACBV to match the site locations of water and air connections. Various cabinet options are also available to maintain a consistent look throughout the building or to match the style of legacy induction units.

This retrofit induction unit can also be paired with a variety of grilles and slot diffusers to suit the design and application requirements of different spaces. Critically, the supplied performance takes into account the entire assembly in order to properly capture the effect of various diffuser options.

BENEFITS OF THE ACBV

All of these improvements over existing hydronic units will assist when seeking LEED certification.

Fan energy savings, quieter operation, and prevention of duct leakage

- The ACBV uses a variety of nozzle sizes and operates at a much lower static pressure than a traditional hydronic induction unit (see **Figure 1**). This lower static pressure will result in a significant reduction in noise level (see **Figure 2**) and fan energy.

Improved performance and air quality

- Higher capacity using existing infrastructure meets modern load requirements.
- Lint screen and wider fin spacing facilitates cleaning and prevents dust particles from contacting the coil. In some cases, it is also possible to meet the same performance with chilled water above dew point.
- Condensate sensors ensure optimal performance.

Efficient Spatial Integration

- The low height and shallow depth of the ACBV uses less space than a legacy unit.

Minimized Installation Time

- Loaded with a variety of beam-specific control sequences, the integrated Price Intelligent Controller for Hydronic Products (PIC-HP) is available with a wireless thermostat for reduced field labor and upgrades controls to native BACnet.

CUSTOMIZATION OPTIONS

All components can be shipped loose for added flexibility during field installation or factory mounted to reduce labor.

- **Radkit:** A variety of pressure-tested hose kits can be selected to connect the active beam coil to the building's hydronic systems. Options include shut-off valves, balancing valves (manual or automatic), and automatic temperature control valves with ON/OFF modulating of a floating point actuator.
- **Manual Quadrant Damper:** Allows the damper blade to be locked into a single position for balancing.
- **VAV Damper:** The damper is controlled by a 0-10 actuator, which can provide additional control for the space without the use of a costly terminal unit. The VAV Damper can be controlled with either the PIC-HP or a third-party controller.
- **Volume Flow Regulator (VFR):** Automatic balancing damper to maintain constant airflow at the beam or induction unit, which can significantly reduce balancing costs on a project.

To learn more about the Price Vertical Active Beam (ACBV), please contact your Price Representative and visit www.priceindustries.com.

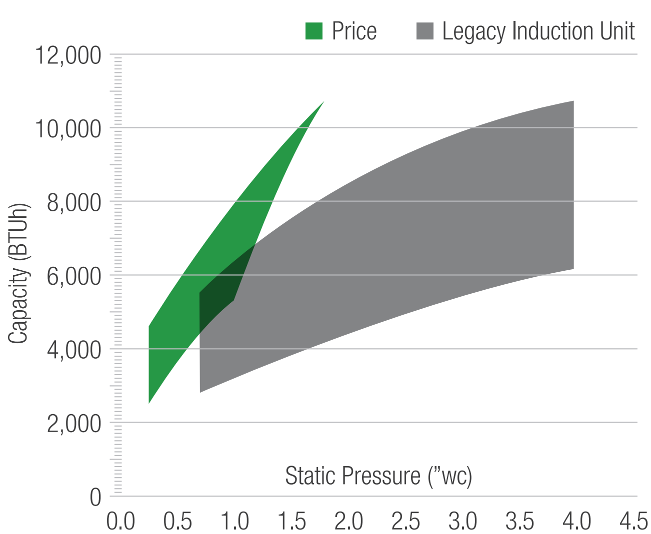


Figure 1 - Price ACBV vs. Legacy Induction Unit

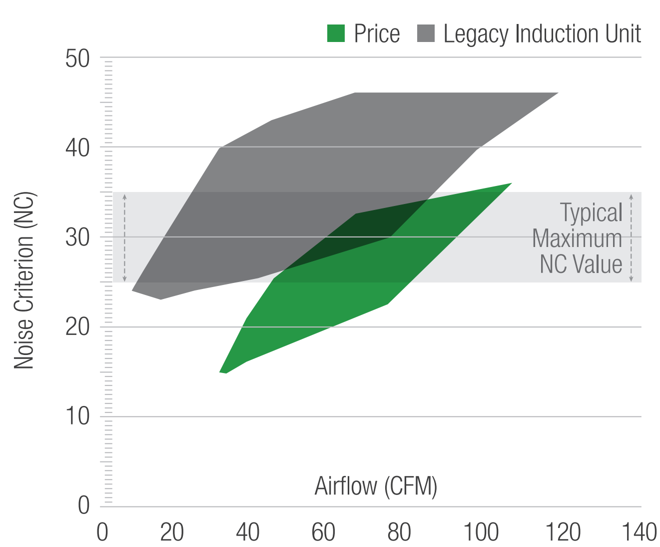


Figure 2 - Noise Levels for typical 4 ft. unit

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TECH TIP: ASHRAE 90.1 CHANGES IN THE 2007 VERSION VS. THE 2010 VERSION

By Jerry Sipes, Ph.D., P.E. – Vice President of Engineering

ASHRAE Standard 90.1 - *Energy Standard for Buildings Except Low-Rise Residential Buildings* is a document that is in a state of continuous maintenance. That means changes to the standard are ongoing and addendum are submitted for public review and approval on a frequent basis. Since the 2004 version, there have been three additional printed/complete versions (2007, 2010, 2013) where all the addendum that have gone through the public review process and have been approved are added. For example, between the 2007 version and the 2010 version there were over 100 approved addenda, 52 of which affect mechanical systems.

Most state code authorities are using one of the complete versions of 90.1 and have differing speeds at which they adopt the newer versions. **Figure 1** shows the version of the 90.1 standard by state as of March 2014. You can see that the majority of states are using the 2007 version of ASHRAE 90.1 or an equivalent of that version.

Figure 2 shows that a significant number of states are in the process of adopting the 2010 version of ASHRAE 90.1 or an equivalent of that version. This movement is being encouraged by the United States Government departments and agencies including the Department of Energy, and by state adoption of energy standards required by green building initiatives such as LEED.

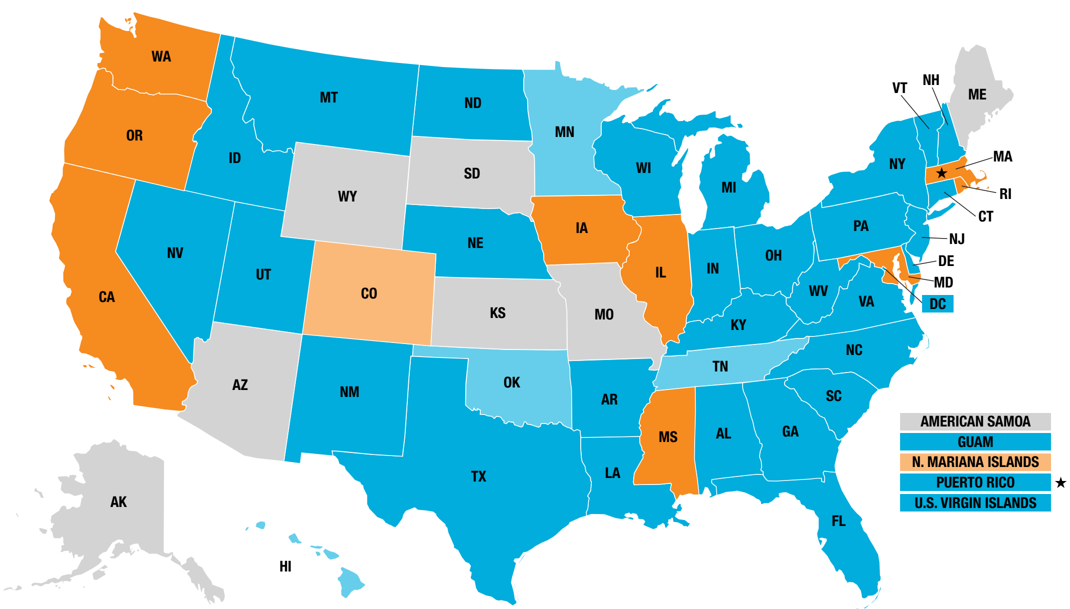

Figure 1: Version of ASHRAE 90.1 by state as of March 2014

Statistics shown below courtesy of the Department of Energy, Office of Energy Efficiency & Renewable Energy

9	ASHRAE 90.1-2010/2012 IECC equivalent or more energy efficient
★	Adopted new code to be effected at a later date
33	ASHRAE 90.1-2007/2009 IECC equivalent or more energy efficient
2	ASHRAE 90.1-2001/2003 IECC equivalent or less energy efficient
4	ASHRAE 90.1-2004/2006 IECC equivalent or more energy efficient
8	No statewide code

As of March 2014

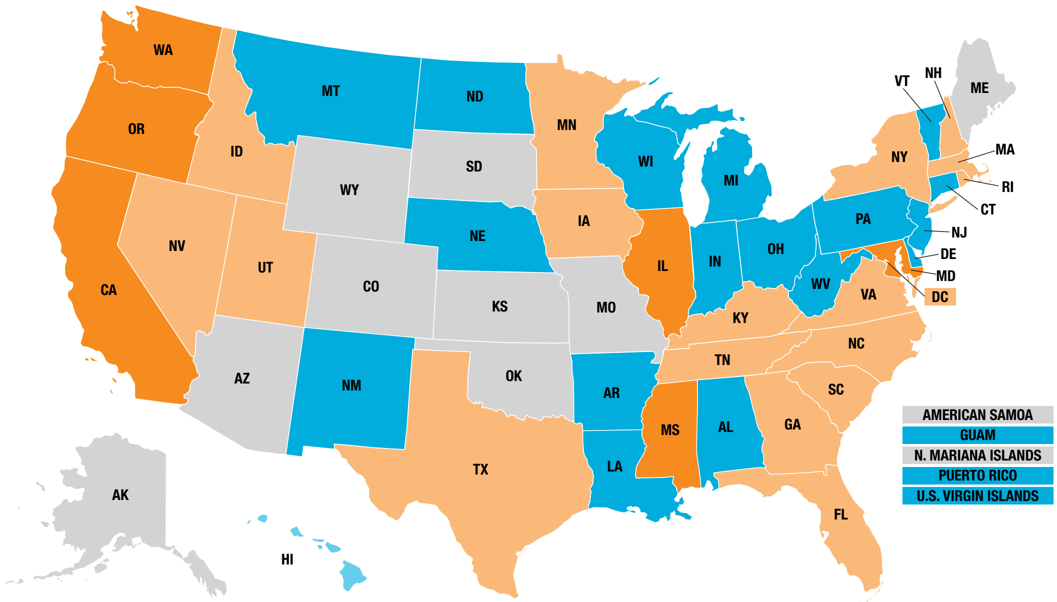

Figure 2: Version of ASHRAE 90.1 by state as projected in the near future

Statistics shown below courtesy of the Department of Energy, Office of Energy Efficiency & Renewable Energy

2009 IECC/90.1-2007, equivalent or better

Projected 2009 IECC/90.1-2007 Adoption by the end of 2015

2012 IECC/90.1-2010, equivalent or better

Projected 2012 IECC/90.1-2010 or equivalent Adoption by the end of 2015

No projection assumed

As of November 2013

Surprisingly, there will still be seven states and one territory without a statewide energy code.

In addition to the 52 addenda which affect mechanical systems, there were other significant changes to the overall scope, lighting, building envelope, and energy modeling sections of the ASHRAE 90.1 Standard that need to be evaluated by the designer in the states adopting the 2010 version. The addenda can be grouped in several ways, but there are only two major groups: 1) equipment efficiency and 2) system design and control requirements. Future Price Tech Tips will cover these two major groups.

When the updated addenda were evaluated by energy modeling such as the kind done at the Pacific Northwest National Laboratory, the simulations indicated that the buildings conforming to 90.1-2010 will consume between 25.6 percent (including plug loads) and 32.7 percent (not including plug loads) less energy than the same buildings conforming to the 90.1-2004 Standard.

The scope of 90.1-2010 was expanded to include “new equipment or building systems specifically identified in the Standard that are part of industrial or manufacturing processes.” One process specifically identified as part of the scope of 90.1-2010 is computer rooms. In the prior versions, they were exempt from the prescriptive economizer requirements, but now must conform.

For more information on the changes between the 2007 and 2010 versions of ASHRAE 90.1, see the Standards page on www.ashrae.org and look for future updates in upcoming Tech Tips.

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ALL-IN-ONE 3 ENGINEERING EDITION ORIENTATION SESSION

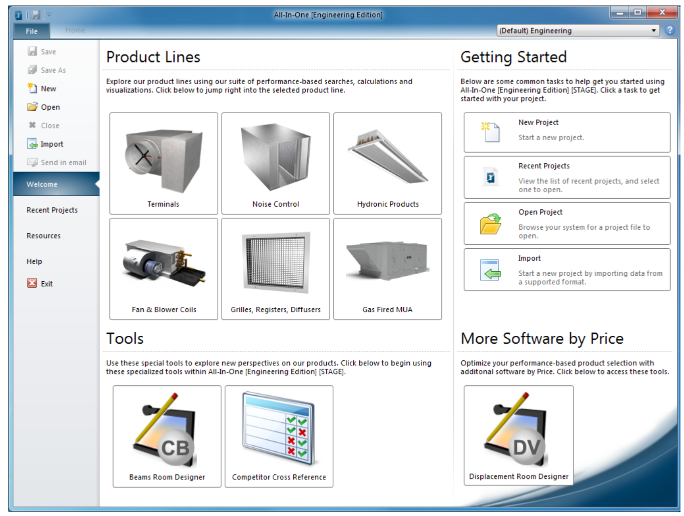
Over the last year All-In-One 3 has been delivering powerful tools to our reps, enabling new levels of insight into Price products. Now, the Engineering Edition of All-In-One 3 aims to deliver similar power to the engineering community. We've redesigned the Engineering Edition to better focus on the needs of engineers, zeroing in on product performance and removing rep focused features such as pricing and ordering.

We invite you to join us for an orientation session on how to best utilize the power of All-In-One 3 when calculating performance for selections across our various product lines. The session will include a look at how to calculate and select performance for various products including air moving products, noise control and hydronics. Each session will be one hour long and will include a question and answer component. Please join us at whichever of the following three times is most convenient for you!

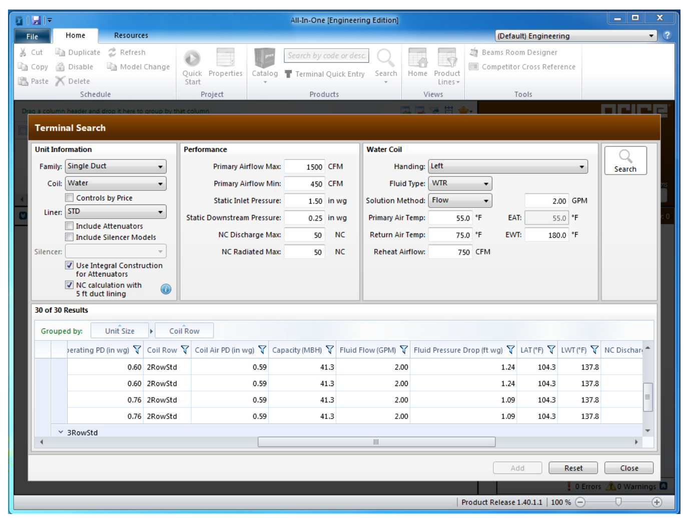
Wednesday, August 20, 2014 at 1 pm EDT

Thursday, September 4, 2014 at 3 pm EDT

Tuesday, September 23, 2014 at 12 pm EDT



All-In-One Welcoming Screen



All-In-One Terminals Search