NEW FEATURES
IN THE
CARRIER
HOURLY ANALYSIS PROGRAM v4.90

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Syracuse, New York

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1. Summary List of Enhancements in v4.90

This document describes enhancements in the Carrier Hourly Analysis Program (HAP) v4.90, released in December, 2014. It is intended for new users and those upgrading from HAP v4.80. A summary list of enhancements is provided below. Sections 2 through 6 describe the changes in greater detail.

1. Plants

- Added a new "Heat Recovery" plant type for use in energy simulations.
- Added a new "Generic Heat Recovery" plant type for use in design calculations.
- Added features for modeling six plant heat recovery schemes within the "Heat Recovery" plant type.

See section 3 for further details

2. Chillers

- Added options for including double bundle condenser, desuperheater and heat recovery condenser components in the chiller and for specifying related performance data.
- Updated the DX free cooling feature to make modeling this feature easier.

See section 4 for further details

3. Wizards

- Revised the Building Wizard to provide more extensive default choices for wall, roof and window assemblies, and to display details to help users understand the construction and performance of the selected wall, roof or window assembly type.
- Revised the Equipment Wizard to include options for modeling heat recovery plants and six types of heat recovery schemes.
- Revised the Utility Rate Wizard to allow remote steam price structures to be defined when working with absorption chiller plants.

See section 5 for further details

4. Miscellaneous Features

- Revised the Ventilation Sizing Summary system design report, when using ASHRAE Standards 62.1-2004, -2007 or -2010 calculations, to Standard 62.1 terminology and to display Standard 62.1 variable names for quantities shown on the report.
- Added simulation weather data for 21 new cities and updated data for 21 further cities..

See section 2 for further details

5. Bug Fixes

- Corrected 8 problems reported in HAP v4.80

See section 6 for further details

1. New Plant Features

a. Heat Recovery Plant Type

Added a new "Heat Recovery" plant type for energy simulations. This is a special type of plant that combines all the equipment and controls for a chilled water cooling plant and a hot water heating plant, and the equipment to recover heat from the cooling system for use in meeting hot water heating loads.

b. Generic Heat Recovery Plant Type

Added a new "Generic Heat Recovery" plant type for plant design calculations. With this single plant, both peak cooling and heating load capacities can be determined.

c. Heat Recovery Schemes

The new "Heat Recovery" plant type offers models for six different heat recovery schemes:

- Dedicated heat recovery chiller (DHRC) in parallel with cooling-only chillers
- Air-cooled chillers with heat recovery condensers
- Heat exchange in condenser loop
- Dedicated heat recovery chiller in condenser loop
- Double-bundle chillers
- Chillers with desuperheaters

d. Pump Efficiency

The default mechanical efficiency of water pumps was changed to 70% (formerly 80%).

e. Plant Oversizing Factors

The default plant oversizing factors were set to 0% (formerly 15% for chilled water plants and 25% for hot water plants). This affects energy simulation results and should avoid unnecessarily large equipment capacities for auto-sized plants.

3. New Chiller Features

a. Double Bundle Condensers, Desuperheaters, and Heat Recovery Condensers

Added features for defining three types of heat recovery components in chillers: Double Bundle Condensers, Desuperheaters, and Heat Recovery Condensers. These heat recovery components must be defined for a chiller included in a heat recovery plant using any of these features.

b. DX Free Cooling

Upgraded features for modeling DX free cooling in air-cooled chillers. HAP now supplies typical default performance data when DX free cooling is selected. In addition, performance may now be defined in terms of % full load capacity and kW/Ton (ikW/kW). Both enhancements assist with schematic design studies for which machine-specific performance data is not yet available.

4. New Wizard Features

a. Building Wizard

Revised the Building Wizard to provide more extensive choices for wall, roof and window assemblies, and to display details of these assemblies to help users understand the construction and performance of the selected wall, roof or window assembly type.

Previously the Building Wizard offered three choices for wall and roof assemblies (Light, Medium and Heavy walls), and two options for window assemblies (Standard and High Performance). These default offerings have been expanded to include ASHRAE 90.1-2010 wall and roof assemblies by climate zone. These assemblies have performance which meets 90.1-2010 prescriptive performance requirements. Default offerings for windows include ASHRAE 90.1-2010 assemblies by climate zone which meet the prescriptive performance requirements for U-value and shade coefficient. In addition, further defaults are offered for common types of single-pane, double-pane and triple-pane windows, with clear, reflective and tinted glazings as well as low-e coatings.

When a wall or roof assembly is selected from the drop-down list, the sequence of material layers and the overall U-value are now displayed for reference. When a window assembly is selected, the U-value and shade coefficient are displayed for reference.

b. Equipment Wizard

Revised the Equipment Wizard to include options for modeling heat recovery plants. The same six heat recovery schemes described in item 1c above are also offered in the Equipment Wizard.

c. Utility Rate Wizard

Revised the Utility Rate Wizard to add pricing information for remote steam. This feature was added for applications using chilled water plants with steam-driven absorption chillers.

5. Miscellaneous Features

a. Ventilation Sizing Summary

Revised the Ventilation Sizing Summary system design report. When using ASHRAE Standard 62.1-2004, -2007 or -2010 as the ventilation sizing method, the report now uses Standard 62.1 terminology and displays the Standard 62.1 variable names for quantities shown on the report.

The original format for this report, introduced in 2005, used general descriptive labels for items on this report because there was not widespread familiarity among users with the Standard 62.1 terminology. More recently, due to code related work and especially as a result of LEED projects, there is broader familiarity and acceptance of the Standard 62.1 terminology in the engineering community.

Based on requests from HAP customers we have revised the report to use Standard 62.1 terminology and to also indicate the Standard 62.1 variable names for each quantity on the report for easier comprehension.

b. Simulation Weather Data

Added or updated simulation weather data for 42 cities. All of the new and updated city files are automatically installed with the program and can be selected via the "Add From HAP Library" window in the Weather Properties window.

Simulation weather data was added for the following cities:

- Oranjestad, Aruba
- Nassau, Bahamas
- Bridgetown, Barbados
- Barranquilla, Colombia
- Cali, Colombia
- San Jose, Costa Rica
- Santo Domingo, Dominican Republic
- San Salvador, El Salvador
- St. George, Grenada
- Guatemala City, Guatemala
- San Pedro Sula, Honduras
- Tegucigalpa, Honduras
- Kingston, Jamaica
- Culiacan, Mexico
- Hermosillo, Mexico
- Mexicali, Mexico
- Tijuana, Mexico
- Torreon, Mexico
- Managua, Nicaragua
- Ljubljana, Slovenia
- Port of Spain, Trinidad and Tobago

- Doha, Qatar

Simulation weather data was updated for the following cities:

- Manama, Bahrain
- Porto Alegre, Brazil
- Rio de Janeiro, Brazil
- Chengdu, China
- Guangzhou, China
- Changsha, China
- Jinan, China
- Tianjin, China
- Wuhan, China
- Xian, China
- Tehran, Iran
- Abidjan, Ivory Coast
- Kuwait City, Kuwait
- Monterrey, Mexico
- Rabat, Morocco
- Muscat, Oman
- Dhahran, Saudi Arabia
- Jeddah, Saudi Arabia
- Durban, South Africa
- Pretoria, South Africa
- Dubai, United Arab Emirates

6. Bug Fixes

This section describes problems identified in HAP v4.80 which were corrected in HAP v4.90.

a. System Calculations - If a 2-pipe fan coil system was defined with hot water heating and 2-pipe changeover controls, was saved, and then later edited to change the heating source from hot water to electric resistance, the 2-pipe changeover controls were not automatically removed. As a result, during system design and system simulation calculations, the program continued to calculate changeover control, resulting in faulty control of the cooling coil. Cooling could be unavailable for many hours. During those hours zone air temperatures could rise to extreme levels. Instead, changeover controls should be disabled when the heating source is no longer hot water.

b. Plant Simulations - While running the simulation for a plant using air-cooled chillers, the simulation halted and displayed and "Error 91" message. This error only occurred when the user was attempting to model waterside economizer and had selected free cooling and specified "one tower for each water-cooled chiller" as the cooling tower configuration. To model waterside economizer with air-cooled chillers the configuration "one tower shared by all water-cooled chillers" must be used.

c. HAP Wizards - After selecting the "Full Wizard Session" on the Wizards Menu or clicking the "Full Wizard Session" button on the toolbar, the Full Wizard screen appeared immediately followed by an "Error 3265" error message. This error only occurred when the current opened project was one of the ASHRAE 90.1-2007 template projects which automatically install with the program. The error was due to bad data in these template projects.

d. System Design Calculations I - When calculating ventilation airflow requirements using ASHRAE Standard 62.1-2004, -2007 or -2010 for a system with parallel fan powered mixing box (PFPMBX) air terminals, two errors could cause ventilation airflow results to be incorrect in specific situations. If the delta-T between heating supply temperature and heating setpoint was less than 15 F, the program set the air distribution effectiveness to 0.8 instead of 1.0. In addition, in a situation where the space outdoor airflow rate (Voz) was larger than the specified minimum primary supply airflow (Vpz), Vpz was incorrectly adjusted to a value larger than Voz. Note that many PFPMBX systems will not be affected by these conditions and produce correct system outdoor air intake airflow (Vot) results. In cases where air system characteristics do trigger the error, Vot could be either overstated or understated depending on conditions.

e. System Design Calculations II - When calculating ventilation airflow requirements using ASHRAE Standard 62.1-2004, -2007 or -2010 for a system with series fan powered mixing box air terminals, two errors could cause ventilation airflow results to be incorrect in specific situations. For the ventilation airflow calculation for the heating design condition, the primary supply airflow rate (Vpz) was incorrectly being set to the primary airflow at maximum supply airflow conditions rather than the minimum primary supply flow. In addition, in a situation where the space outdoor airflow rate (Voz) was larger than the specified minimum primary supply airflow (Vpz), Vpz was incorrectly adjusted to a value larger than Voz. Depending on air system characteristics, these errors could cause the outdoor air intake airflow (Vot) to be unchanged, overstated or understated.

f. System Design Calculations III - For an air system serving one zone containing one space in which ventilation airflow was calculated per ASHRAE Standard 62.1-2004, -2007, or -2010, the Ventilation Sizing Summary displayed incorrect values of "Uncorrected Outdoor Airflow" (Voz). The report also displayed the diversity factor which is extraneous information for this scenario and should not be shown. However, note that the outdoor air intake airflow (Vot) was calculated and reported correctly in this case. Only the "Uncorrected Outdoor Airflow" items were shown incorrectly.

g. System Design Calculations IV - When calculating ventilation airflow requirements using ASHRAE Standard 62.1-2004, -2007, or -2010, for certain system types with a design heating supply air temperature exactly 15 F higher than the occupied heating thermostat setpoint, the program incorrectly set the air distribution effectiveness (Ez) to 1.0 instead of 0.8. The affected system types were single zone CAV, VVT, dual duct CAV, 2-deck multizone, 3-deck multizone and terminal units such as fan coils and WSHP. Note that cooling only systems, systems with a heating SAT to room delta-T other than 15 F or systems in which cooling mode dictates the outdoor intake airflow (Vot), this error had no effect. In those cases where the error did affect results, it typically caused ventilation airflow to be understated.

h. System Design Calculations V - When calculating ventilation airflow requirements using ASHRAE Standard 62.1-2004, -2007, or -2010, for 2-Fan Dual Duct VAV or 1-Fan Dual Duct VAV systems in which the design heating condition determines the worst case outdoor air intake airflow (Vot), the combined hot deck and cold deck airflow rate was incorrectly calculated. This could cause the outdoor air intake airflow (Vot) for the system to be either understated or overstated.