What’s New with NEBB?

Have questions regarding Title 24? Want the latest information? Check out the article from our new Title 24 Chair, Amber Ryman.

How has ANSI accreditation affected you and your NEBB discipline? Did you know we have a new 8th Edition of the TAB Standards Manual published? Check out our article from our Technical Chair, Art DeLeon.

What happened in Hawaii? See our article from President Steve. Check out our pictures!

This edition is packed with so much information. Be sure to read it.
Although chilled beam systems have been used in Europe and Australia for many years, they are a new concept to many in the U.S. Those interested in learning more about these systems, as with any new concept, are faced with the task of discerning its true strengths and weaknesses. The goal of this article is to investigate the common claims about chilled beam systems. This is part three.

Is chiller efficiency higher? Because the temperature of water supplied to the chilled beams must be relatively warm (typically between 58°F and 60°F) to avoid unwanted condensation, the water chiller can be more efficient (higher COP) than if it was making colder water (typically between 40°F and 44°F) for central VAV air-handling units.

But remember, the primary AHUs in a chilled-beam system must dehumidify the air to a low enough dew point to offset the space latent loads. This typically requires as cold, if not colder, water—offsetting the same space latent load with less primary airflow requires that air to be drier—than is typically used for a conventional VAV system.

Whether or not the warmer water delivered to the chilled beams contributes to a higher chiller COP depends on the configuration of the chiller plant.

If separate chiller plants are used, the plant serving the primary AHUs can make cold water to sufficiently dehumidify the primary air, while the plant serving the chilled beams can make warmer water and benefit from operating at a higher COP. Of course, using separate chiller plants increases installed cost, and considering that only a fraction of the annual cooling loads in the building are handled by the chilled beams—the primary AHUs handle the cooling loads of the outdoor air, plus typically provide some of the space sensible cooling—the benefit of a dedicated chiller serving the chilled beams and operating at a higher COP is lessened on an annual basis.
A more common plant configuration is to use one set of chillers to make cold water (42°F in this example) for the entire building (Figure 8). Some of this water is delivered to the primary airhandling units for dehumidification, and the rest is mixed with warm water (63°F) returning from the chilled beams to achieve the desired water temperature (58°F) to deliver to the beams.

The supply water temperature is not the only factor that impacts chiller energy use. Some other factors that impact the difference in chiller energy use between ACB and VAV systems include:

- ACB systems typically do not employ demand-controlled ventilation (DCV), so outdoor airflow remains constant. VAV systems, however, are more likely to implement some form of DCV to reduce outdoor airflow and chiller energy use during partial occupancy.[3]

- Since ACB systems are designed to deliver less primary airflow, the primary air system typically has little or no capacity for airside economizing. A VAV system, however, can provide up to 100 percent of design supply airflow for "free" cooling, when outdoor conditions permit. Using the previous office space example, the primary air-handling unit in the ACB system can provide up to 0.36 cfm/ft2 of outdoor air for economizing. The VAV air-handling unit can provide up to 0.72 cfm/ft2, which offers more capacity to reduce chiller energy use through an airside economizer cycle.

- Of course, chilled beam systems can be equipped with a waterside economizer, such as a plate-and-frame heat exchanger (Figure 8). For most applications, however, a waterside economizer does not provide as much energy savings as an airside economizer.

However, focusing on the chiller is only part of the story. Since the temperature of water supplied to the chilled beams must be relatively warm (typically between 58°F and 60°F) to prevent condensation, they are often selected with high water flow rates (gpm) to provide the required cooling capacity. Typically, ACBs are selected with a 5°F or (Continued on Page 9)
Air Systems recently celebrated 41 successful years in business by building strong relationships with their customers. They provide comprehensive design/build mechanical, plumbing and electrical contracting, architectural sheet metal, high purity process piping, building automation systems, energy solutions and preventive maintenance services to Bay Area clients and partners. Air Systems was founded in 1974 by John Davis who had a vision of building a full-service design/build mechanical construction and service company with its primary focus on building relationships.

Through the years, the company has gone through several acquisitions, but always continued to be spearheaded by a dedicated management team. The current management team includes Art Williams, President, Marty Cull, Vice President and CFO, and Byron Rifenburg, Vice President. Air Systems currently has 126 office employees and approximately 300 craftspeople in the field.

Air Systems’ core business philosophy is, and always has been, based on building relationships. It is this foundation that has allowed Air Systems to maintain consistent repeat business and retain a core group of dedicated employees. In their constant search for ways to improve service, adjust to changes in the marketplace, and grow their technological capabilities, Air Systems is fully staffed with Professional Engineers, NEBB-Certified Professionals, 3-D CAD drafters/detailers and a host of complimentary infrastructure resources including automated shop fabrication equipment, a class 10,000 cleanroom, and an in-house auto/fleet maintenance shop.

Building relationships is directly tied to community involvement at Air Systems and the company philosophy and culture is based on giving back. Air Systems extends this guiding principle each year by supporting local charitable organizations, community outreach groups and a host of community youth programs. Each year, Air Systems and its employees lend their support to community programs and non-profit organizations throughout Silicon Valley. Through financial con-
tributions, fundraising events, and countless volunteer hours, the Air Systems family is committed to helping community partners succeed in their missions.

Air Systems sponsors a Foundation Scholarship Program which has been helping local students since 2001 in their pursuit of higher education. Each year, the Foundation has awarded scholarships up to $2,500 to select high school seniors residing in Santa Clara County. The Academic Scholarship Program has awarded 98 students to date, for a total of approximately $268,000. In addition to supporting higher education of local students, Air Systems fulfills the holiday wishes of mothers and teens living in transitional housing. Air Systems partners with Cityteam’s House of Grace, Cityteam’s Heritage House and Bill Wilson Center’s Runaway and Homeless Youth Shelter Program. Each year, they also select a local non-profit organization to receive a cash donation of up to $10,000. Past recipients have been South Bay Blue Star Moms, Second Harvest Food Bank, Loaves and Fishes, American Cancer Society and the Transitional Housing Placement Program.

Approximately 80% of Air Systems business is design/build, and as a NEBB certified firm, many of their clients are confident in them self-performing all TAB activities. The Air Systems TAB department started in 1984 when current Air Systems President, Art Williams became certified in Air & Hydronics. Air Systems currently has (3) NEBB certified professionals on staff: Byron Rifenburg, PE, Steve Conn, PE and Jeff Balvanz. They also employ (2) NEBB certified technicians: Sonny Tran and Kit Chan.

Byron Rifenburg is the Vice President of the MEP Division and has been with the company for 21 years. Byron graduated from Santa Clara University with a BS degree in Mechanical Engineering and has experience in HVAC, clean-room, process exhaust, process piping and plumbing. His specialties are energy and building retrofit and complex projects in existing buildings. Byron received his Air & Hydronics certification in 1998 and became certified in Cleanroom Performance Testing in 2000.

Steve Conn is an Account Executive in the MEP Division and has been with Air Systems for 16 years commencing his last year of college. Steve graduated from San Jose State University with a BS in Mechanical Engineering. Steve’s experience includes HVAC, cleanroom, process exhaust, process piping and plumbing. He specializes in new building construction; complex projects in existing buildings, large scale design/build HVAC and chilled water central plant construction. Steve has been NEBB certified in Air & Hydronics since 2004.
Jeff Balvanz is a Project Manager for the BAS Department. He started in the field as a technician and has been with Air Systems for 27 years. Jeff manages key customer accounts and has 31 years of experience in the HVAC industry. Jeff has experience with cleanrooms, HVAC, data centers, energy management control systems, retrofit, new construction and project management. Jeff received his NEBB Air & Hydronics certification in 1998.

Over the course of the last 31 years, Air Systems has completed hundreds of successful self-performed NEBB certified projects. Some of the noteworthy standout projects completed over the last couple years include: Google Nest Campus (4 buildings), SanDisk Milpitas Campus (5 buildings), VMware Phase 3 (4 buildings), Apple Bubb 7, Cisco 19 Rack Lab, Google 1201 Charleston, Google 1393 Shorebird, Google TC6, LinkedIn One Montgomery and Sutter Medical Foundation Castro Valley.

When asked what value Air Systems finds in their NEBB certification, all certified professionals endorsed the company philosophy that NEBB certification provides another level of quality and service for Air Systems to provide to their clients. NEBB certification separates Air Systems from other (uncertified) design/build companies and is a tangible marketing and sales tool for Air Systems as well. Guided by adherence to the NEBB standards, Air Systems offers quality assurance to their clients through and including the TAB process.

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If you have any questions please contact us.

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Aloha….Those words were spoken much at our 2015 NEBB Conference that appeared to be a big hit this year. According to our NEBB National Board, this year’s NEBB Conference in Hawaii had the highest attendance of any meeting that was recorded at 400 plus with many staying longer than the planned meeting. Considering the tone a year ago about traveling so far, the attitudes were quickly changed once enjoying the beauty and Aloha of Hawaii. I recall talking with our National Board in Ft. Lauderdale in 2014 about leaving their suits at home as they would be in Hawaii and the dress attire is different. Many listened and embraced the Hawaiian typical dress attire which was a great sight to see. The National Board even quickly commented that they were enjoying the attire. Of course, we had to have the one rebel from our own chapter, Martin Burke, who wore a full suit with tie. Martin gave our chapter a good laugh over it at our local annual meeting.

This year’s conference brought many spouses and families. Many members were shooting between their work and family throughout the week. The optional excursions were well attended by all. The fishing trip was rough but the golfing was said to be the best course that many had ever played. The opening get together was a unique Hawaiian experience with great food, interesting local entertainment and of course typical Hawaiian weather with a little rain. Well, Hawaii was such a hit with so many that there was an underlying discussion of having a reoccurring meeting in Hawaii maybe every 5 or 10 years.

Thank you to all our chapter members that helped and attended. We had an 80% attendance from our own chapter. Our Hawaiian members helped put together a small token gift from our chapter to all the attendees (Sunblock, Macadamia Nut shortbread cookie, maps, coupons, bags and a Kukui Lei). The Kukui Leis were a big hit with the National gift of a Hawaiian shirt and worn by many. If the National Board decides to have the annual meeting in Hawaii again, we will
definitely work our chapter annual meeting in parallel. Our next NEBB Conference will be in Albuquerque, New Mexico in 2016. Hope to see all of you there.

There were many subjects discussed at the NEBB Conference but none more than the ANSI changes. ANSI is impacting our whole NEBB organization and everyone has the subject as a main discussion point. There are many changes that are being embraced and others heavily discussed. The exact impacts are hard to layout as they are a work in progress but will be shared as they are clearly defined. Two notable changes are the responsibility that has shifted from local chapters to NEBB National and the separation of the discipline committees to a procedures and education side. The impact to the local chapters was heavily discussed at several meetings with options discussed on how we keep the chapters strong with involvement. The National BOD listened and went into further discussions after the general meeting. We hope to hear more soon on their thoughts. We know that NEBB needs to go back and look at the legal implications on the options before saying more.

The separation of the discipline committees created a request for more volunteers to help on either the procedures side or the education side. The committee members are no longer able to work on both sides of the discipline. To connect the two subcommittees, we need to create a common list of discipline requirements and job descriptions. This list has been referred to as a firewall between the sides but lays out the common goals for each sub-committee to focus their actions.

Our chapter annual meeting occurred on Saturday morning before the town hall meeting. Our meeting started on a somber note recognizing a loss of a great man, Bill Jeffrey. Bill left us in March and will be truly missed. Then, our BOD each had a chance to share their new information (see their articles). Art DeLeon (Technical Chair) shared the changes in the TAB Standards Manual 8th Addition; Amber Ryman (Education Chair and new T24 Chair and Vic Congi, President Elect/Treasurer) shared our local budget impact and the T24 update from the National BOD point of view. Interestingly, 7 others states are supposedly watching our T24 actions with intentions to follow. Bill Edwards made a great point to our chapter members regarding volunteering for our local T24 committee that hits home. The small number of T24 volunteers has a lot of work on their shoulders that will not get complete if they do not get help. We can really use your help. Vic Congi has chosen to step down from our BOD and T24 position at this time. Per the bylaws, your BOD voted and Art DeLeon will finish out the 2015 President Elect/Treasurer position also.

T24 changes keep occurring and we keep hearing about more and more project requirements. We all need to get up to speed on the subject and there is no better way than to work alongside others with the program. If you have time, contact Audrey or Amber directly.

Until our next newsletter.

Steve Smith
Chapter President
Technical Committee Report

I hope everyone who attended the NEBB Annual Conference in Hawaii had as good a time as I did. It was nice seeing so many there from our chapter.

There are many changes happening due to NEBB’s ANSI accreditation process for TAB, Cx and Retro-Cx. If you haven’t done so already, please download from NEBB’s website: NEBB Certification Board Policy Program Manual and the new 2015 Eighth Edition of the Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems. In these 2 documents there are changes to the structural body of NEBB and our Certification(s)/Certification Process and procedural standards for TAB. I highlighted some of the changes I noticed when going through the manual prior to our Chapter meeting at the conference in Hawaii. Listed below is what I discussed:

Procedural Standards for TAB of Environmental Systems 2015 - Eighth Edition:

Sheet #7: Work Completion; All systems are within specs OR reasonable efforts have been taken. In this event the CP will notify the appropriate personnel of the systems preventing TAB within design tolerances before the final TAB report is submitted. Also make sure you note in the TAB report Summary these items.

Sheet #14: Instrument Calibration; In the final TAB report where the instruments are listed it now states; This is a listing of the instruments that will be used to verify the reported data including instrument type, mfg., model#, serial #, and calibration date. No longer states you have to insert the dates the instruments were used.

Sheets #15 thru #17: Required Report Data;

They now have required data for "Fan, Motor and Drive Accessible" and for "Embedded, Not Accessible".

Filters; Need to include "Quantity, Type & Size".

Heat Exchangers; Now have a chart that will indicate all the information you need to include in the report. It now includes air Face Velocities and Face Area for coils.

Circulating Pumps; Now has a "Pump Off" pressure that needs to be included.

Control Dampers (OSA, Return Air, Relief, etc...) Now requires you to put the "% Open Setting".

Last is a section on sheet #17 that states "Final System Settings". They list 7 items (if applicable because they include "Air & Hydronics") that need to be included in the report, i.e. Primary Air System delta Setpoint, Final Hertz, Hydronic System Fill Pressure.

Sheets #19 & #20: Pitot tube and Airfoil Traverses.

Sheet #29; VFD’s: It states that the most accurate method is to use the voltage and amperage provided on the display screen. Also states that when it’s unavailable to get the readings from the display (like on older VFD’s that don’t have this on the display) that to consult the drive Mfg. for best reading methods and locations.

Art De Leon
Technical Committee Chair
Title 24 Status Report

As many of you have heard, I have taken over the Chair position for the California Title 24 program. We are working closely with NEBB National and we are in the process of finalizing our Phase 2 Application for the California Energy Commission.

The task of getting our Phase 1 Interim application was handled by a group of volunteers from Northern and Southern California. The initial application only covered the first 8 forms. To complete the remaining forms and to move forward with our program, we are looking to our Chapter members for help. NEBB’s involvement in Title 24 opens the door to non-signatory individuals and firms as mentioned in the ATTCP Certification requirements. See the paragraph below.

B. ATTCPs provide reasonable access, determined by the Energy Commission, for the training and certification for the majority of professions qualified to complete the work of mechanical field technicians. These professions include: Professional engineers, HVAC installers, mechanical contractors, TABB certified technicians, controls installation and startup contractors and certified commissioning professionals who have verifiable training, experience and expertise in HVAC systems. The Energy Commission will consider, in its determination of “reasonable access,” factors such as certification costs commensurate with the complexity of the training being provided, prequalification criteria, curriculum and, class availability throughout the state.

We cannot accomplish this goal without the involvement of non-signatory individuals helping NEBB to achieve final approval from the CEC on this program. Please contact me or Audrey Kearns if you can help.

As new information comes in, I will be keeping you all updated. Thank you.

Amber Ryman
Title 24 Chair

Got Technical Updates?
We’re always looking for quality articles for The NEBB Professional.
Please submit topic idea with a brief description to marketing@nebb.org
6°F \( \leq \) T, compared to the 10°F to 14°F \( \leq \) T commonly used for selecting cooling coils in a VAV system.

Therefore, ACB systems will likely use more **pumping energy** than a VAV system because a) the pumps need to move a lot more chilled water (higher gpm) and b) this water needs to be pumped throughout the entire building (to one or more chilled beams installed in every space), rather than pumped only to the mechanical rooms that contain the centralized VAV air-handling units.

Is reheat energy avoided? Some proponents suggest that since chilled beams provide space cooling using zone-level cooling coils, they avoid the need for reheat that is common in many VAV systems.

A VAV system reduces the airflow delivered to the zone as the sensible cooling load in that zone decreases. Reheat is only activated after primary airflow (PA) has been reduced to the minimum setting for the VAV terminal. Returning to the previous office space example, if the minimum airflow setting for the VAV terminal is 40 percent of design airflow (0.90 cfm/ft² x 0.40 = 0.36 cfm/ft²), reheat is not activated until the space sensible cooling load drops below 40 percent of the design load. Below that point, the 55°F primary air (now 0.36 cfm/ft²) provides more cooling than the space requires, so the heating coil inside the VAV terminal unit warms the primary air just enough to avoid overcooling the space (Figure 9).

An ACB system reduces the water flow rate through the coil as the sensible cooling load in the zone decreases. When the space sensible cooling load drops below the point when the chilled-water (CHW) valve is completely closed, the primary airflow (0.36 cfm/ft² delivered at 55°F, for this example) provides more cooling than the space requires, so a four-pipe ACB will need to open the hot-water valve and add heat to the induced room air (RA) to avoid overcooling the space (Figure 9). (A two-pipe ACB would need to either add heat to the space with a separate heating system, switch-over the water-distribution system to deliver warm water to all beams, or just allow the space to overcool.)

When the space sensible cooling load drops below 40 percent of design load, both the VAV and ACB system are delivering 0.36 cfm/ft² of 55°F primary air to the zone,
so the same amount of heat would be needed to prevent overcooling the space.

The annual difference in reheat energy depends on the primary airflow delivered to the ACBs, the minimum airflow setting for the VAV terminals, the primary air temperature (see sidebar), whether there is any temperature reset strategy being used for the primary-air in either system, and the number of hours when the zones experience these low cooling loads. (VAV systems can benefit by using parallel fan-powered VAV terminals to draw warm air from the ceiling plenum as the first stage of heating, thereby reducing reheat energy use.)

However, reheat is not the only factor that impacts the difference in heating energy use between ACB and VAV systems. As mentioned earlier, ACB systems typically do not employ demand-controlled ventilation, so outdoor airflow remains constant. VAV systems, however, are more likely to implement some form of DCV to reduce outdoor airflow and heating energy use during partial occupancy.[3]

Of course, the actual difference in energy use for a specific building depends on climate, building usage, and system design. Building analysis tools (like TRACE™ 700) can be used to analyze the performance of different HVAC systems and design strategies. However, only a few whole-building energy simulation tools can currently model chilled beam systems, so be sure to understand the capabilities of the software.

To illustrate, TRACE™ 700 was used to compare an active chilled beam system to a chilled-water VAV system in an example office building (Figure 10). The baseline building uses a conventional chilled-water VAV system, modeled according to Appendix G of ASHRAE Standard 90.1-2007.

![Figure 10. Comparison of annual energy use for an example office building](image)

The building with the chilled beam system includes four-pipe ACBs, separate primary AHUs for perimeter versus interior zones, separate chiller plants (one supplying warm water to the chilled beams and the other supplying cold water to the primary AHUs), and an air-side economizer on the primary air systems. The chilled water system serving the primary AHUs is a "low flow" design with high efficiency chillers, a VFD on the cooling tower fans, and the chiller-tower optimization control strategy.

For this example, the building with the ACB system uses about 8 percent less energy than the conventional chilled water VAV system in Houston, 7 percent less in Los Angeles, 13 percent less in Philadelphia, and 15 percent less in St. Louis.

However, this analysis also investigated a "high-performance" chilled-water VAV system, which uses 48°F supply air (rather than the conventional 55°F, but kept the same size ductwork), supply-air-temperature reset and ventilation optimization control strategies, and parallel fan powered VAV terminals. The chilled water system is a "low flow" design with high-efficiency chillers, a VFD on the cooling tower fans, and the chiller tower optimization control strategy.

The high-performance chilled-water VAV system uses less energy than either the baseline VAV or the ACB systems: 11 percent less energy than the ACB system in Houston, 3 percent less in Los Angeles, 7 percent less in
Challenges of Using Chilled Beams

The purpose of this section is to review the challenges associated with applying chilled beams, and some ways to overcome those challenges.

High installed cost. Active chilled beam systems often have a higher installed cost than other system alternatives because the chilled beams have a relatively low cooling capacity. This means that more coil surface area is needed to provide the required space cooling. In addition, piping and control valves must be field-installed to deliver chilled water to the beams installed in every space.

Two factors that significantly limit the cooling capacity of an ACB are warm entering-water temperature and low inlet air pressure.

1) The entering-water temperature must be relatively warm (typically between 58°F and 60°F) to prevent condensation. With a warmer water temperature, a higher water flow rate (gpm) and/or more coil surface area is needed to provide the required cooling capacity.

2) The higher the static pressure entering the nozzles of an ACB, the more room air is induced through the coils inside the chilled beam. However, a higher inlet pressure requires more fan power. To keep fan energy use low—and avoid the fan energy penalty that plagued the high-pressure induction systems that were popular in the 1960s and 1970s—active chilled beams are typically selected with an inlet static pressure between 0.3 and 0.5 in. H2O, which is similar to the inlet pressure required by a VAV terminal unit. To induce sufficient room airflow with this low inlet static pressure, the pressure drop for induced airflow through the coil must be very small, which again results in the need for a lot of coil surface area. Returning to the same example, four 6-ft long active chilled beams are needed to offset the space sensible cooling load for this 1000 ft² office space (Figure 11). Notice how much ceiling area is covered with the beams.

Figure 11. Larger area of ceiling space required for chilled beams

four (4) active chilled beams, each 6-ft long x 2-ft wide

Example: 1000 ft² office space

Note: This example is based on two-way, four-pipe active chilled beams. Primary airflow of 360 cfm (0.36 cfm/ft²) is delivered to the beams at 55°F dry bulb and 0.50 in. H2O inlet static pressure. The entering water temperature is 58°F and the waterside ΔT is 5°F. The design space sensible cooling load is 19,500 Btu/h (19.5 Btu/ft²) and the zone cooling setpoint is 75°F.
Upcoming Events

NEBB RETRO COMMISSIONING CERTIFIED PROFESSIONALS SEMINAR

June 3-6, 2015
Minneapolis, Minnesota
Contact the NEBB Office to sign up or to receive more information at www.nebb.org

NEBB FUME HOOD TESTING SEMINAR FOR CERTIFIED PROFESSIONALS

September 28 - October 2, 2015
Labconco
Kansas City, Missouri
Contact the NEBB Office to sign up or to receive more information at www.nebb.org

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