HOURLY ANALYSIS PROGRAM VERSION 4.8



Building Wizard - Building Footprint Screen

The Building Wizard is used to define the size, shape, usage, envelope and internal loads for a complete building. This Wizard consists of two input screens:

1. The Building Footprint screen defines the footprint size and shape, the number of floors, building usage type and zoning. This screen is discussed in further detail in this topic.
2. The Building Details screen defines outdoor ventilation air requirements, internal loads, envelope construction and infiltration for the building. Read More.

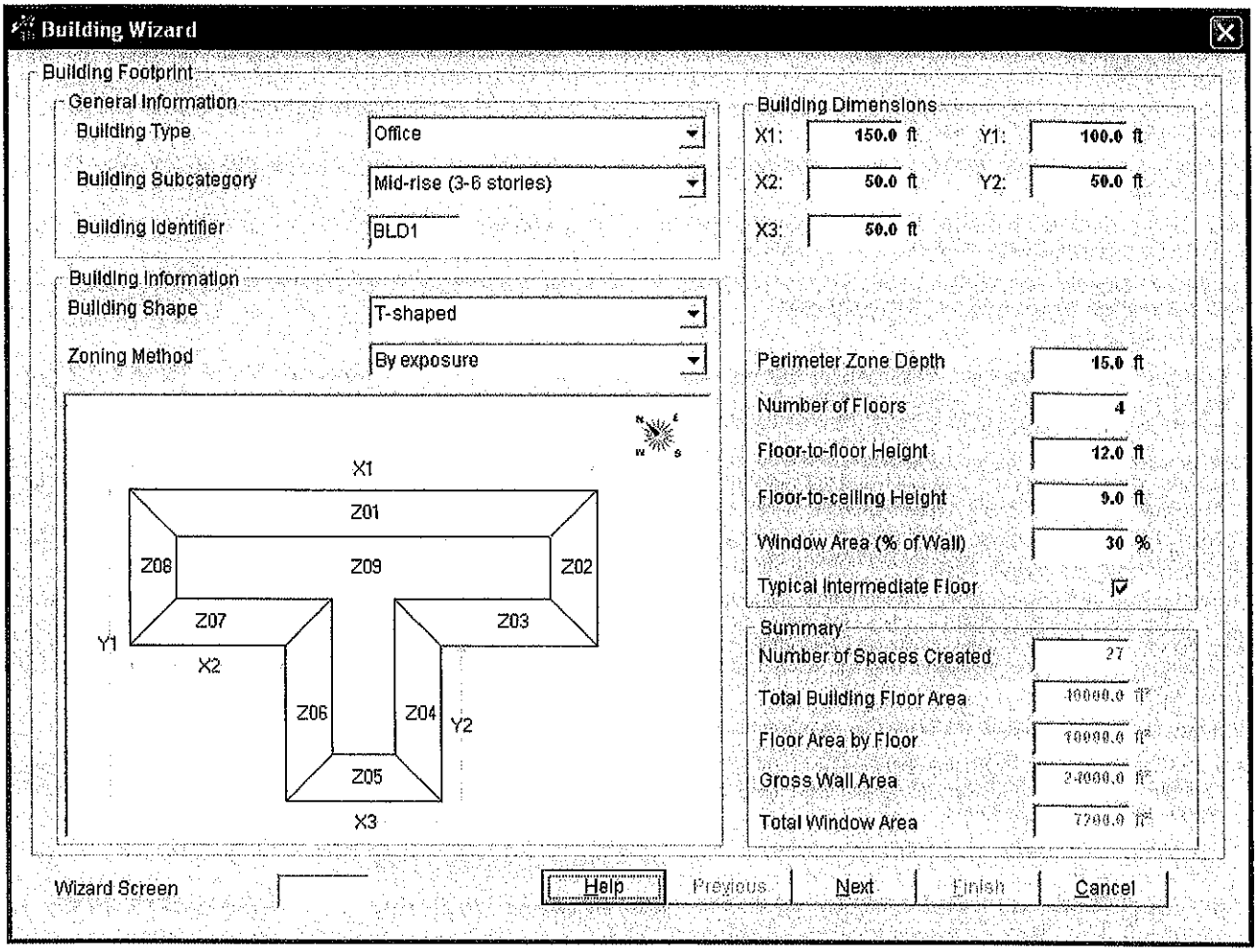
Building Wizard inputs will ultimately be used to generate a complete set of detailed inputs for spaces in the building as well as wall, roof, and window assemblies and internal load schedules.

The **Building Footprint** input screen, shown below, contains inputs divided into 4 groups and command buttons in the lower right. Each of these input screen features will be discussed below.

1. **General Information.**
   a. **Building Type** and **Building Subcategory** together define the usage type for the building being created. These inputs will determine the defaults for outdoor ventilation, internal loads, constructions and infiltration that appear on the Building Details screen. When you change either input, items on the Building Details screen are automatically reset to the proper defaults.
   b. **Building Identifier** is a short label that will be used to identify all spaces created from the wizard inputs. This label appears as the prefix in the space name. If you are using the Building Wizard to create multiple building scenarios, this feature helps you manage your data by identifying which spaces are associated with which building definition.
2. **Building Information** defines the building footprint shape and the method of zoning. This section also contains a diagram of the building footprint to help you visualize the building being configured.

   The orientation of the building can be controlled using the compass icon located in the upper right-hand corner of the building view pane. Initially the compass North points to the top of the pane, indicating "up" is north. To change the orientation use your mouse to drag the compass North pointer clockwise or counterclockwise to the desired point of the compass rosette. For example if you drag the compass North needle clockwise until the West pointer points up, the face of the building pointing up is facing West. In the figure above "up" is northeast.
3. **Building Dimensions.** Items in this section describe the horizontal and vertical dimensions of the building.
   a. **X and Y Dimensions** define the dimensions of the building footprint. The X and Y labels refer to X and Y dimensions shown in the footprint diagram in the lower left part of the input screen. As you change these values the diagram will adjust to show a scale representation of the footprint.
   b. **Perimeter Zone Depth** - The horizontal distance from the exterior wall to the interior boundary of the perimeter zone. As you change this value the footprint diagram will be scaled to show the relative size of the perimeter zone.
   c. **Number of Floors** - The number of floors in the building. Inputs may be limited by the Building Subcategory input. For example if you specify "Low Rise 1-2 stories" number of floors will be limited to 2.
   d. **Floor to Floor Height** - The vertical distance between floors. This value is used to compute wall surface area.
   e. **Floor to Ceiling Height** - The vertical distance from floor to ceiling level. This distance is used to compute space volume for converting infiltration air changes into airflow quantities.
   f. **Window Area** - The percentage of gross wall area which is fenestration. For example if 15% is specified, the target for each space created is a window to wall ratio of 15%. Note the actual window to wall ratio in the generated spaces may not exactly equal the value you define. Using the dimensions of the window assembly specified on the Building Details input screen, HAP will determine the number of windows that comes closest to the window to wall ratio you specified. Because HAP will not consider "partial" windows, the dimensions of your window assembly may result in a window to wall ratio slightly above or below the value you specified.
   g. **Typical Intermedigte Floor.** When the building contains 4 or more floors, you can choose whether to represent each intermediate floor separately, or with as one typical floor with a multiplier applied. If you wish to use the typical floor approach, place a check mark in the box. This feature provides a way to minimize space data created when it is not necessary to model floors above the first floor and below the top floor separately.

      Example: A building has a rectangular footprint with perimeter by exposure zoning so there are 5 zones per floor. The building has 10 floors. If you check the box for "Typical Intermediate Floor", HAP will generate 15 spaces - 5 for the first floor, 5 for one intermediate floor representing floors 2 to 9, and 5 spaces for the 10th floor. If the "Typical Intermediate Floor" box is not checked, HAP will generate 50 spaces, 5 for each of the 10 floors.
4. **Summary.** This section contains display-only information about the building you are creating. Data includes the number of spaces that will be created and floor, wall and window areas. Sometimes this information is helpful if you are trying to match a particular building floor area target or wall area target.
5. **Command Buttons.** The following command buttons are provided.
   a. **Help** - Displays this help topic.
   b. **Next** - Displays the Building Details input screen.
   c. **Cancel** - Exits the Building Wizard without saving any changes you made.

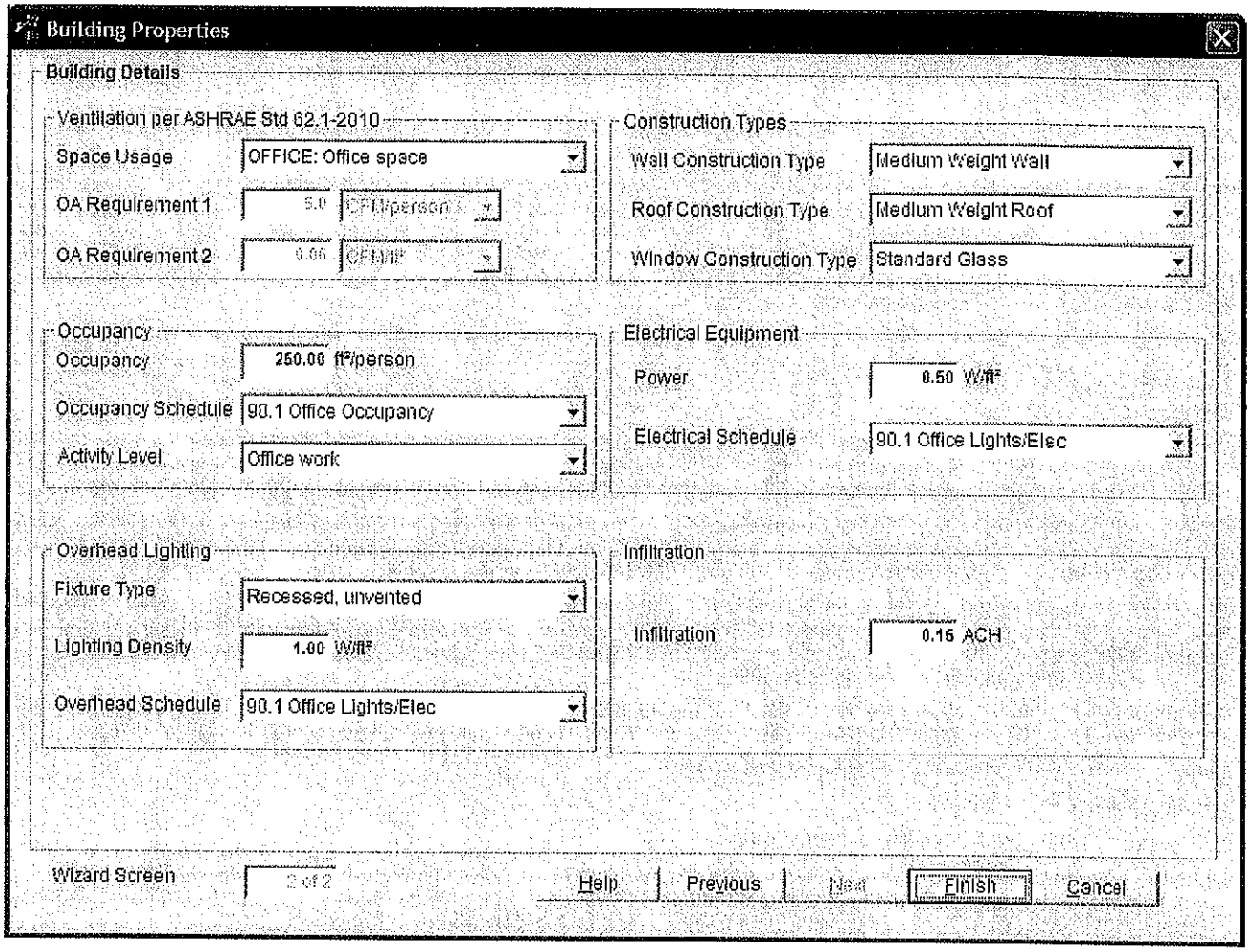

Building Wizard
Building Footprint
General Information
Building Type
Office
Building Subcategory
Mid-rise (3-6 stories)
Building Identifier
BLD1
Building Information
Building Shape
T-shaped
Zoning Method
By exposure
X1
Z01
Z08
Z09
Z02
Z07
Z03
Y1
X2
Z06
Z04
Y2
Z05
X3
Building Dimensions
X1: 150.0 ft
Y1: 100.0 ft
X2: 50.0 ft
Y2: 50.0 ft
X3: 50.0 ft
Perimeter Zone Depth 15.0 ft
Number of Floors 4
Floor-to-floor Height 12.0 ft
Floor-to-ceiling Height 9.0 ft
Window Area (% of Wall) 30 %
Typical Intermediate Floor
Summary
Number of Spaces Created 27
Total Building Floor Area 40000.0 ft²
Floor Area by Floor 10000.0 ft²
Gross Wall Area 24000.0 ft²
Total Window Area 7200.0 ft²
Wizard Screen
Help
Previous
Next
Finish
Cancel

Building Wizard - Building Details Screen

The Building Details input screen is the second of two Building Wizard screens. It allows details regarding ventilation airflow requirements, internal loads, envelope construction and infiltration to be defined. These inputs will apply uniformly to all spaces generated for the building.

This input screen contains inputs divided into six groups and command buttons in the lower right. Each of these input screen features will be discussed below.

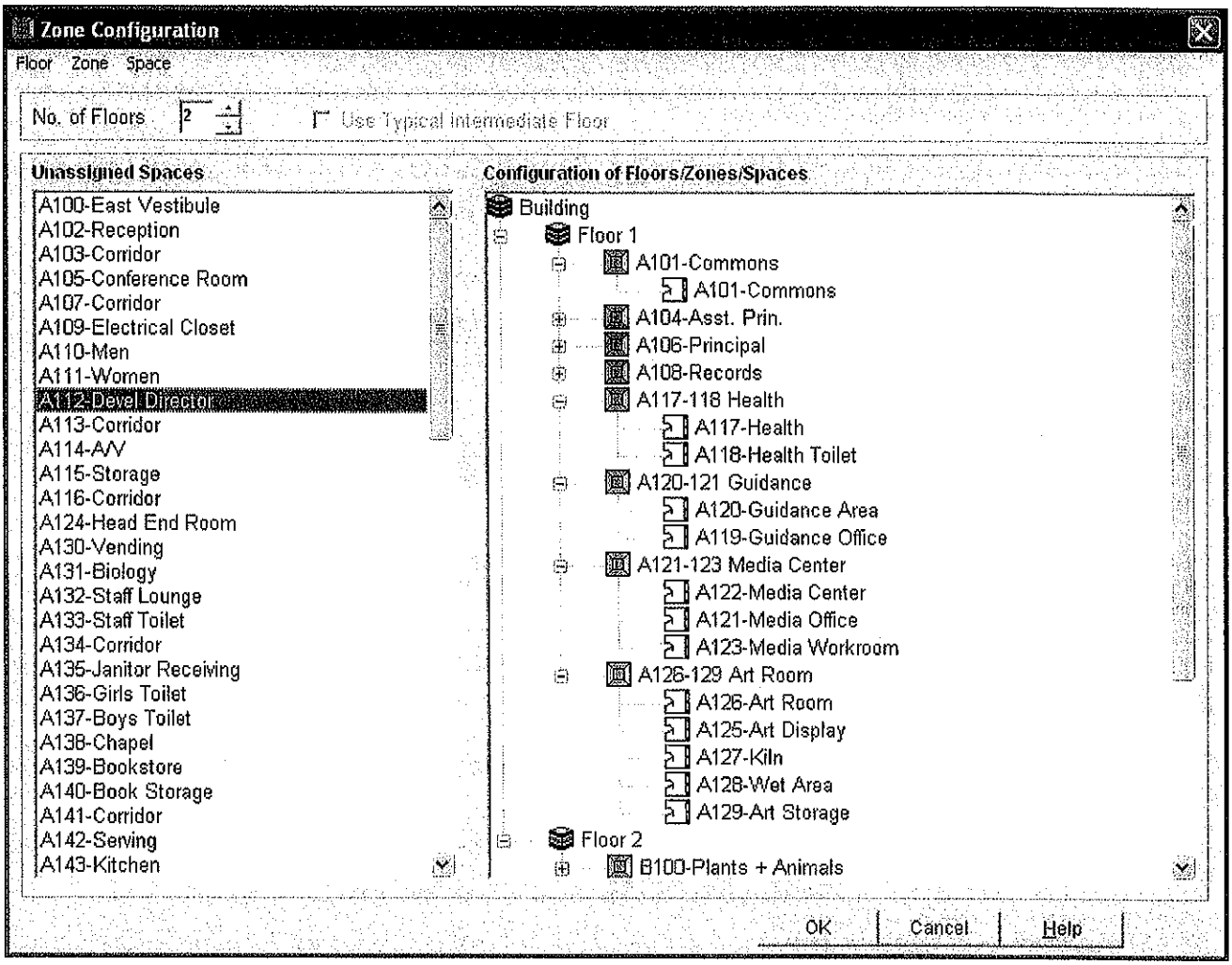
1. **Ventilation.** Ventilation inputs define the outdoor ventilation airflow requirements for spaces in the building. The Space Usage input allows ventilation requirements to be defaulted based on space usage types listed in ASHRAE Standard 62-2001, 62.1-2004, 62.1-2007 or 62.1-2010. The ASHRAE Standard currently in effect is shown in the title for this group of inputs (this is changed via the View/Preferences option in the HAP main window). Items in the space usage list match those listed in the selected standard. When a space usage type is selected, outdoor air requirements 1 and 2 are defaulted. If you choose "user defined" as the space usage type, then the outdoor air requirements can be directly specified.
2. **Occupancy** defines the density, hourly schedule and activity level for occupants in the spaces. The drop down list for the schedule contains a series of standard schedules taken from the ASHRAE Standard 90.1 User's Manual and any schedules previously defined in the HAP project. If you select one of the standard schedules, the Wizard will add it to the HAP project along with the spaces it creates.
3. **Overhead Lighting** defines the fixture type, density and hourly schedule for overhead lighting. As with occupants, the drop-down list for schedule contains standard schedules from the ASHRAE Standard 90.1 User's Manual and any schedules previously defined in the HAP project. If necessary, the Wizard will add the schedule you choose to your HAP project along with the spaces it creates.
4. **Construction Types** Defines the construction assemblies used for exterior wall, roof and window elements of the building. Each drop-down list contains typical assemblies as well as any wall, roof, or window assemblies defined in the HAP project. If you select a typical construction, the Wizard will add it to the HAP project along with the spaces it creates.
5. **Electrical Equipment** defines the power density and hourly schedule for electrical equipment in the spaces. Often these are referred to as "plug loads". As with occupants and overhead lighting, standard schedules from the ASHRAE Standard 90.1 User's Manual and schedules previously defined in the HAP project are shown in the drop-down list. When necessary, the schedule you choose will be added to the HAP project along with the spaces created.
6. **Infiltration** defines the infiltration air changes per hour for spaces in the building. Infiltration will only apply to spaces having a perimeter exposure. The same infiltration value will be used for cooling design, heating design and energy simulation conditions.
7. **Command Buttons.** The following command buttons are provided.
   a. **Help** - Displays this help topic.
   b. **Previous** - Returns you to the Building Footprint input screen.
   c. **Finish** - If running the Building Wizard as part of a Full Wizard Session, the Finish button retains your inputs and returns you to the Full Wizard Session window. If running Building Wizard alone from the Wizards Menu, the Finish button will display the Building Wizard input report and then convert Building Wizard inputs into a full set of detailed space data.
   d. **Cancel** - Exits the Building Wizard without saving any changes you made.


Building Properties
Building Details
Ventilation per ASHRAE Std 62.1-2010
Space Usage
OFFICE: Office space
OA Requirement 1
5.0
CFM/person
OA Requirement 2
0.06
CFM/ft²
Construction Types
Wall Construction Type
Medium Weight Wall
Roof Construction Type
Medium Weight Roof
Window Construction Type
Standard Glass
Occupancy
Occupancy
250.00 ft²/person
Occupancy Schedule
90.1 Office Occupancy
Activity Level
Office work
Electrical Equipment
Power
0.50 W/ft²
Electrical Schedule
90.1 Office Lights/Elec
Overhead Lighting
Fixture Type
Recessed, unvented
Lighting Density
1.00 W/ft²
Overhead Schedule
90.1 Office Lights/Elec
Infiltration
Infiltration
0.15 ACH
Wizard Screen
2 of 2
Help
Previous
Next
Finish
Cancel

Zone Wizard - Zone Configuration Screen

The Equipment Wizard option on the Wizards menu is used to rapidly apply HVAC equipment to spaces that were previously defined in HAP. When this option is selected the Zone Configuration input screen appears first. The purpose of this screen is to organize spaces in your project into floors and zones so the Equipment Wizard can properly apply air systems to the spaces. Spaces are organized by first creating floors and then using drag-and-drop or menu items to assign spaces on the left side of the screen to floor-zone-space tree diagram on the right side of the screen.

Quick Tip. For preliminary design or screening studies use the following steps to rapidly configure spaces:
a. Specify the number of floors and whether the typical intermediate floor option is used.
b. In the Unassigned Spaces list highlight all spaces on the first floor and then drag and drop the spaces onto the Floor 1 node in the tree. All spaces will be automatically converted into single space zones.
c. Repeat the previous step for each floor.
d. Press OK to proceed.



The Zone Configuration input screen is divided into five key sections, each of which is described below:

1. The **Number of Floors** panel contains the following inputs:
   a. **Number of Floors** - Allows the number of floors in the building to be defined. One floor node for each floor your create will appear in the tree diagram panel.
   b. **Use Typical Intermediate Floor** - When 4 or more floors are specified, you have the option of modeling the intermediate floors with one representative floor. For example, if the building has 10 floors, floors 2 through 9 could be modeled with a single representative floor if they are sufficiently similar. When this option is chosen, the program applies a multiplier of 8 to the floor so the actual number of floors, floor area, wall area and window area are accounted for. When this option is not selected, all floors must be separately modeled.
2. The **Unassigned Spaces** panel on the left lists all spaces currently defined in your project. Using drag-and-drop you can assign spaces to zones in the tree diagram on the right, or you can highlight spaces in the list and use an the Assign Spaces option on the Space Menu to accomplish the same result. Details:
   a. If you drag and drop spaces onto a zone node in the tree, the spaces will be assigned to that particular zone.
   b. If you drag and drop spaces onto a floor node in the tree, the program will automatically create as series of single-space zones for that floor. Each space will be assigned to one zone. This is a useful shortcut method for assigning spaces. It saves you the step of creating zones first allowing you to accomplish creation of zones and assignment of spaces in a single step.
   c. All spaces to which you want to apply equipment must be assigned.
   d. It is not necessary to assign all spaces in the Unassigned Spaces list. If you are modeling only a portion of the building, or only using a portion of your spaces, these can be assigned to zones. The other spaces can remain on the Unassigned Spaces list.
3. The **Floors/Zones/Spaces Tree Diagram** panel on the right shows the relationship between floors, zones and spaces in the building. In this diagram you can highlight nodes in the tree, expand and collapse the tree display and right-click on nodes to display

pop-up menus. Details:

a. Click the plus sign next to a node to expand the tree. For example, if you click the plus sign for a zone node, the tree expands to show the spaces assigned to that zone.
b. Click the minus sign next to a node to collapse the tree. For example, if you click the minus sign for a zone, that portion of the tree will collapse so it no longer shows spaces assigned to the zone.
c. Right-click on a floor node to display a pop-up menu containing options for performing tasks with the floor. The menu contains the same items as appear on the Floor Menu on the Menu Bar (see below).
d. Right-click on a zone node to display a pop-up menu containing options for performing tasks with the zone. The menu contains same items as appear on the Zone Menu on the Menu Bar (see below).
e. Right-click on a space node to display a pop-up menu containing options for performing tasks with the space. The menu contains same items as appear on the Space Menu on the Menu Bar (see below).

4. The **Menu Bar** along the top of the window contains three menus providing options which duplicate drag-and-drop and mouse-click functionality in the Floor/Zone/Space tree diagram panel.

Floor Menu:
a. Add One Zone - Adds one empty zone to the floor node currently highlighted in the tree diagram.
b. Add Multiple Zones - Adds multiply empty zones to the floor currently highlighted in the tree diagram. When you select this option you will be prompted for the number of zones to add.

Zone Menu:
a. Delete Zone - Erases the zone highlighted in the tree diagram. If the zone contained spaces, they will be moved back to the Unassigned Spaces list on the left. Deleting a zone does not destroy any spaces.
b. Rename Zone - Allows you to rename the zone currently highlighted in the tree diagram.

Space Menu:
a. Assign to Zone - The space or spaces highlighted in the Unassigned Spaces list on the left will be assigned to the Zone highlighted in the tree view diagram.
b. Specify Multiplier - Allows you to define a multiplier for the space currently highlighted in the tree diagram.
c. Remove Space - Removes the highlighted space from the tree diagram on the right and moves it to the Unassigned Spaces list on the left. Note that removing does not erase the space. It merely moves the space.

5. **Command Buttons** appear in the lower right:

a. **OK** - Saves your zone configuration information and proceeds to the first screen of the Equipment Wizard. Later when Equipment Wizard inputs are converted to detailed HAP data, equipment will be applied to spaces as you have configured them.
b. **Cancel** - Ends the wizard session without saving any data or generating any detailed HAP data.
c. **Help** - Displays this help topic.

Preliminary Design Applications. When performing preliminary design or screening studies, you will often have a simple model of the building where each space represents an entire zone. If so you can quickly configure your spaces into zones and floors with the following steps:

a. First specify the number of floors and whether the typical intermediate floor option is used.
b. In the Unassigned Spaces list highlight all spaces on the first floor and then drag and drop the spaces onto the Floor 1 node in the tree. All spaces will be automatically converted into single space zones.
c. Repeat the previous step for each floor.
d. Press OK to proceed.

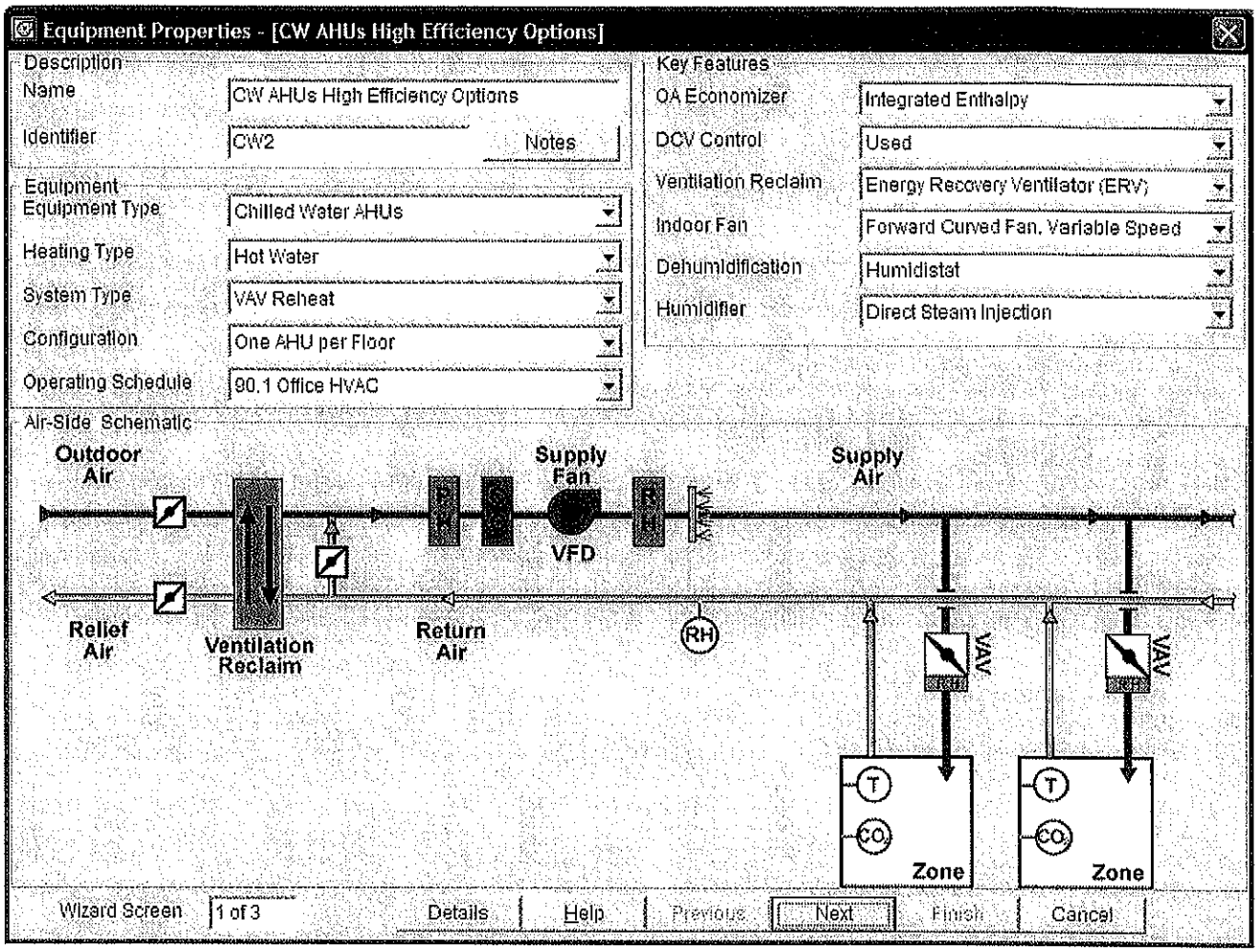
Detailed Design Applications. When performing detailed design work, you will typically have a detailed model of the building which may involve varying numbers of spaces per zone.. For this application:

a. First specify the number of floors and whether the typical intermediate floor option is used.
b. For each floor add the required number of zones using the Floor Menu on the Menu Bar or the right-click pop-up menu feature in the tree diagram.
c. Assign spaces to individual zones, as required using drag-and-drop or options on the Zone Menu.
d. Repeat previous two steps for all floors and zones.
e. Press OK to proceed.

Equipment Wizard - Systems and Equipment Screen

The Equipment Wizard is used to define one HVAC design alternative for a building. The Equipment Wizard consists of 1, 2 or 3 input screens depending on the type of equipment being configured. Some of these Wizard input screens offer a Details button that can be used to display and modify a second level of more detailed inputs. More about HAP Wizards.

The **Systems and Equipment Wizard** screen contains data for air-side equipment. When configuring DX Equipment it also contains performance data for the DX equipment.



The content and format of the Systems and Equipment Wizard screen varies depending on the equipment being configured. The figure above shows the content when configuring chilled water AHU equipment. The screen is divided into up to 5 sections and also provides command buttons in the lower right. These input screen features are described below.

1. **Description.**
   a. **Name** - A reference name for the equipment alternative being defined. When data is later converted to detailed HAP inputs, this name will be used for the HAP "building" representing the design alternative.
   b. **Identifier** - A short unique label which identifies this design alternative. Examples: BASE or ALT1. This identifier will be used as the prefix for the name of every system, plant, chiller, cooling tower and boiler generated from the equipment wizard inputs. In this way you can easily recognize which data items belong together with each design alternative.
   c. **Notes** - The Notes button displays a small window that allows you to enter descriptive information about the design alternative. This information will only appear on the Equipment Wizard Input Report. It is not saved as part of the detailed HAP inputs.

2. **Equipment** describes the kind of equipment being configured.
   a. **Equipment Type** - Choose the type of equipment being analyzed.
   b. **Heating Type** - Choose the heat source for the equipment.
   c. **System Type** - Choose the type of air-side system.
   d. **Configuration** - Specify how air-side equipment is arranged in the building - one unit for the entire building, one unit per floor, or one per zone.
   e. **Operating Schedule** - Choose the operating schedule for the equipment. This will be used to create a fan/thermostat schedule in the detailed HAP data. The drop-down list includes a series of default schedules taken from the ASHRAE 90.1 User's Manual and also any fan/thermostat schedules previously defined in the current project.

3. **Performance** defines performance for DX equipment. When multiple DX units will be created, these performance values apply to all DX units created.
   a. **AHRI Cooling Rating** - Specify the AHRI or ISO/ARI cooling performance rating in EER or SEER as applicable. In English units EER is W/BTUh and in Metric it is W/W.
   b. **AHRI Heating Rating** - For heat pump equipment specify the ARI or ISO/ARI heating performance rating in COP or HSPF as applicable.
   c. **Heating Efficiency** - For combustion heating equipment, specify the heating efficiency such as a steady state efficiency, an annual fuel utilization efficiency (AFUE) or a similar standard rating.

4. **Key Features** provides options for key control or energy conservation features used with the air-side equipment. The number and

type of these options varies with the type of equipment and system specified. These features include:

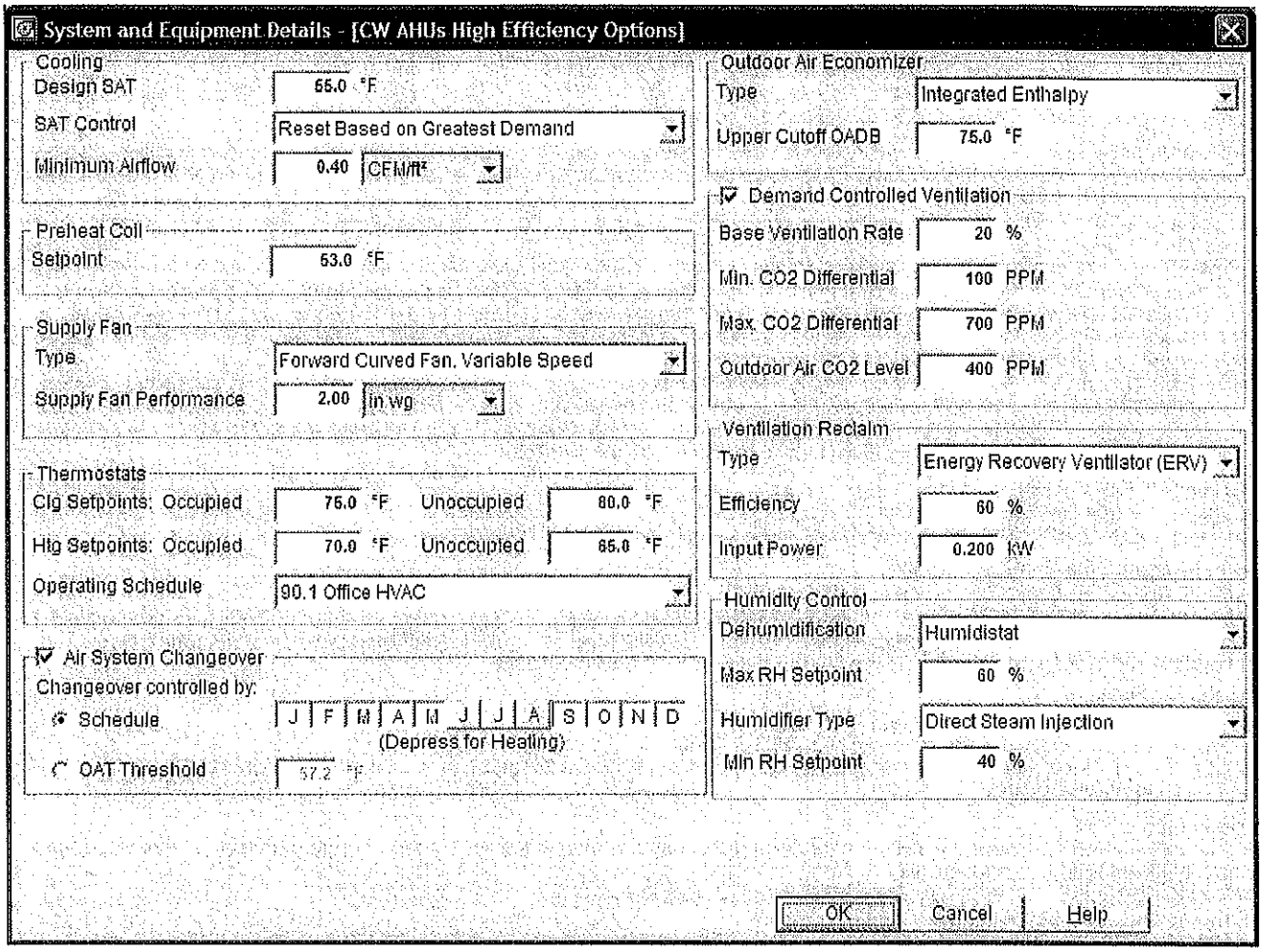
a. **OA Economizer** - Offers several types of outdoor air economizer control.
b. **Common Ventilation** - Offers several types of common ventilation air units. This option applies to terminal type systems such as DX fan coils, hydronic fan coils, induction beams, active chilled beams, VRF and water source heat pump systems.
c. **DCV Control** - Demand Controlled Ventilation control.
d. **Ventilation Reclaim** - Offers several types of ventilation air heat reclaim devices.
e. **Indoor Fan** - Offers options for fan type and control.
f. **Fan Control** - Offers options for 1-speed or 2-speed supply fan control. This option is offered for Constant Volume - Single Zone systems with equipment type "packaged rooftop", "split DX AHU", "air cooled vertical packaged units", or "water-cooled vertical packaged units".
g. **Capacity Control** - Offers options for 1-stage or 2-stage cooling. This option is offered for Constant Volume - Single Zone systems with equipment type "packaged rooftop", "split DX AHU" or "air cooled vertical packaged units".
h. **Dehumidification** - "Passive" refers to uncontrolled dehumidification at the cooling coil. "Humidistat" refers to active humidity control using a humidistat and a reheat coil.
i. **Humidifier** - Offers several options for humidifier equipment.
j. **Cooling Tower Fan** - Offers several fan control options. This option only appears for water-cooled vertical packaged equipment. For other tower applications such as WSHP systems and chilled water plants, cooling tower fan control options are provided on one of the subsequent wizard screens.

5. **Air System Diagram.** The air system diagram panel depicts the main components of the air-side system you are configuring. As you input data the diagram changes to adapt to your inputs. Readers should note that these diagrams are not meant to be an exact "schematic" diagram of a system. Each diagram is instead meant to show the major components of the system and their position relative to one another.

6. **Command Buttons** are provided in the lower right:
   a. **Details** - Displays the Details input screen for system and equipment data. If you are defining central equipment such as rooftops or chilled water AHUs, the details screen for central systems appears. If you are defining terminal equipment such as fan coils or WSHPs, the details screen for terminal systems appears.
   b. **Help** - Displays this help topic.
   c. **Next** - If further Wizard input screens are needed to define the equipment, this button will be enabled and can be used to proceed to the next screen.
   d. **Finish** - If the Systems and Equipment screen is the only screen needed to define the equipment, the Finish button will be enabled. When using the Full Wizard Session feature, the Finish button retains the inputs and returns you to the Equipment Alternatives screen. When using the Equipment Wizard option on the Wizards Menu, clicking the Finish button displays the Equipment Wizard Input Report and then the detailed HAP data is generated, before you are returned to the HAP main window.
   e. **Cancel** - Exits the Equipment Wizard without retaining any inputs or changes, and without generating any detailed HAP data.

Equipment Wizard - System and Equipment Details - Central Systems

This input screen contains detailed inputs for the air-side system that was configured on the Equipment and Systems Wizard screen. As inputs are modified on the Equipment and Systems Wizard screen, intelligent defaulting is used to set values shown on this Details screen. Some users prefer to customize these details and therefore visit this screen to edit the data. Other users prefer to accept the program defaults and do not visit this screen.



This Details screen contains data for central types of equipment such as rooftops, vertical packaged units, split DX AHUs and chilled water AHUs. The format and content of this screen varies depending on the type of equipment and type of air-side system being defined. The screen is divided into as many as 12 sections and also contains command buttons in the lower right. Each feature of this input screen is described below.

1. **Cooling** - Describes the central cooling apparatus.
   a. **Design SAT** - The design supply air temperature for cooling operation.
   b. **AHRI Clg Rating** - For DX equipment, the AHRI rating for cooling equipment in EER or SEER as applicable. In English units EER is W/BTUh. In Metric units EER is W/W.
   c. **Minimum Airflow** - For VAV systems, the minimum airflow for VAV terminals.
   d. **Oversizing Factor** - For DX equipment, the oversizing factor to be applied to the equipment. For example 15% means the gross cooling capacity is to be set as peak cooling coil load plus 15%.
   e. **Capacity Control** - Offers options for 1-stage or 2-stage cooling. This option is offered for Constant Volume - Single Zone systems with equipment type "packaged rooftop", "split DX AHU" or "air cooled vertical packaged units"

2. **Heating** - Describes the central heating apparatus.
   a. **Design SAT** - The design supply air temperature for heating operation. This only applies to systems providing central heating, such as a single zone CAV system or a VVT system.
   b. **AHRI Htg Rating** - For DX heat pump equipment, the AHRI rating in COP or HSPF as applicable.
   c. **Efficiency** - For combustion heating equipment, the heating efficiency such as a steady state efficiency or an annual fuel utilization efficiency (AFUE) or similar value.
   d. **Oversizing Factor** - For DX heat pump and combustion equipment, the oversizing factor to be applied to the equipment. For example, 25% means the gross heating capacity is to be set as peak heating coil load plus 25%.

3. **Preheat Coil** - Constant Volume Reheat and VAV systems are assumed to have a preheat coil.
   a. **Setpoint** - The setpoint temperature for the coil. The coil is controlled by a duct thermostat located downstream of the coil.
   b. **Efficiency** - For combustion heating equipment, the heating efficiency such as a steady state efficiency or an annual fuel utilization efficiency (AFUE) or similar value.
   c. **Oversizing Factor** - For combustion equipment, the oversizing factor to be applied to the equipment. For example, 25% means the gross heating capacity is to be set as peak heating coil load plus 25%.

4. **Supply Fan**
   a. **Type** - Allows the fan type and constant speed or variable speed to be defined. Also provides an option to use the part-load fan curve from ASHRAE Standard 90.1-2004 Appendix G. This has application for LEED EA Credit 1 analysis.
   b. **Supply Fan Performance** - The performance of the fan in terms of total static, BHP, motor kW, or Watts per unit flow.

c. **Terminal Fan Performance** - For fan powered mixing box terminals, the fan performance in terms of total static, BHP, motor kW, or Watts per unit flow.
d. **Fan Control** - Offers options for 1-speed or 2-speed supply fan control. This option is offered for Constant Volume - Single Zone systems with equipment type "packaged rooftop", "split DX AHU", "air cooled vertical packaged units", or "water-cooled vertical packaged units".
e. **Low Speed Fan Flow** - When 2-speed supply fan control is selected, this input is used to specify the ratio of airflow at low speed to airflow at high speed. For example, a value of 67% means the low speed airflow is 67% of the high speed airflow.

5. **Thermostats**
   a. **Setpoints** - The occupied and unoccupied setpoints for cooling and heating.
   b. **Operating Schedule** - The fan/thermostat schedule for system operation. The drop-down list contains default options from the ASHRAE 90.1 User's Manual and any fan/thermostat schedules currently defined in the HAP project.

6. **Air System Changeover** - This section only appears for Chilled Water AHU equipment. It is used to specify whether this is a 2-pipe changeover system and if so, how changeover is controlled. If a changeover system is being modeled, check this box. Inputs in this section will then be enabled.
   a. **Changeover Controlled By** - Changeover can be controlled in one of two ways. To select an option click the radio button next to the desired option.
      (i) **Schedule** - With this option availability of cooling or heating is scheduled by month. Next to this option is a row of buttons, one for each month. If the button has a "pushed in" appearance, usually indicated by a white background, that means heating is scheduled for the month. If the button has raised appearance, usually indicated by a gray background, that means cooling is scheduled for the month. In the figure above heating is scheduled ON for January through May and September through December. Cooling is scheduled ON for June through August.
      (ii) **OAT Threshold** - With this option, the system switches between cooling and heating based on an outdoor air dry-bulb temperature (OAT) threshold. When the OAT is above the threshold, cooling is ON. When the OAT is below the threshold heating is ON. When this option is selected, HAP will automatically assign a changeover deadband of 7 F and a minimum cycle time of 4 hours. Click here for information about these changeover settings.

7. **Outdoor Air Economizer**
   a. **Type** - The type of economizer control.
   b. **Upper Cutoff OADB** - The upper cutoff above which economizer operation is locked out.

8. **Demand Controlled Ventilation (DCV)**
   a. **Base Ventilation Rate** - The minimum outdoor ventilation airflow rate.
   b. **Min and Max CO2 Differentials** - The indoor-outdoor CO2 differentials for DCV control. At the maximum CO2 differential the ventilation airflow is at its design value. At the minimum CO2 differential the ventilation airflow is at the base ventilation rate.
   c. **Outdoor Air CO2 Level** - Carbon dioxide level for outdoor air at the building site.

9. **Ventilation Reclaim**
   a. **Type** - The type of ventilation heat reclaim device used.
   b. **Efficiency** - The thermal efficiency of the heat reclaim device.
   c. **Input Power** - Input power required by the device. This could represent the motor for a heat or energy wheel or the pump power for a pump around system.

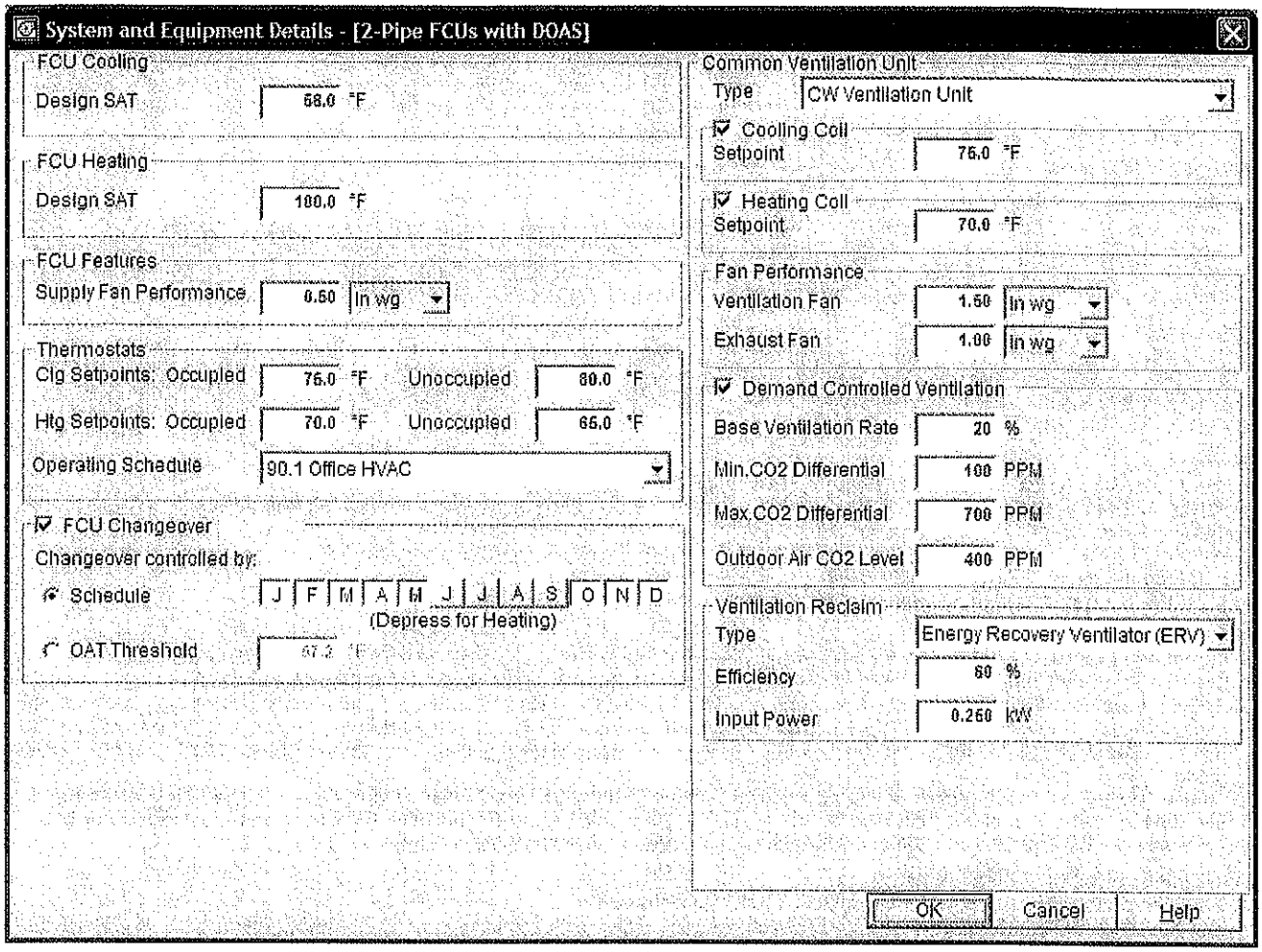
10. **Humidity Control**
    a. **Dehumidification** - "Passive" is uncontrolled dehumidification occurring at the cooling coil. "Humidistat" is active humidity control using a humidistat and a reheat coil.
    b. **Max RH Setpoint** - The maximum RH setpoint for active (humidistat) control.
    c. **Humidifier** - The type of humidifier used.
    d. **Min. RH Setpoint** - The minimum RH setpoint for controlling the humidifier.

11. **Cooling Tower** - Cooling tower data only appears here for water-cooled vertical packaged equipment. For WSHP and chilled water plant equipment, cooling tower inputs are found a different input screen.
    a. **Design OAWB** - The design outdoor air wet-bulb temperature for sizing the cooling tower.
    b. **Fan Control** - The method of controlling the fan when holding the minimum return water setpoint.
    c. **Fan kW/Ton** - The design tower fan input power in kW per ton of heat rejection.
    d. **Condenser Water Flow** - The condenser water flow rate for the tower.
    e. **Condenser Water Pump** - Performance for the condenser water pump defined in terms of head, motor kW or Watts per unit flow.
    f. **Minimum ECWT** - The minimum return water setpoint for the tower. When the tower can produce colder return water it modulates its operation to hold this setpoint. Modulation is accomplished the method specified in Fan Control above.

12. **Command Buttons**
    a. **OK** - Saves the changes and returns to the System and Equipment Wizard screen
    b. **Cancel** - Returns to the System and Equipment Wizard screen without saving changes.
    c. **Help** - Displays this help topic.

Equipment Wizard - System and Equipment Details - Terminal Systems

This input screen contains detailed inputs for the air-side system that was configured on the Equipment and Systems Wizard screen. As inputs are modified on the Equipment and Systems Wizard screen, intelligent defaulting is used to set values shown on this Details screen. Some users prefer to customize these details and therefore visit this screen to edit the data. Other users prefer to accept the program defaults and do not visit this screen.



This Details screen contains data for terminal types of equipment such as fan coils, water source heat pumps, induction beams or chilled beams. The format and content of this screen varies depending on the type of equipment being defined. The screen is divided into as many as 13 sections and also contains command buttons in the lower right. Each feature of this input screen is described below.

1. **Cooling** - Describes the terminal cooling equipment.
   a. **Design SAT** - The design supply air temperature for cooling operation.
   b. **AHRI Clg Rating** - For DX equipment, the AHRI or ISO/ARI rating for cooling equipment in EER or SEER as applicable. In English units EER is W/BTUh. In Metric units EER is W/W..
   c. **Oversizing Factor** - For DX equipment, the oversizing factor to be applied to the equipment. For example 15% means the gross cooling capacity is to be set as peak cooling coil load plus 15%.

2. **Heating** - Describes the terminal heating equipment.
   a. **Design SAT** - The design supply air temperature for heating operation.
   b. **AHRI Htg Rating** - For DX heat pump equipment, the AHRI or ISO/ARI rating in COP or HSPF as applicable..
   c. **Efficiency** - For combustion heating equipment, the heating efficiency such as a steady state efficiency or an annual fuel utilization efficiency (AFUE) or similar value.
   d. **Oversizing Factor** - For DX heat pump and combustion equipment, the oversizing factor to be applied to the equipment. For example, 25% means the gross heating capacity is to be set as peak heating coil load plus 25%.

3. **Features**
   a. **Supply Fan Performance** - The performance of the terminal unit supply fan in terms of total static, BHP, motor kW, or Watts per unit of flow. This input only applies to terminal equipment containing a fan: DX fan coils, hydronic fan coils, VRF indoor units, water source heat pumps.
   b. **Airflow Ratio** - The ratio of total supply air to primary air delivered by an induction terminal. This input only applies to Induction Beam and Active Chilled Beam systems. Example: A particular type of Induction Beam terminal has an airflow ratio of 4.0. For a given zone, the primary supply air to the terminal is 150 CFM. Therefore the total supply air produced by the terminal will be 150 CFM x 4 = 600 CFM, of which 150 CFM is primary air and 450 CFM is induced room air.

4. **Thermostats**
   a. **Setpoints** - The occupied and unoccupied setpoints for cooling and heating.
   b. **Operating Schedule** - The fan/thermostat schedule for system operation. The drop-down list contains default options from the ASHRAE 90.1 User's Manual and any fan/thermostat schedules currently defined in the HAP project.

5. **Changeover** - This section only appears for 2-Pipe Fan Coil, Induction Beam and Active Chilled Beam equipment. It is used to specify whether changeover controls are used and if so, how changeover is controlled. If a changeover system is being modeled,

check this box. Inputs in this section will then be enabled.

a. **Changeover Controlled By** - Changeover can be controlled in one of two ways. To select an option click the radio button next to the desired option.
   (I) **Schedule** - With this option availability of cooling or heating is scheduled by month. Next to this option is a row of buttons, one for each month. If the button has a "pushed in" appearance, usually indicated by a white background, that means heating is scheduled for the month. If the button has raised appearance, usually indicated by a gray background, that means cooling is scheduled for the month. In the figure above heating is scheduled ON for January through May and September through December. Cooling is scheduled ON for June through August.
   (ii) **OAT Threshold** - With this option, the system switches between cooling and heating based on an outdoor air dry-bulb temperature (OAT) threshold. When the OAT is above the threshold, cooling is ON. When the OAT is below the threshold heating is ON. When this option is selected, HAP will automatically assign a changeover deadband of 7 F and a minimum cycle time of 4 hours. Click here for information about these changeover settings.

The remaining sections deal with a common ventilation unit.

6. **Common Ventilation Unit**
   a. **Type** - The type of common ventilation unit used to supply treated or untreated outdoor air to the intakes of the fan coil or WSHP units, or to the primary supply air nozzles in Induction Beam or Active Chilled Beam terminals. A common ventilation unit must be used for Induction Beam and Active Chilled Beam systems. For all other terminal equipment type it is optional. When a common ventilation unit is not used, the fan coil or WSHP introduces outdoor ventilation air directly through a wall opening.

7. **Cooling Coil**
   a. **Used** - Specify whether common ventilation unit contains a cooling coil.
   b. **Setpoint** - Control setpoint for the coil. The coil is controlled by a duct thermostat downstream of the common ventilation unit.
   c. **AHRI Cooling Rating** - For DX equipment the AHRI or ISO/ARI rating for cooling in EER or SEER as applicable. In English units EER is W/BTUh. In Metric units EER is W/W.

8. **Heating Coil**
   a. **Used** - Specify whether the common ventilation unit contains a heating coil.
   b. **Setpoint** - Control setpoint for the coil. The coil is controlled by a duct thermostat downstream of the common ventilation unit.
   c. **Heating Type** - Source of heating for the coil.
   d. **Efficiency** - For combustion heating equipment, the heating efficiency such as a steady state efficiency or an annual fuel utilization efficiency (AFUE) or similar value.
   e. **AHRI Htg Rating** - For heat pump equipment, the AHRI or ISO/ARI rating in COP.

9. **Fan Performance**
   a. **Ventilation Fan** - The performance for the ventilation fan in terms of total static, BHP, motor kW or Watts per unit of flow.
   b. **Exhaust Fan** - The performance for the exhaust fan in terms of total static, BHP, motor kW or Watts per unit of flow.
   c. **Unocc Damper Position** - Whether outdoor air dampers in the ventilation unit are open or closed during unoccupied fan/thermostat schedule periods. This input is only offered for Induction Beam and Chilled Beam systems. When outdoor air dampers are closed during the unoccupied period, 100% of primary air is recirculated. With dampers open, 100% of primary air is outdoor air.
   d. **Unocc Airflow** - Primary airflow during unoccupied fan/thermostat periods as a percentage design primary airflow. Airflow is specified in increments of 5% from 50% to 100%. This input is only offered for Induction Beam systems. Applications of these systems often can use reduced primary airflow during unoccupied times to minimize energy use.

10. **Demand Controlled Ventilation (DCV)**
    a. **Base Ventilation Rate** - The minimum outdoor ventilation airflow rate.
    b. **Min and Max CO2 Differentials** - The indoor-outdoor CO2 differentials for DCV control. At the maximum CO2 differential the ventilation airflow is at its design value. At the minimum CO2 differential the ventilation airflow is at the base ventilation rate.
    c. **Outdoor Air CO2 Level** - Carbon dioxide level for outdoor air at the building site.

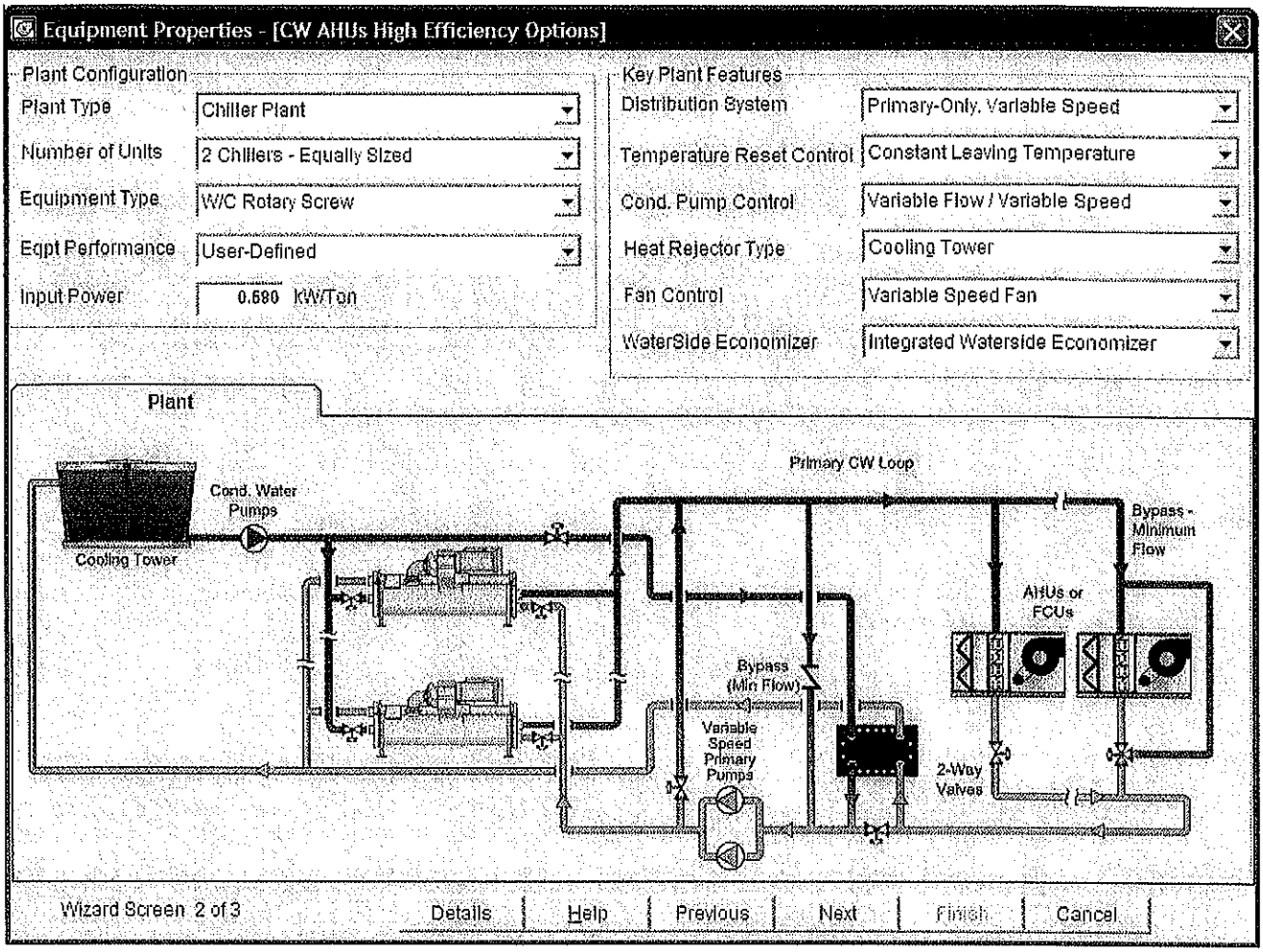
11. **Ventilation Reclaim**
    a. **Type** - The type of ventilation heat reclaim device used.
    b. **Efficiency** - The thermal efficiency of the heat reclaim device.
    c. **Input Power** - Input power required by the device. This could represent the motor for a heat or energy wheel or the pump power for a pump around system.

12. **Humidity Control**
    (These inputs are offered only for Induction Beam and Active Chilled Beam systems)
    a. **Dehumidification** - "Humidistat" means active humidity control is used, with a humidistat located in the ventilation air handler discharge to control discharge humidity, and a dehumidification reheat coil. "Passive" means dehumidification cooling coil is not actively controlled.
    b. **Max RH Setpoint** - Specify the maximum RH setpoint at the ventilation air handler discharge for active (humidistat) control..

13. **Command Buttons**
    a. **OK** - Saves the changes and returns to the System and Equipment Wizard screen
    b. **Cancel** - Returns to the System and Equipment Wizard screen without saving changes.
    c. **Help** - Displays this help topic.

Equipment Wizard - Chilled Water Plant Screen

The Chilled Water Plant Wizard screen contains data describing a plant with cooling only chillers or reversible chillers. This screen only appears when configuring equipment for chilled water AHUs, 2-Pipe or 4-Pipe Fan Coils, Induction Beam or Active Chilled Beam systems.



The Chilled Water Plant Wizard screen is divided into three sections and also provides command buttons in the lower right. These input screen features are described below.

1. **Plant Configuration**
   a. **Plant Type** - Specifies whether the plant is a Chiller Plant or a Changeover Plant. A Chiller Plant provides cooling only and uses chillers. A Changeover Plant provides both cooling and heating and uses reversible chillers. When a Changeover Plant is modeled, make sure to specify air-side changeover controls. These inputs are found on the System and Equipment Details screen either for central systems for fan coil systems.
   b. **Number of Units** - This defines the number of chillers connected in parallel in the plant, and how the plant capacity is shared between the chillers. For example "2 Chillers - Equally Sized" means the two chillers each are sized for 50% of the plant capacity. "2 Chillers - 60%/40%" means the first chiller is sized for 60% of the plant capacity and the second chiller is sized for 40%.
   c. **Equipment Type** - The type of chiller or reversible chiller used in the plant. All equipment in the plant will have the same type.
   d. **Input Power** - The full load input power for each chiller in the plant. For a Changeover Plant separate input power values are defined for full load cooling and full load heating duty.

2. **Key Plant Features** provides options for key control and energy conservation features used in the plant. These features include:
   a. **Distribution System** - The type of chilled water distribution system used.
   b. **Temperature Reset Control** - The type of supply water temperature reset control used. Choices include constant supply water temperature, reset based on an outdoor air temperature schedule and reset based on load (holding a constant return water temperature). For chiller plants this input applies to chilled water temperature control. For changeover plants this input applies to both chilled water and hot water supply temperature control.
   c. **Condenser Pump Control** - For a chiller plant using water-cooled chillers, how the condenser water loop is controlled. Choices include constant flow / constant speed and variable flow / variable speed.
   d. **Source Water Pump Control** - For a changeover plant using water-to-water reversible chillers, how the source water loop is controlled. Choices include constant flow / constant speed and variable flow / variable speed.
   e. **Heat Rejector Type** - Offers a choice of cooling towers, dry coolers, and geo, well or surface water sources as heat rejection equipment for water cooled chiller plants. Geo, well or surface water is required for water to water changeover plants.
   f. **Fan Control** - For cooling towers, several options are offered for controlling the tower fans when holding hold minimum return water setpoint. For dry coolers, fan cycling is used to hold minimum setpoint. This input only applies for water-cooled chiller plants.
   g. **Auxiliary Heating** - For changeover plants, this item specifies whether auxiliary heating capability is included.
   h. **Water Side Economizer** - The type of water sized economizer used. Non-Integrated means the economizer only operates when it is able to supply 100% of the plant load. Integrated means the economizer can operate in tandem with mechanical cooling to provide partial free cooling thus increasing the number of economizer operating hours. Only applies for water-cooled chiller plants and water to water changeover plants

3. **Plant Diagram.** The plant diagram depicts the components of the plant you are configuring. As you input data the diagram changes to adapt to your inputs. Readers should note these diagrams are not meant to be exact "schematic" diagrams of a plant. Due to space limitations, each diagram is instead meant to only show the major components of the system and their position relative to one another.

   Example: The diagram always shows two chiller icons regardless of how many chillers have been specified. For a water-cooled plant there is one cooling tower icon, even though the equipment will be configured with one tower per chiller on a common water loop.

   When defining a chiller plant there is one diagram panel showing the configuration of components. For a changeover plant there are two tabbed panels, one for the equipment in cooling mode and one for heating mode. To view each panel, click its tab.

4. **Command Buttons**
   a. **Details** - Displays the Chilled Water Plant Details input screen.
   b. **Help** - Displays this help topic.
   c. **Previous** - Returns you to the System and Equipment Wizard screen.
   d. **Next** - If hot water or steam heating is used, this button will be enabled and can be used to proceed to the Heating Plant Wizard screen.
   e. **Finish** - If the Chilled Water Plant Wizard screen is the last screen needed to define the equipment, the Finish button will be enabled. When using the Full Wizard Session feature, the Finish button retains the inputs and returns you to the Equipment Alternatives screen. When using the Equipment Wizard option on the Wizards Menu, clicking the **Finish** button displays the Equipment Wizard Input Report and then the detailed HAP data is generated, before you are returned to the HAP main window.
   f. **Cancel** - Exits the Equipment Wizard without retaining any inputs or changes, and without generating any detailed HAP data.

Equipment Wizard - Chilled Water Plant Details Screen

This input screen contains detailed inputs for the chiller plant or changeover plant configured on the Chilled Water Plant Wizard screen. As inputs are modified on the Chiller Plant Wizard screen, intelligent defaulting is used to set values shown on this Details screen. Some users prefer to customize these details and therefore visit this screen to edit the data. Other users prefer to accept the program defaults and do not visit this screen.

This screen has different content depending on whether you're configuring a Chiller Plant or a Changeover Plant. Figure 1 at the end of this topic shows the content for a Chiller Plant. Figure 2 shows the content for a Changeover Plant. Items on the screen are grouped in up to 7 sections with command buttons in the lower right. Features of this input screen are described below.

1. **Plant Configuration** - This section applies for both chiller plants and changeover plants.
   a. **Number of Units** - This defines the number of chillers or reversible chillers connected in parallel in the plant, and how the plant capacity is shared. For example "2 Chillers - Equally Sized" means the two chillers each are sized for 50% of the plant capacity. "2 Chillers - 60%/40%" means the first chiller is sized for 60% of the plant capacity and the second chiller is sized for 40%.
   b. **Plant Control** - Scheme for controlling chillers in the plant. "Sequenced" means individual chillers are added as load increases and are turned off as load decreases. Those chillers running at any point in time share the load by running at equal part load ratios. "Equal Unloading" means all chillers share the load running at equal part load ratios for all load conditions.
   c. **Full Load ECWT, EWT or OAT** - For chillers, this input describes the entering condenser water temperature (ECWT) for water-cooled chillers or the outdoor air temperature (OAT) for air cooled chillers at the full load rating point. For water source reversible chillers in changeover plants a pair of inputs describes the ECWT for cooling and the entering water temperature (EWT) for heating at full load. For air source reversible chillers a pair of inputs describes the cooling OAT and heating OAT for the full load rating point.
   d. **Full Load LCHWT or HWST** - Full Load LCHWT is the design leaving chilled water temperature (LCHWT) for the plant. For changeover plants the full load hot water supply temperature (HWST) is also required.
   e. **Temperature Control** - The type of supply water reset control used. Choices include constant supply water temperature, reset based on an outdoor air temperature schedule and reset based on load (holding a constant return water temperature). For a changeover plant this control will apply to both cooling and heating duty for the plant.
   f. **Maximum LCHWT** - For chiller plants and changeover plants in cooling mode, the maximum leaving chilled water temperature (LCHWT) is defined when temperature reset is used.
   g. **OADB for Min LCHWT, OADB for Max LCHWT** - When supply water temperature reset is based on an outdoor air dry-bulb (OADB) schedule, these two inputs define control points for reset in cooling mode.
      (i) The full load LCHWT is used when the OADB is equal to or warmer than the "OADB for Min LCHWT".
      (ii) The maximum LCHWT is used when the OADB is equal to or colder than the "OADB for Max LCHWT".
      (iii) Between the two OADB values, LCHWT is reset along a linear profile.
   h. **Minimum HWST** - For changeover plants in heating mode, the minimum hot water supply temperature is defined when temperature reset is used.
   i. **OADB for Min HWST, Max HWST** - When supply water temperature reset is based on an outdoor air dry-bulb (OADB) schedule, these two inputs define control points for reset in heating mode.
      (i) The full load HWST is used when the OADB is equal to or colder than the "OADB for Max HWST".
      (ii) The minimum HWST is used when the OADB is equal to or warmer than the "OADB for Min LCHWT".
      (iii) Between the two OADB values, HWST is reset along a linear profile.
   j. **Oversizing Factor** - The oversizing factor to be applied to the plant. For example 15% means the plant capacity will be determined as peak plant load plus 15%. In a changeover plant the same factor is used for determining cooling and heating capacity. For example a 15% factor means cooling capacity is peak plant cooling load plus 15% and peak plant heating capacity is peak plant heating load plus 15%.
2. **Equipment** - This section applies for both chiller plants and changeover plants.
   a. **Type** - The type of chiller or reversible chiller used in the plant. All equipment in the plant will have the same type.
   b. **Input Power** - The full load input power for each chiller in the plant. For a changeover plant separate input power values are defined for full load cooling and full load heating duty.
3. **Distribution System** - This section applies for both chiller plants and changeover plants.
   a. **Type** - The type of supply water distribution system used.
   b. **Flow** - The design supply water flow rate. For changeover plants the chilled and hot water supply flow rates will be equal.
   c. **Primary Pump Power** - Performance for the primary supply water pumps defined in terms of head, pump kW or Watts per unit of flow. The units of measure defined here also applies to secondary pumps, if they are used.
   d. **Secondary Pump Power** -Performance for the secondary supply water pumps, if used, defined in terms of head, pump kW or Watts per unit of flow.
   e. **Control Head** - In a variable flow system, the head that is independent of flow.
   f. **Minimum Flow** - In a variable flow system, the minimum flow allowed for both primary and secondary loops.
4. **Cooling Towers** - This section applies for chiller plants only.
   a. **Heat Rejector Type** - Offers a choice of cooling towers and dry coolers as heat rejection equipment.
   b. **Design OAWB** - The design outdoor air wet-bulb temperature for sizing a cooling tower.
   c. **Design OADB** - The design outdoor air dry-bulb temperature for sizing a dry cooler.
   d. **Fan Control** - The method of controlling the fan when holding the minimum return water setpoint.
   e. **Fan kW/Ton** - The design tower fan input power in kW per ton of heat rejection.
   f. **Average Monthly Source Water Temperatures** - The average source water temperature is defined for each month of the year to represent performance of the geo well field, surface water or well water that serves as a heat sink.

5. **Water Source Details** - This section applies for water-to-water changeover plants only.
   a. **Average Monthly Source Temperatures** - For a changeover plant using water-to-water reversible chillers, the average source water temperature is defined for each month of the year to represent performance of the geo well field, surface water or well water that serves as a heat source/sink.
6. **Condenser Water Loop or Source Water Loop** - For chiller plants this section describes the condenser water loop and pumps. For a changeover plant this section describes the source water loop and its pumps.
   a. **Pump Control** - How the water loop is controlled, for water-cooled chillers or water-to-water reversible chillers. Choices include constant flow / constant speed and variable flow / variable speed.
   b. **Flow** - The water flow rate for the tower, dry cooler, or geo/surfece/well source. This value can be specified as flow (gpm or L/s), delta-T (F or K) or flow per unit of capacity (gpm/ton or L/s/kW). For a changeover system, the same flow is used for both cooling and heating mode.
   c. **Pump** - Performance for the water pump defined in terms of head, motor kW or Watts per unit of flow.
   d. **Minimum ECWT** - For chiller plants only, the minimum return water setpoint for the tower or dry cooler. When the tower can produce colder return water it modulates its operation to hold this setpoint. Modulation is accomplished the method specified in Fan Control specified earlier in the cooling towers section.
   e. **Static Head** - Describes the portion of the condenser pump head due to the vertical rise in the condenser pumping loop. This input is only enabled when "Variable Flow / Variable Speed" pump control is specified. In an open loop condenser water loop, the presence of static head causes the zero flow point on the pump system curve to correspond to static head, rather than passing through the zero flow, zero head point. This has a significant effect on pump performance when operating at reduced pump flow and speed. If the condenser loop is a closed loop, specify zero for static head.

      Note: For chiller plants and for changeover plants using a geothermal / well / surface water source this input is not applicable and should be specified as zero.
   f. **Minimum Flow** - Specifies the minimum flow setpoint as a percent of design water flow. This input is only enabled when "Variable Flow / Variable Speed" pump control is specified. In a chiller plant, the water flow varies to hold the delta-T across the condenser constant down to minimum flow. As load continues to drop, water flow is held constant and the delta-T decreases with load. In a changeover plant, the source water flow is controlled in the same manner.
7. **Waterside Economizer** - This section applies for both chiller plants and changeover plants.
   a. **Type** - The type of water sized economizer used. Non-Integrated means the economizer only operates when it is able to supply 100% of the plant cooling load. Integrated means the economizer can operate in tandem with mechanical cooling to provide partial free cooling thus increasing the number of economizer operating hours. Only applies for water-cooled chiller plants and water-to-water changeover plants.
   b. **HX Approach** - Defines the performance of the plate frame heat exchanger used in a waterside economizer. The approach is the difference between the temperature of water in the chilled water loop leaving the heat exchanger minus the cold water from the heat rejection system entering the heat exchanger.
8. **Command Buttons**
   a. **OK** - Saves the changes and returns to the Chilled Water Plant Wizard screen
   b. **Cancel** - Returns to the Chilled Water Plant Wizard screen without saving changes.
   c. **Help** - Displays this help topic.

Figure 1. Details Screen Content for a Chiller Plant

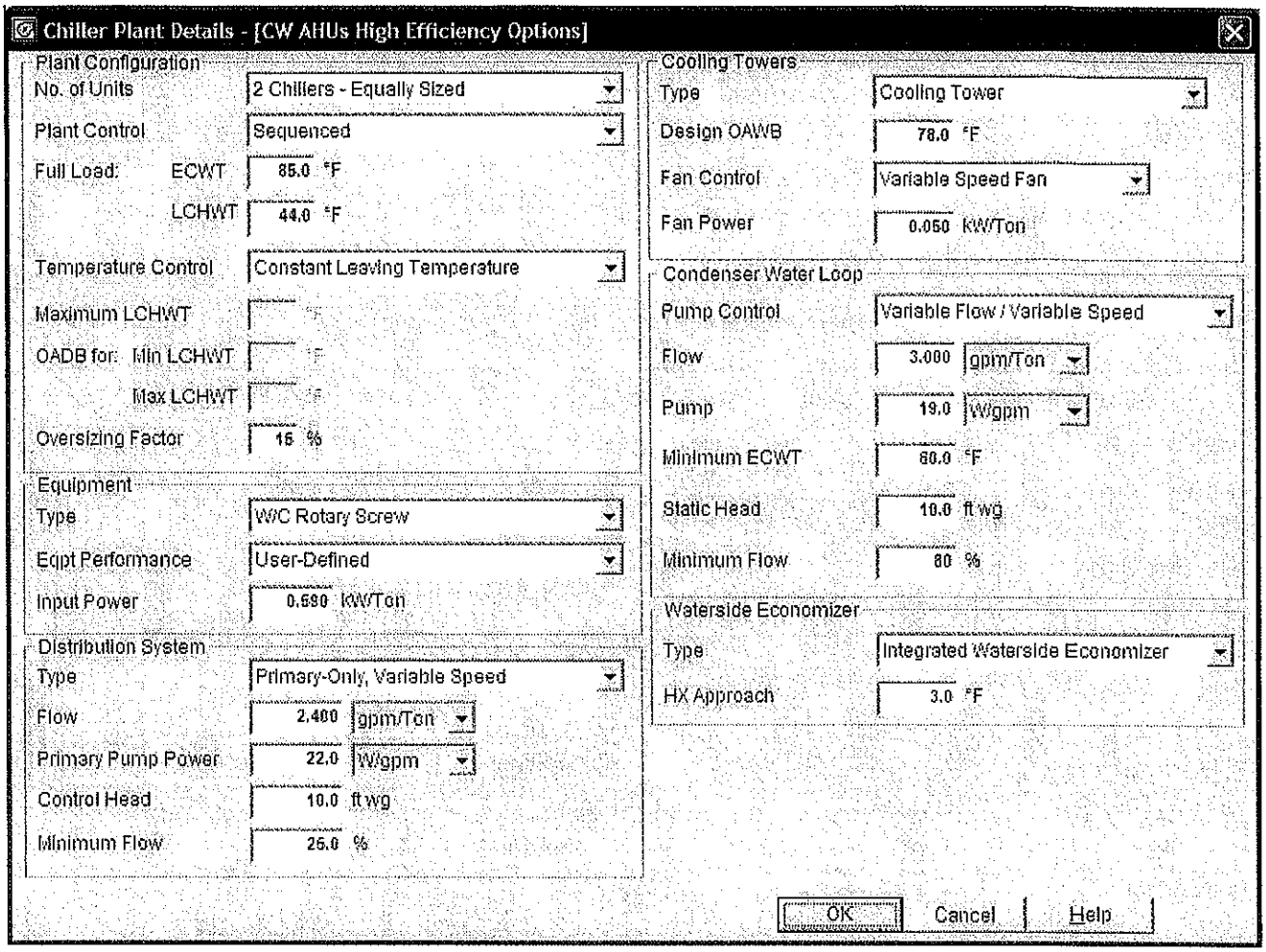
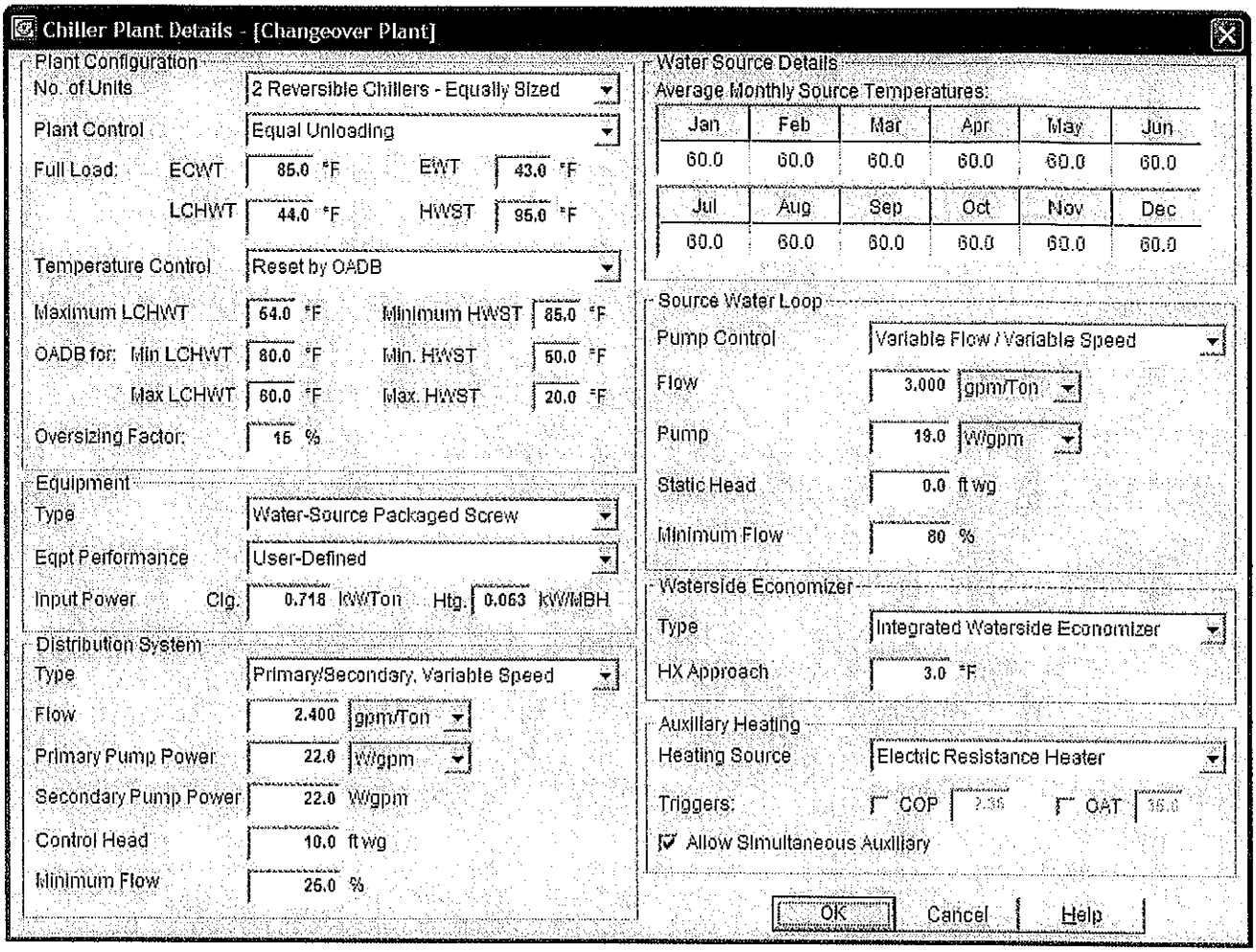


Figure 2. Details Screen Content for a Changeover Plant


Chiller Plant Details - [Changeover Plant]
Plant Configuration
No. of Units
2 Reversible Chillers - Equally Sized
Plant Control
Equal Unloading
Full Load: ECWT 85.0 °F EWT 43.0 °F
LCHWT 44.0 °F HWST 95.0 °F
Temperature Control
Reset by OADB
Maximum LCHWT 64.0 °F Minimum HWST 85.0 °F
OADB for: Min LCHWT 80.0 °F Min. HWST 50.0 °F
Max LCHWT 60.0 °F Max. HWST 20.0 °F
Oversizing Factor: 15 %
Equipment
Type
Water-Source Packaged Screw
Eqpt Performance
User-Defined
Input Power Clg. 0.718 kW/Ton Htg. 0.063 kW/MBH
Distribution System
Type
Primary/Secondary, Variable Speed
Flow 2.400 gpm/Ton
Primary Pump Power 22.0 W/gpm
Secondary Pump Power 22.0 W/gpm
Control Head 10.0 ft wg
Minimum Flow 25.0 %
Water Source Details
Average Monthly Source Temperatures:
Jan Feb Mar Apr May Jun
60.0 60.0 60.0 60.0 60.0 60.0
Jul Aug Sep Oct Nov Dec
60.0 60.0 60.0 60.0 60.0 60.0
Source Water Loop
Pump Control
Variable Flow / Variable Speed
Flow 3.000 gpm/Ton
Pump 19.0 W/gpm
Static Head 0.0 ft wg
Minimum Flow 80 %
Waterside Economizer
Type
Integrated Waterside Economizer
HX Approach 3.0 °F
Auxiliary Heating
Heating Source
Electric Resistance Heater
Triggers: COP 2.30 OAT 15.0
Allow Simultaneous Auxiliary
OK
Cancel
Help