EXchange

Analyzing Induction Terminal Systems in HAP v4.8

When HAP v4.8 is released in July, it will add design and simulation capabilities for induction beam and chilled beam HVAC systems.

Induction beams (IB) and chilled beams (CB) are modern updates to the induction air systems invented by Willis Carrier in the 1930s. Chilled beam systems have been in use in Europe for 10 to 20 years and have more recently been introduced in North America. In an active chilled beam (ACB) system a dedicated outside air system (DOAS) provides cooled and dehumidified primary air to the terminals. In the terminal, primary air flows through specially designed nozzles to discharge the air at high velocity into a mixing chamber. This high velocity air induces room air to flow into the terminal and through a cooling coil. This induced and cooled room air then mixes with the primary air before discharging to the room. An ACB terminal is a sensible-only cooling device. Therefore, special attention must be given to dehumidifying primary air at the DOAS cooling coil to the point where it can absorb the entire latent room load, thus preventing condensation of moisture on the terminal cooling coil.

eDesign Suite

Carrier

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Advantages of ACB systems include increased energy efficiency due to reduced fan energy, low noise, good room air distribution effectiveness, superior comfort through reduced potential for drafts, and minimal maintenance of the terminals. However, the drawback to this system is design complexity. Special attention is required to ensure no condensation occurs on terminal cooling coils or exposed supply piping. Designing either a dual temperature chilled water temperature distribution system or separate chilled water systems for the DOAS air handler and the ACB terminals accomplishes this.

Induction beams represent the next step in the evolution of this concept. IB terminals use the same fundamental principles as ACB terminals, but include a drain pan and condensate drain piping to permit both sensible and latent cooling at the terminal. With an IB system, the DOAS generally handles the ventilation air sensible and latent loads, while the terminal handles the room sensible and latent loads. As a result, induction beams can accept much colder chilled water and therefore, have larger cooling capacities. This allows use of fewer terminals per space than chilled beams, reducing first cost and installation cost. It also greatly simplifies the design of the airside system because primary air dehumidification is less critical, and it allows use of a single temperature chilled water supply system. This simplification of design also contributes to improved energy performance.

HAP v4.8 provides the following capabilities for ACB and IB applications:

- Peak cooling and heating load calculation
- DOAS system and air terminal sizing

- Export of sizing data to Carrier Electronic Catalog (ECAT) for selection of induction beams using the Carrier Induction Terminal Builder software
- Hour-by-hour energy simulation of air-side and plant side energy performance
- Ability to compare IB and ACB system energy performance, and to compare performance with conventional systems such as VAV/Reheat

Further information on induction beams, and modeling of IB and ACB systems HAP is available in the following resources:

- Brochure: ActivAIR Induction Beams - Engineered Comfort for Today's Buildings
- White Paper: Induction Beams: Engineered for Today's Comfort
- eHelp: Modeling Induction Beam Systems in HAP v4.8
- eHelp: Modeling Active Chilled Beam Systems in HAP v4.8

Carrier 36IB Induction Beam Air Terminal Operating Diagram
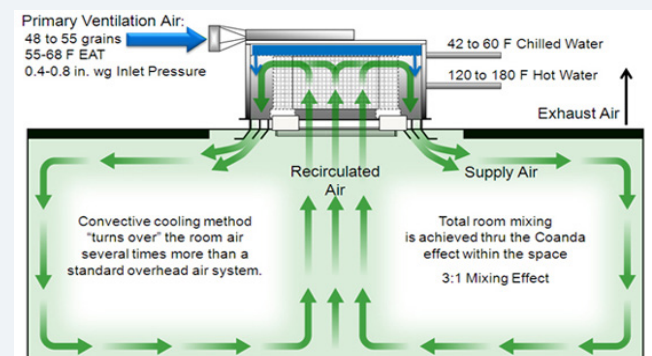
eDesign Suite Moves to Electronic Software Delivery

Starting with the release of HAP v4.8 in July, Carrier will begin delivering eDesign Suite software exclusively by electronic means. This completes a transition to electronic delivery started in March 2010.

Up to this point, Carrier has delivered software to licensees both electronically via web download and physically via CD-ROM. For the Hourly Analysis Program (HAP), System Design Load and Building System Optimizer, licensed customers can download and install full versions of the software from the Carrier website. For these programs and for Block Load, Engineering Economics and Refrigerant Piping, a package containing the program CD-ROM and a printed manual has also been shipped to customers.

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The switch to exclusive electronic delivery of software means:

- New customers licensing any eDesign Suite program will receive a web link and access code to immediately download and install their software.

- When software updates are issued, existing customers will receive e-mail notification of the update with a web link and access code to immediately download and install the updated software.

- Licensed customers can download full versions of their software from the Carrier website at any time. This is useful when reinstalling the software or installing on new computers.

- All eDesign Suite programs will automatically install electronic versions of the program manual in Adobe PDF format. Manuals are placed in the \E20-II \Manual folder. Some programs such as HAP directly link to the manual from within the program. All programs continue to offer extensive help documentation accessible from within the program.

- Packages containing the CD-ROM and a printed manual will no longer be mailed to customers.

This change keeps Carrier in step with industry practices and customer expectations. Most software vendors today rely on electronic delivery. Customers tell us they prefer electronic delivery and we want to respond to that request.

Frequently Asked Questions

Q. How many computers can I load my software program on?

A. The eDesign software license permits concurrent use of the software on up to 10 computers. In many companies the software is installed on up to 10 computers, or 10 network workstations if a network is used. If use of the software is intermittent, the software can be installed on more than 10 computers. The only stipulation is that no more than 10 copies be in use at one time.

Q. What is a gbXML file and can it increase my productivity when using HAP?

A. gbXML is increasingly being accepted as a neutral format for exchanging building data between Building Information Modeling (BIM) tools and engineering analysis software programs like HAP. gbXML stands for "green building XML". XML stands for "extensible mark-up language" which is a computer language for representing information. While the name suggests a use for green building applications, gbXML is usable for any application, green or otherwise. Certain BIM software vendors offer tools to produce gbXML-format files from BIM models. As long as a tool generates gbXML data which conforms to the gbXML "schema" (the rules for formatting the data) HAP will be able to read and translate the gbXML data.

As far as increasing your productivity, the answer is "yes"!
This feature can substantially reduce the time and effort needed to transfer building information from a BIM project into HAP for use in load calculations and energy analysis. Defining spaces one-by-one can be tedious. This electronic transfer replaces the manual process of taking data off drawings and manually entering it into HAP. Its use automatically generates HAP space, wall, roof, window, door and schedule data.

Q. What gbMXL data will HAP import?

A. HAP will import all of the data listed below.
gbXML files can contain a wide range of information. Depending on the tool that generated the gbXML file and how much effort the user invested in adding content to the original BIM model, the gbXML file could contain a lot or a little of this data. Item 1 below tends to be the minimum data present in a gbXML file. Some tools are capable of adding information about items 2-11 if the user chooses to do so.

1. Surface data: dimensions (HxW, LxW), gross areas, and orientations for:

   - Exterior walls
   - Horizontal roofs
   - Sloped roofs
   - Windows
   - Doors
   - Skylights
   - Basement floors
   - Basement walls
   - Slab-on-Grade floors
   - Raised floors

2. Exterior wall construction information.

3. Roof construction information.

4. Window and skylight thermal performance data.

5. Door thermal performance data.

6. Construction and thermal performance data for basement floors, basement walls and slab-on-grade floors.

7. Software automatically calculates building weight for the space if items 1, 2, 3, and 6 are supplied.

8. Internal heat gain data for the following:

   - Occupant density, sensible and latent heat gains.
   - Overhead lighting W/sqft
   - Electric equipment W/sqft

9. Schedules for internal heat gains.

10. Infiltration airflow data.

11. Outdoor ventilation airflow requirements.

Q. I am running an energy analysis and am studying the energy use of a base case system versus a system which includes an energy recovery ventilator (ERV) unit. When I compare the final energy use and operating cost results I find there is no difference. Why doesn't adding an ERV reduce the energy use and cost?

A. Check the system inputs to see if 100% of outdoor ventilation air is being directly exhausted from zones in the system. If all ventilation air is being directly exhausted this is the culprit.
An Energy Recovery Ventilator (aka Ventilation Reclaim device) transfers heat and moisture between the outdoor ventilation and exhaust air streams. These devices can be heat wheels, heat pipes, pump-around systems, air-to-air heat exchangers or similar equipment. In order to function, a flow of outdoor ventilation air and exhaust air is required at the air handler. If all outdoor ventilation air is directly exhausted from zones (via toilet exhausts, lab hoods, kitchen exhaust, thru-the-wall exhaust or similar means) then no ventilation air returns to the air handler to be exhausted. Because there is no exhaust at the air handler, the ventilation reclaim device cannot function and no energy savings will be seen.

If you remove direct exhaust from the system you should see the reduction in energy use and energy cost that you expect.

2013 Training Class Schedule

Location	Load Calculation for Commercial Buildings	Energy Simulation for Commercial Buildings	Energy Modeling for LEED® Energy & Atmosphere Credit 1	Advanced Modeling Techniques for HVAC Systems
Vancouver, BC	Jun 3	Jun 4	Jun 5	Jun 6
Montreal, QC	Jun 25	Jun 26	Jun 27	Jun 28
Savannah, GA	Aug 20	Aug 21	Aug 22	Aug 23
Chicago, IL	Sept 17	N/A	N/A	Sept 18
Philadelphia, PA	Oct 21	N/A	Oct 22	Oct 23

Additional classes are being added.

eDesign Suite Software Current Versions (North America)

Program Name	Current Version	Functionality
Hourly Analysis Program (HAP)	v4.70	Peak load calculation, system design, whole building energy modeling, LEED® analysis.
Building System Optimizer	v1.10	Whole building energy modeling for schematic design.
Block Load	v4.15	Peak load calculation, system design.
Engineering Economic Analysis	v3.01	Lifecycle cost analysis.
Refrigerant Piping Design	v4.00	Refrigerant line sizing.
System Design Load	v4.70	Peak load calculation, system design.

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