

TECH TIPS

Test Standard, ASHRAE 200, and Certification Program, AHRI 1240, Released for Active Chilled Beams

By Jerry Sipes, PH.D., P.E.

In the HVAC design process, designers must balance product selection and performance against design parameters such as sound, thermal capacity, and power consumption characteristics. It's expected that the manufacturer's performance data is accurate and the product will perform as described. Manufacturers provide performance data for their products, but without a standard to verify performance against or a required minimum set of data in a specific format, it could be argued that the data presented is more marketing than engineering as it's difficult to compare performance of one brand against another, particularly if different test methodologies were used. Without a consistent test method and certification program, product selection and performance expectations might be based on who has the best story and who you trust.

This has been particularly true of chilled beam products, where some manufacturers provide data to different standards or to a self-generated test method. Most commonly, there have been two different standards that manufacturers have been using to develop performance data. The first standard is Nordtest Method NT VVS 078, Ceiling Cooling Systems: Cooling Capacity, 1999-11. The second standard is European Standard EN 15116, Ventilation in Buildings – Chilled beams – Testing and Rating of Active Chilled Beams, 2008. Both standards outline the testing requirements for thermal performance of water coils in active chilled beams.

Nordtest Method NT VVS 078 primarily focuses on passive cooling products (panels and passive beam type products), not induced air movement products like active chilled beams, and as a result, doesn't address primary airflow, primary

pressure drop, or primary air temperature as part of the standard. It has no guidance on testing for sound or induced air volume. If the manufacturer of beams lists NT VVS 078 as the test method, they should also reference the standard they used for sound measurement, primary airflow, and pressure drop as well as the throw distance.

European Standard EN 15116 does focus on active chilled beams, but like the NT VVS 078 standard, it doesn't provide guidance on testing for sound or induced air volume. If the manufacturer of beams lists EN 15116 as the test method, they should also reference the standard they used for sound measurement as well as the throw distance.

It's my opinion that using either NT VVS 078 or EN 15116 can make your specifications/design documents more complicated and submittals less easily compared to verify performance compliance. Many times, I have only seen references to the coil capacity and no mention as to how the other design parameters were obtained. Due to the dynamic interactions of the water coil, induction ratio, static pressure, and discharge characteristics, how is a designer to understand the efficiency of the product selection without proper and complete data?

There are no provisions or requirements for testing sound generation, induced air volume, or throw distance in either standard. In part, due to the minimal reported performance metrics in the two aforementioned standards, ASHRAE developed a new method of test, ASHRAE Standard 200 Methods of Testing Chilled Beams, and AHRI developed a new certification program, AHRI 1240/1241, Standard for Performance Rating of Active Chilled Beams.

Manufacturers using either the EN 15116 or NT VVS 078 standards often downplay sound generation and report it as a dBA or NC with little (if any) explanation of how the value was determined. As you may recall in other Tech Tips, I have discussed the importance of proper sound data to help prevent spaces that do not meet the space sound design goal. Both dBA and NC are approximations and have serious design limitations.

The dBA is a measured and averaged value of the sound generated by the chilled beam and is environment specific. The data is only valid in the room it was measured in and the distance and orientation of the instrument relative to the chilled beam. Since the room and measurement method weren't described in either standard, the reported dBA values are most likely not consistent between manufacturers and are unlikely to reflect actual sound characteristics of the space you are designing. This leaves you with a design challenge. In my opinion, dBA values aren't a good design parameter as your space will have either less or more sound attenuation (reflective, absorptive or diffusing room surfaces) or different room volumes than the space where you obtained the dBA measurement.

NC values are a commonly used design parameter in the HVAC industry. For diffusers, ASHRAE Standard 70 instructs manufacturers to test their diffusers by octave band and then assume 10 dB absorption in all frequencies before determining the NC value. The 10 dB absorption is based on a typical office and it's possible that most spaces won't have that much absorption. Unless you specify the attenuation characteristics of the occupied space and then use those attenuation values, the NC

number may not be a good representation of the space being designed. I believe that most manufacturers of active chilled beams use the 10 dB factor when determining the NC values for their products. Since active beams use nozzles to inject the primary air into the induction chamber, they have a sound generation characteristic that will change based on the driving static pressure. If the static is high enough (above 1 to 1.5 inches W.C. depending on the beam size, type, etc.), there is a possibility that the active chilled beam will start generating pure tones in the 2000 Hz band. That is why both Standard 200 and Standard 1240 require sound power to be reported by octave band rather than by NC as the NC value is an average and doesn't indicate if pure tones are present. As long as the NC calculation is consistent between vendors, NC values allow a comparison between different products. Your specifications should specify Standard 200 as the method of test and then require either a 10 dB attenuation across the octave bands, or a specified amount of attenuation, before determining the NC value.

For more on dBA ratings and NC values, please see Chapter 7, Basics of Acoustics, of the Price Engineer's HVAC Handbook.

In 2009, ASHRAE Technical Committee 5.3 Room Air Distribution called for a new test standard to be developed to address the limited performance data and different test methods currently being used. At the same time, AHRI formed a new product section, chilled beams, to

develop a certification program for active chilled beams that would use the ASHRAE method of test. I volunteered to chair both standards and am excited to let you know that after five years of work, both are now publicly available documents.

ASHRAE Standard 200-2015, Methods of Testing Chilled Beams

PURPOSE: To define laboratory methods of testing chilled beams to determine performance.

SCOPE: Defines laboratory methods of testing chilled beams to determine performance. It specifies test instrumentation, facilities, installation methods, and procedures for determining the performance of chilled beams.

Table 1 shows a summary of the different test parameters between the three chilled beam test standards.

Now that we have a test method for active chilled beams that provides an enhanced data set, how does a designer decide if the data provided is representative of the product performance characteristics? That is where the AHRI certification program comes into play.

AHRI Standard 1240-2014 (IP) and Standard 1241-2014 (SI) Standard for Performance Rating of Active Chilled Beams

PURPOSE: The purpose of this standard is to provide, for active chilled beams: definitions, classifications, standard equipment, testing requirements, rating requirements, minimum data requirements for published ratings, marking and nameplate data, and conformance conditions.

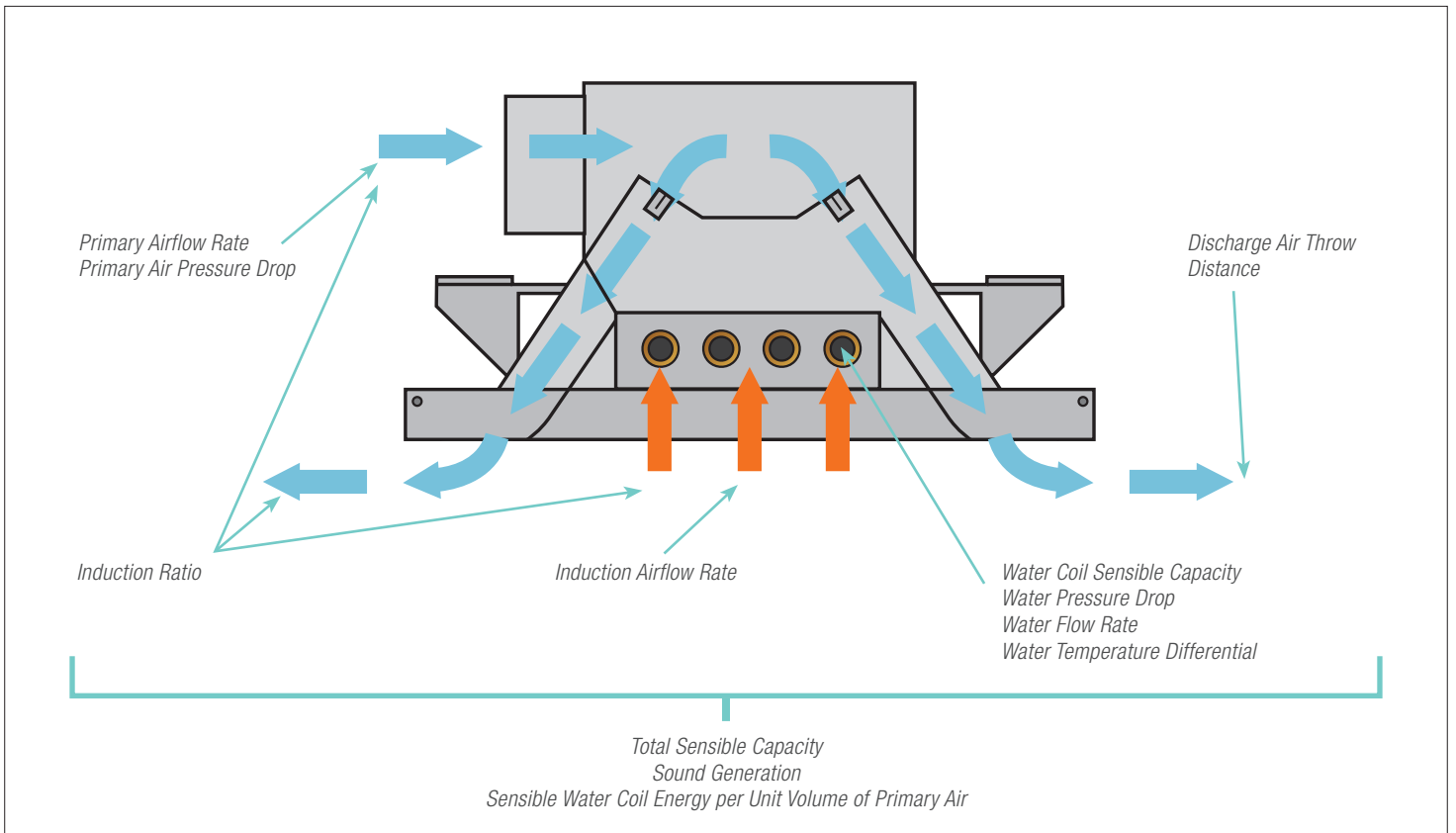
SCOPE: This standard applies to active chilled beams, including multi-service active chilled beams and room air induction units. This standard doesn't apply to active chilled beams employing volatile-refrigerant coils, condensing coils or steam coils. It doesn't apply to passive beams.

AHRI is a globally accredited organization for HVACR and water heating certification. In the North American market, the Environmental Protection Agency, U.S. Department of Energy, Federal Trade Commission, Natural Resources Canada, and California Energy Commission all recognize AHRI.

The AHRI 1240/1241 certification program is voluntary and all participants must provide ratings for all models they manufacture in order to claim their active chilled beams are certified.

| Standard | NT VVS 078 | EN 15116 | ASHRAE 200 |
|---|------------|----------|------------|
| Water Coil Sensible Capacity | • | • | • |
| Water Pressure Drop | • | • | • |
| Water Flow Rate | • | • | • |
| Water Temperature Differential | • | • | • |
| Primary Air Pressure Drop | | • | • |
| Primary Airflow Rate | | • | • |
| Induced Airflow Rate | | | • |
| Induction Ratio | | | • |
| Discharge Air Throw Distance | | | • |
| Sound Generation (sound power by octave) | | | • |
| Total Sensible Cooling Capacity of Device | | | • |
| Sensible Water Coil Energy per Unit Volume of Primary Air | | | • |

Table 1: Comparison of Test Standards



ASHRAE 200 Data Points

Each year, 20% of all of a manufacturer's basic model groups are independently tested in a third-party lab (not AHRI). This independent verification of the performance ratings ensures that the manufacturers are held accountable for their performance data. Should a manufacturer not participate in the 1240 certification program, they can still rate their products in accordance, but the data isn't independently third-party verified. Table 2 shows the difference between Rated in Accordance and AHRI-Certified.

I encourage designers to update their specifications for active chilled beams so that ASHRAE Standard 200 is the test method and

AHRI 1240 is the certification program used to determine the performance data you use in your HVAC designs.

Since the certification program is newly established, it will be implemented over the next three years. Designers are cautioned to verify any claims to data and certification. One way to check certification is the AHRI online certification database. It is anticipated that during the start-up period of the 1240 certification program (three years), manufacturers will be adding their data to the online database.

For example: Active chilled beams shall be tested in accordance with ASHRAE Standard 200-2015

Methods of Testing Chilled Beams and certified under the AHRI 1240 certification program.

For more information on acoustics or active chilled beams, please see the Price Engineer's HVAC Handbook or visit priceindustries.com.

| Rated in Accordance | AHRI-Certified |
|--------------------------------------|---|
| Conforms to Standard (self-verified) | Conforms to Standard (third-party verified) |
| | Subject to rigorous and continuous testing |
| | Manufacturer's performance ratings independently measured |
| | All products within program scope |
| | Provides marketplace clarity |

Table 2: Comparison between Rated in Accordance and AHRI-Certified