

EXchange



Modeling Hospital Spaces in HAP to meet ASHRAE Standard 170 Requirements



ASHRAE¹ Standard 170, rather than ASHRAE Standard 62.1, governs ventilation for acceptable indoor air quality in Healthcare facilities, and/or in healthcare-oriented spaces. In Standard 170, the space ventilation requirements are expressed in terms of Air Change per Hour (ACH) rather than CFM/sq ft or CFM/person, as they are in Standard 62.1. In addition, there are sometimes minimum Total supply airflow requirements in terms of ACH. HAP does not currently have Space Usage categories for Healthcare spaces. This feature will be added to a future HAP update. However, until then the following workaround procedure may be used to derive the proper health care space ventilation inputs for HAP.

Currently there are no ACH inputs for ventilation air in the spaces in HAP. One reason for this

is because ACH will not work with the ASHRAE Standard 62.1 ventilation equations. Therefore, the Min OA ACH must be converted into an equivalent ventilation CFM/sq ft

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value and entered into the space as a “User-Defined” CFM/sq ft value for OA Requirement 1 only (see steps below).

To simplify this process an Excel spreadsheet has been developed by Carrier to perform the required airflow calculations. First, we will explain the process to manually compute and derive these ventilation and ACH values, then we will demonstrate the use of the spreadsheet, which will be much easier and faster to use.

Manual Procedure (for demonstration only):

The ASHRAE Standard 170 ACH values must be entered in two different places in HAP.

Figure 1 below is an excerpt from Table 7.1 from ASHRAE Standard 170-2017. Note the three columns with red arrows, Minimum Outdoor ACH, Minimum Total ACH and room direct exhaust requirements. The latter involves situations whereby room air cannot be used as return air flowing back to the AHU due to the presence of contaminants.

Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (h), %	Design Temperature (l), °F/°C
SURGERY AND CRITICAL CARE							
Critical and intensive care	NR	2	6	NR	No	30–60	70–75/21–24
Delivery room (Caesarean) (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Emergency department decontamination	Negative	2	12	Yes	No	NR	NR
Emergency department exam/treatment room (p)	NR	2	6	NR	NR	Max 60	70–75/21–24
Emergency department public waiting area	Negative	2	12	Yes (q)	NR	Max 65	70–75/21–24
Intermediate care (s)	NR	2	6	NR	NR	Max 60	70–75/21–24
Laser eye room	Positive	3	15	NR	No	20–60	70–75/21–24
Medical anesthesia gas storage (r)	Negative	NR	8	Yes	NR	NR	NR
Newborn intensive care	Positive	2	6	NR	No	30–60	72–78/22–26
Operating room (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Operating/surgical cystoscopic rooms (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Procedure room (o), (d)	Positive	3	15	NR	No	20–60	70–75/21–24
Radiology waiting rooms	Negative	2	12	Yes (q), (v)	NR	Max 60	70–75/21–24

Figure 1. ASHRAE Standard 17-2017, Table 7.1 excerpt – Design Parameters for Hospital Spaces

Step 1: Take the value from the Standard 170 table 7.1 (Figure 1) listed as **Min Outdoor ACH** and convert it to an equivalent CFM/sq ft using the equation below. Normally in order to compute the equivalent Min Outdoor Air CFM we would need the space floor area and ceiling height, which defines space volume (cu ft), using the equation shown below:

(Equation 1)

$$\text{Equivalent CFM} = (\text{Required Min Total ACH}) \times (\text{Space Floor Area}) \times (\text{Floor to Ceiling Height}) / (60 \text{ min/hr})$$

However, because all we need for the HAP space input is CFM/sq ft and HAP knows the space area we can omit the space floor area from the equation because it cancels-out, so the equation may be simplified to:

(Equation 2)

$$\text{Equivalent CFM/sq ft} = (\text{Required Min Total ACH}) \times (\text{Floor to Ceiling Height}) / (60 \text{ min/hr})$$

As an example, consider an Operating Room with a 10-ft ceiling height. As highlighted in Figure 1 above, the Minimum OA ACH is 4. Solving the equation:

$$\text{Equivalent CFM/sq ft} = (4 \text{ ACH}) \times (10 \text{ ft}) / (60 \text{ min/hr}) = 0.67 \text{ CFM/sq ft}$$

In the HAP Space input screen for OA Ventilation Requirements change the Space Usage category to “User-Defined” then enter this resultant cfm/sq ft value as the space ventilation for OA1, as shown in Figure 2.

(Continued from page 2)

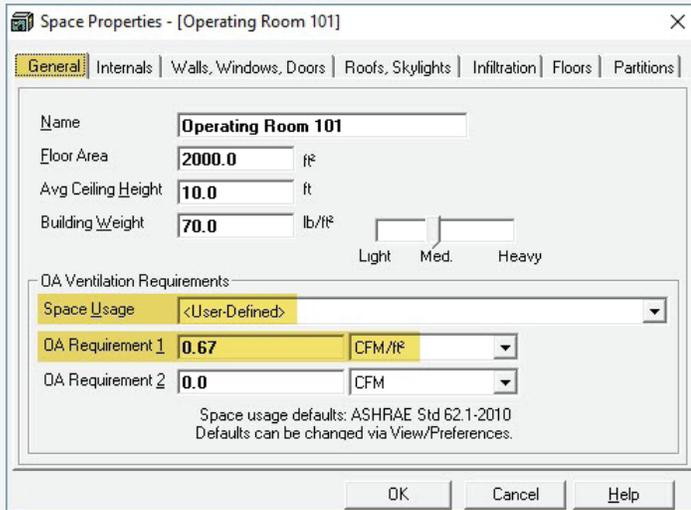


Figure 2. HAP Space Properties – OA Ventilation Requirements Inputs

NOTE: Some space function categories such as storage rooms, corridors, etc. have no Min OA ACH requirement. For those cases simply enter 0 cfm/ sq ft for OA1 in the space (see Figure 2).

Step 2: ASHRAE Standard 170 allows the user to select either “Sum of space airflows” or the 62.1 Ventilation Rate Procedure (VRP) to compute the system OA intake flow requirement (Vot).

For an air system that serves multiple spaces, there is value in using the VRP approach. This is because the VRP ensures you get the specified outdoor air to the breathing zone of all spaces served by the common air system. Only the VRP considers air distribution effectiveness (air not getting to breathing zone because of stratification), and the over-supply of air needed in some spaces to get the proper airflow to the critical space in the system. “Sum of space airflows” doesn’t consider either factor. Therefore, to use the VRP in HAP, set the ventilation sizing method to ASHRAE 62.1 under the System Components tab under Ventilation Air, as indicated in Figure 3.

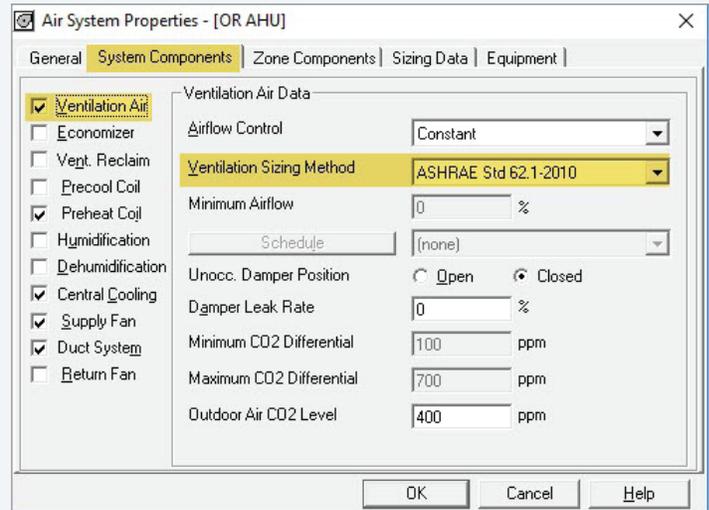


Figure 3. HAP Air System Properties – Ventilation Air – Ventilation Sizing Method

Step 3: Now take the **Min Total ACH** value (20 ACH) from the Standard 170 table 7.1 (Figure 1) and directly enter it in the system under the Zone Components tab under Supply Terminals input, as indicated in Figure 4 below:

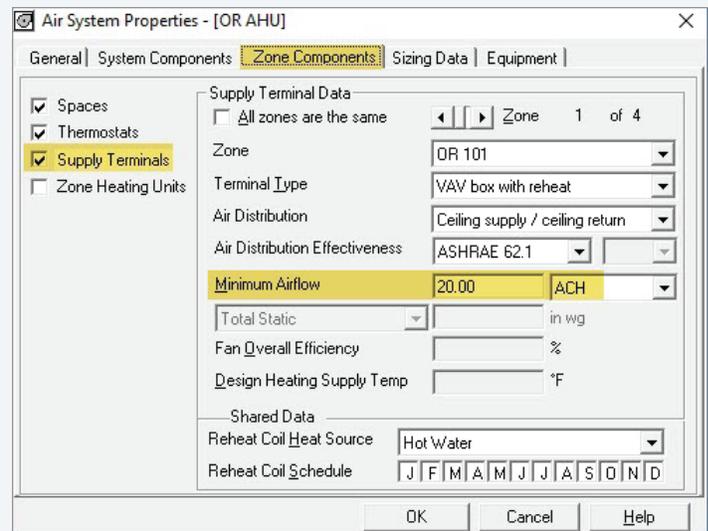


Figure 4. HAP Air System Properties – Zone Components – Supply Terminals Min Airflow Input



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Finally, verify the requirement for "Direct Exhaust" from the zone, per the Table 7.1 requirement (Figure 1). This is entered under the Thermostats setting, as shown in Figure 5 below:

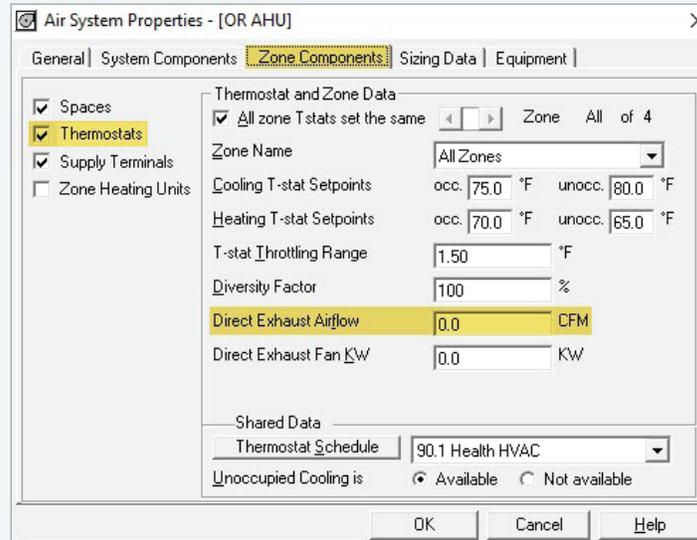


Figure 5. HAP Air System Properties – Zone Components – Thermostats – Direct Exhaust Airflow Input

As indicated in Table 7.1 (Figure 1) an Operating Room does not have a requirement for Direct Exhaust, however, certain other space types do, such as decontamination, waiting areas and medical gas storage. For those space types you will need to compute the Total Space CFM, using Equation 1, and enter that same airflow value for Direct Exhaust Airflow (see Figure 5).

ASHRAE Standard 170 Minimum Airflow Calculator for HAP

To streamline the process noted above, Carrier has developed the [ASHRAE Standard 170 Minimum Airflow calculator for HAP](http://www.carrier.com/commercial), downloadable from the [Download Software section](#) of the website (www.carrier.com/commercial). Both the 2013 and 2017 versions of ASHRAE Standard 170 Table 7-1 values are included. A screenshot of the spreadsheet appears in Figure 6 below:

ASHRAE Standard 170-2017 Minimum Airflow Calculator for HAP										REV 1
Space Designation	System	Zone Terminal	Space Floor Area (sqft)	Floor to Ceiling Height (ft)	Function of Space	Pressurization Relationship to Adjacent Areas	Minimum Outdoor Air ACH	Minimum Supply Air ACH (Enter into HAP as Min Airflow ACH)	All Room Air Exhausted Directly to Outdoors?	Minimum Outdoor Air in CFM/sqft (Enter into HAP as OA1)*
OR-1	AHU-1	Zone 1-1	2,000.0	10.0	Critical and intensive care	NR	2	6	NR	0.33
Toilet Room 1	AHU-2	Zone 2-1	50.0		Delivery room (Caesarian) (m) (o)	Negative	NR	10	Yes	#VALUE!
Patient Room 100	AHU-2	Zone 2-2	150.0		Emergency department contamination	NR	2	4	NR (y)	0.30
X-ray 1A	AHU-2	Zone 2-3	180.0		Emergency department examination room (p)	NR	2	6	NR	0.33
Newborn Nursery	AHU-2	Zone 2-3	500.0		Emergency department public waiting area	NR	2	6	NR	0.33
			1,000.0		Intermediate care (s)	Negative	2	12	Yes	0.33
					Laser eye room					
					Medical anesthesia gas storage (r)					
						#N/A	#N/A	#N/A	#N/A	#N/A
						#N/A	#N/A	#N/A	#N/A	#N/A
						#N/A	#N/A	#N/A	#N/A	#N/A

Figure 6. ASHRAE Standard 170 Minimum Airflow Calculator Spreadsheet

(Continued from page 4)

To use this spreadsheet, first select the proper tab at the bottom, either the 2013 or 2017 Standard 170 Calculator, depending on your requirements. Next, note the background colors of the table cells. As the legend at the top indicates, yellow indicates input cells while blue indicates the auto look-up values from Table 7-1 in Standard 170 for each of the available *Function of Space* categories. Finally, the green cells are resultant calculation values. The three columns on the left, *Space Designation*, *System* and *Zone Terminal* are optional, used for user-input reference only so that you may designate each space name as well as the system and zone that it is assigned to. The *Space Floor Area* and *Floor-to-Ceiling Height* fields are mandatory input fields and are used in

the calculations. The *Function of Space* field contains a drop-down list box of all possible Health Care space categories. When selected this will auto-populate the blue fields with the correct data from Table 7-1 as well as the green calculation field.

After selecting the *Function of Space* input, note the values in blue and green. Using our previous example, Operating Room with 10 ft. ceiling height, we select the Operating Room space function category and note the *Minimum Outdoor Air ACH is 4.0*, the *Minimum Supply Air ACH is 20* and the *Minimum Outdoor Air in CFM/sq ft is computed as 0.67 CFM/sq ft*.

Function of Space	Pressurization Relationship to Adjacent Areas	Minimum Outdoor Air ACH	Minimum Supply Air ACH <i>(Enter into HAP as Min Airflow ACH)</i>	All Room Air Exhausted Directly to Outdoors?	Minimum Outdoor Air in CFM/sqft <i>(Enter into HAP as OA1)*</i>
Operating Room (m), (o)	Positive	4	20	NR	0.67

Figure 7. Operating Room Minimum Airflow Calculations

As in our previous example the 0.67 CFM/sq ft value is entered in the space under Space Properties (see Figure 2) and the Minimum Supply Air ACH is entered in the System under Zone Components > Supply Terminals (see Figure 4). As before, make note of any requirement for "Direct" exhaust air from the zone, as indicated by the column, *All Room Air Exhausted Directly to Outdoors?* If required this direct exhaust should be set in the Zone Components > Thermostats field (see Figure 5). For the Operating Room there is no requirement (NR) for direct exhaust so we leave this input set to zero.

It should be noted that there are some space function categories that have no requirement for supply air or minimum outdoor air. Typically, spaces such as storage rooms or toilets will indicate "NR" under the Minimum Outdoor Air ACH field and "#VALUE!" under the Minimum Outdoor Air in CFM/sq ft field, as shown in Figure 8 below. In these instances, simply enter 0 CFM/ sq ft for OA1 in the space (see Figure 2).

Function of Space	Pressurization Relationship to Adjacent Areas	Minimum Outdoor Air ACH	Minimum Supply Air ACH <i>(Enter into HAP as Min Airflow ACH)</i>	All Room Air Exhausted Directly to Outdoors?	Minimum Outdoor Air in CFM/sqft <i>(Enter into HAP as OA1)*</i>
Toilet room	Negative	NR	10	Yes	#VALUE!
Bathing room	Negative	NR	10	Yes	#VALUE!
Clean linen storage	Positive	NR	2	NR	#VALUE!

Figure 8. Space Functions with No Minimum Supply or Outside Air



Overview of Part-Load Simulation of DX Equipment in HAP

HAP provides part-load performance models for the HVAC equipment it models. Slightly different approaches are taken for the different types of equipment based on the nature of the equipment and performance data that's commonly available for the equipment. Each type of equipment is described below along with the procedures for part-load modeling:

1. Air-Cooled DX Equipment (including RTUs, Split Systems, VPACs, PTACs)

HAP provides detailed part-load performance models for these types of equipment that were developed from detailed product performance data from Carrier and other manufacturers. The models represent a class of equipment, rather than single model or unit.

User input data is widely available for the equipment; for cooling equipment:

- Gross Cooling Capacity
- Compressor + Outdoor Fan kW, or AHRI-Rated EER or SEER
- Stages of compression
- Whether low ambient (aka head pressure) control is used

And for heating equipment:

- Heating Capacity
- Compressor + Outdoor fan kW or AHRI-Rated COP or HSPF
- Stages of compression
- Minimum cutoff
- Type of auxiliary heating

Note that IEER is not a user input because the only thing you can do with IEER is calculate equipment performance by crude approximation: $\text{Power} = \text{Load} / \text{IEER}$. Such a calculation does not account for how the equipment efficiency changes for each hour's specific operating conditions. Instead HAP applies the user input information

to detailed equipment performance curves that account each hour for:

- Gross Cooling Capacity as a function of OADB, coil EWB, staging
- Cooling Compressor + Outdoor Fan kW as a function of OADB, coil EWB, staging, and part-load ratio
- Heating Capacity as a function of OADB, coil EDB, staging, and defrost cycles (if present)
- Heating Compressor + Outdoor fan kW as a function of OADB, coil OADB, staging, part load ratio, and defrost cycles (if present)

In this way HAP accounts for how the efficiency of the equipment changes hour-by-hour as operating conditions change. The individual performance curves are embedded in the software rather than being user inputs, since this detailed part-load information is rarely available to users from equipment manufacturers.

2. Water-Source DX Heat Pump Equipment (WSHPs, GSHP, GWSHP)

Similar to air-cooled equipment, HAP provides detailed part-load models for water-source DX heat pump equipment that are embedded in the software.

HAP asks for commonly available input data:

- Gross Cooling capacity
- Cooling Compressor input kW or AHRI-Rated EER
- Heating Capacity
- Heating Compressor input kW or AHRI-Rated COP

And then applies that to detailed equipment performance curves which calculate each hour:

- Gross cooling capacity as a function of EWT
- Compressor kW as a function of EWT, part-load ratio
- Heating capacity as a function of EWT
- Compressor kW as a function of EWT, part-load ratio

(Continued from page 6)

3. Air-Cooled VRF Equipment

HAP provides detailed part-load models for air-cooled VRF units. The models are embedded in the software.

HAP asks for commonly available input data such as:

- Gross cooling capacity
- Cooling compressor and outdoor fan kW at design, or AHRI-Rated EER
- Heating capacity
- Heating compressor and outdoor fan kW at design, or AHRI-Rated COP.
- Compressor type, because performance curves are rather different for VSD scroll, digital scroll, VSD rotary compressor products
- Refrigerant line length and vertical distance, because these affect capacity and efficiency loss.
- Whether or not heat recovery is used.

HAP then applies the input data to detailed part-load performance curves that consider:

- Gross cooling capacity as a function of OADB, indoor unit EWB, refrigerant line length and vertical distance, compressor type
- Cooling compressor and outdoor fan kW as a function of OADB, indoor unit EWB, refrigerant line length and vertical distance, compressor type, part-load ratio.
- Heating capacity as a function of OADB, indoor unit EDB, refrigerant line length and vertical distance, compressor type, defrost cycle (if present)
- Heating compressor and outdoor fan kW as a function of OADB, indoor unit EDB, refrigerant line length and vertical distance, compressor type, part-load ratio, defrost cycle (if present).
- Whether heat recovery is used (affects all of the above).

4. Air- and Water-Cooled Chillers

For these types of equipment, off-design and part-load performance is modeled using the performance map data that is shown in the Chiller input screen, as shown in Figure 10 below. Each chiller type (centrifugal, screw, scroll, recipricating and absorption) has a default part-load performance table. These tables were developed based on Carrier’s published performance data and represent “typical” performance for that type of chiller rather than performance for a particular model and unit.

For a water-cooled chiller there are three possible methods of entering chiller part-load data:

1. Default Performance Map (based on chiller type, full load LCHWT, ECWT, capacity and power)
2. Chiller Template
3. Import from Carrier Electronic Catalog (E-CAT)

Each of the three methods is illustrated next.

Default Performance Map

On the General tab select the Equipment Type (in this case W/C Centrifugal chiller). Note the *Chiller Template and Import* buttons on the right. Do not press these for the default performance map. Their functionality is discussed on page 8.

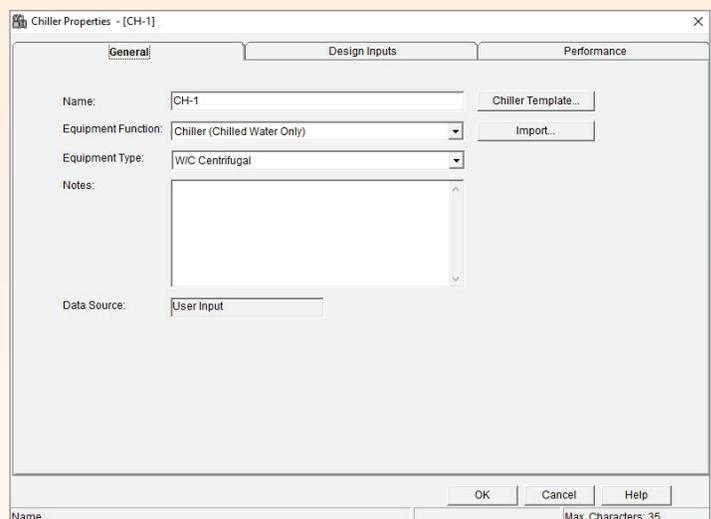


Figure 9. Chiller Properties – Water-Cooled Chiller

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Next, select the Design Inputs tab. The input screens below represent a 500-ton water-cooled chiller input. The Full Load LCHWT and ECWT is entered along with the Full Load Capacity and Full Load Power, kW/Ton, Minimum ECWT

Setpoint and Minimum Load %. HAP then populates the entire performance map with input power and capacity at each ECWT and each operating step from maximum to minimum load steps.

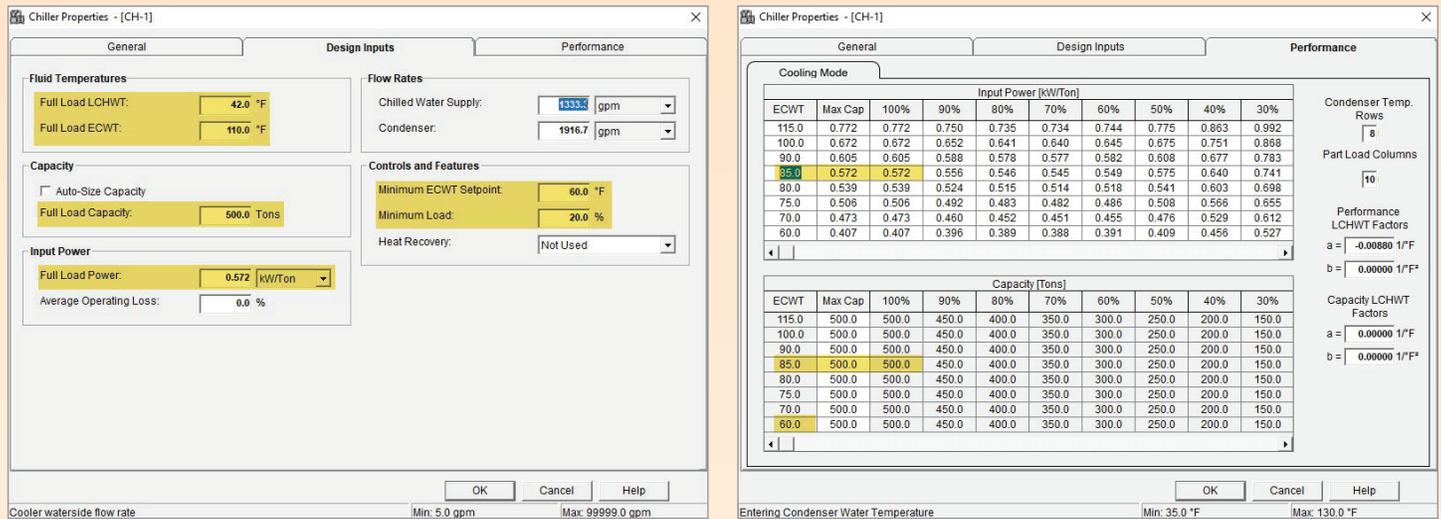


Figure 10. Chiller Properties - Design Inputs (left) and Performance Map (right)

These part-load values are based on representative tables for the type of chiller selected (centrifugal, screw, scroll, reciprocating or absorption). Highlighted in yellow are the ECWT of 85F, Full Load Capacity and Full Load Power values, carried over from the Design Inputs tab to the Performance map. If you modify the full load input power on the Design Inputs tab, HAP will automatically adjust the performance map. For example, if you reduced the full load input power by 10%, you'll see all the performance map cells adjust by 10%.

This performance map data is visible to the user and can be directly entered or modified if you have actual equipment performance data at each ECWT from max to min as well as both capacity and power data at each unloading step from 100% down to the minimum operating step.

Chiller Template

Alternatively, you may use the "Chiller Template" option on the General tab (see Figure 9). This option is useful when you have a load-line run or published part-load performance data from the chiller manufacturer. Press the Chiller Template button to open a new input window, where you can define a load-line run or published chiller data for up to 10 part-load data points. A typical AHRI type performance rating might involve four data points (100, 75, 50 & 25%) load at the full load ECWT and reduced ECWT values, depending on the type of chiller, as shown in Figure 11 (left) on the following page.

(Continued from page 8)

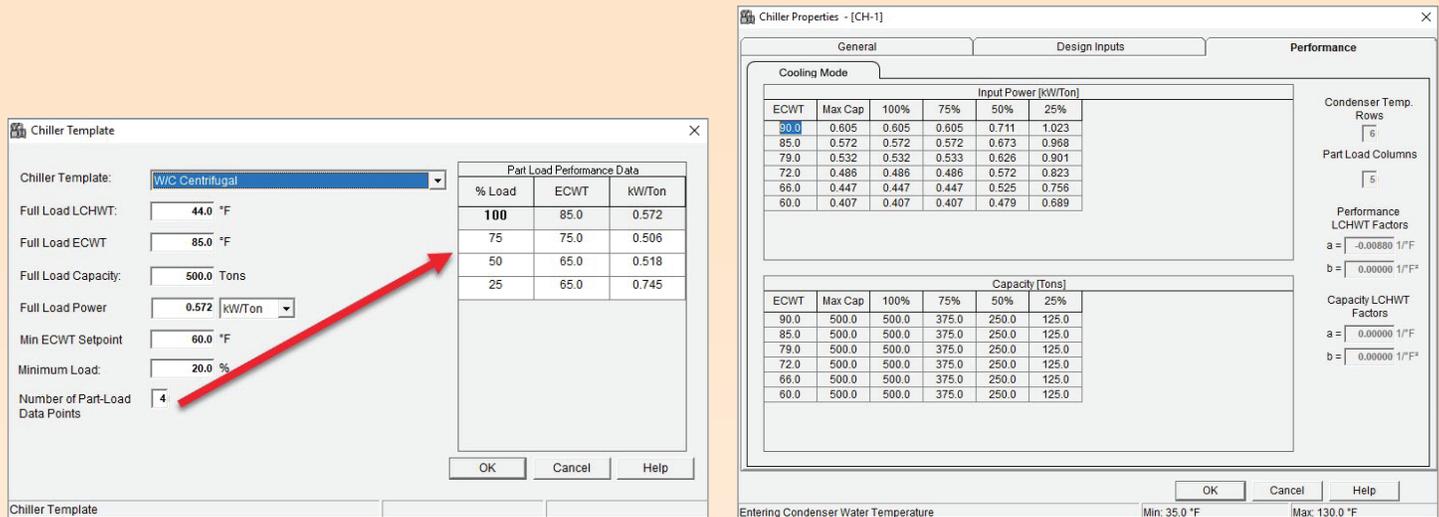


Figure 11. Chiller Template - Design Inputs (left) and Performance Map (right)

HAP will then estimate the full performance map based on these user input values, as shown on the right figure in Figure 11. This estimate is less accurate than if you have actual load line runs to fill the performance map, but you can provide acceptable accuracy when only the four IPLV points or a single load line is available.

Import Chiller from Carrier E-CAT

The third possible method of entering chiller data is by importing it from the Carrier Electronic Catalog (E-CAT) software for specific chiller models. Your local Carrier sales engineer can perform a chiller selection then generate the chiller performance data file which can be imported into HAP using the Import button on the Chiller input screen (see Figure 9). HAP will not show you all the individual performance values in the performance map in this case since the part-load data is proprietary. However,

it is modeling the part-load performance in the same way — kW or kW/ton as a function of part-load ratio and entering condenser temperature, and leaving chilled water temperature. This is the most accurate method for modeling a specific Carrier chiller model to your specific and unique design conditions.

Note: For air-cooled chillers it is not possible to use the Chiller Template option. This is because it is not possible to accurately produce a “default” chiller part-load table from a small set of IPLV points or a single load line. However, if you have part-load capacity and efficiency data from the chiller manufacturer at various condensing temperatures from design to minimum operating temperature, you may enter data directly on the Performance tab by selecting the number of condensing temperatures and the number of part-load values, such as 100, 75, 50 & 25%.

Frequently Asked Questions

FAQ #1: How does a DOAS (dedicated outdoor air system) function when equipped with a Ventilation Reclaim device? In other words, will an HRV (heat recovery ventilator) exchange sensible heat between incoming OA and outgoing exhaust air regardless of whether or not the DOAS requires cooling or heating of the OA? And what if cooling and heating coils are NOT present in the DOAS, how does this affect the HRV operation? If the HRV does NOT have heating or cooling coils in the DOAS does the HRV simply run “wild” exchanging heat between outgoing exhaust air and incoming OA?

Answer: A DOAS may be configured with an HRV device and/or with cooling and heating coils to control the leaving air DB from the DOAS, as indicated in Figure 1 below.

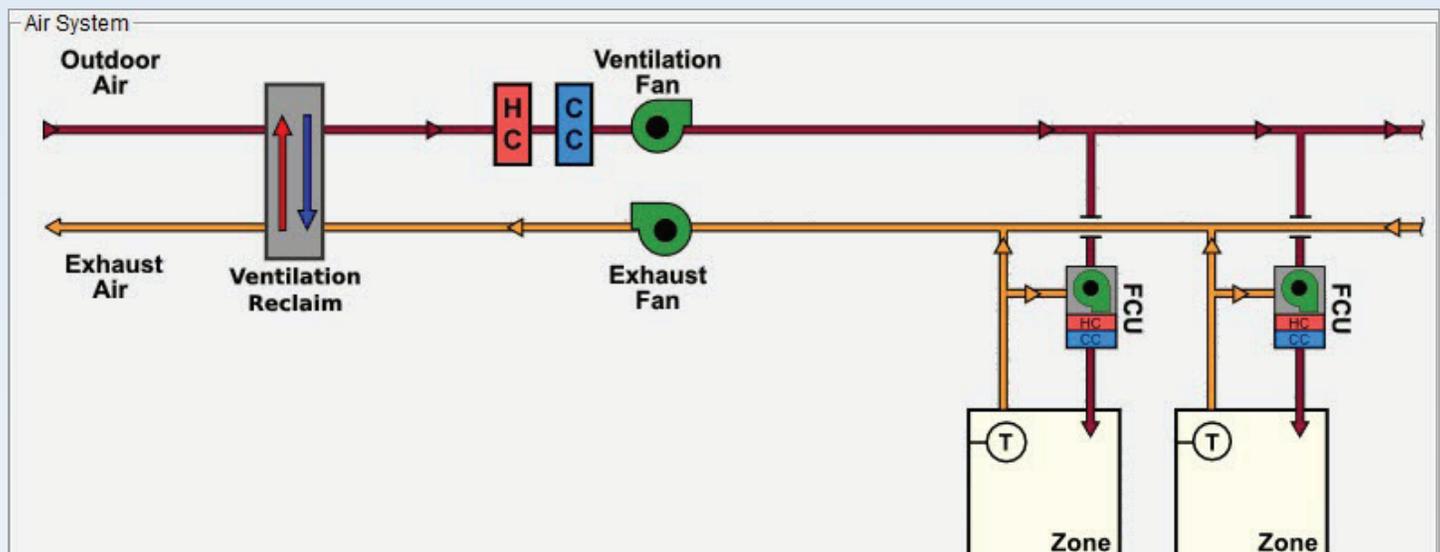


Figure 1. Terminal Unit System with DOAS, Ventilation Reclaim & Heating/Cooling Coils

The HRV will operate whenever the incoming OA and outgoing exhaust air conditions allow it to do so, but assumes control logic exists that prevents the HRV from operating if it will increase rather than decrease coil load. As an example, let's assume the DOAS contains an HRV and cooling and heating coils with cooling and heating setpoints of 75°F and 70°F, respectively. So, the DOAS is configured to essentially deliver “neutral” ventilation air to the zones since 75°F is a typical cooling thermostat setpoint and 70°F is a typical heating thermostat setpoint. The HRV is controlled by those coil setpoints and works to minimize or eliminate mechanical cooling or heating. This means it will not reclaim heat when the cooling coil is running because that would make the vent cooling coil load larger. The following three scenarios explain how the HRV functions at various ambient conditions:

Scenario 1: Outdoor air dry-bulb is 95°F. Exhaust side dry-bulb is 77°F. Without an HRV, the DOAS cooling coil would energize and have to cool the outdoor air from 95°F to 75°F, a coil delta-T of 20°F. (Note: This is a simplification assuming no fan heat for purpose of explanation. In the real system, the coil outlet would have to be less than 75°F so that when fan heat is added, the discharge setpoint of 75°F is met). Because the DOAS is in cooling mode and because a favorable temperature gradient exists between outdoor air and exhaust air (95°F vs 77°F) for cooling recovery, the HRV will operate. Assuming a 60% thermal efficiency for the HRV and balanced flows, the HRV can cool the incoming outdoor air to 84.2°F. This reduces the required coil delta-T to 10.8, cutting the coil sensible load almost by half.

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Scenario 2: Outdoor air dry-bulb is 50°F. Exhaust side dry-bulb is 72°F. Without an HRV, the DOAS heating coil would energize and have to warm the outdoor air from 50°F to 70°F a coil delta-T of 20°F. (As in Scenario 1 this is a simplification for purposes of explanation. Fan heat gain would mean the heating coil discharge could be slightly less than 70°F since the fan heat will raise the air temperature to 70°F at the discharge.) Because the DOAS is in heating mode and because a favorable temperature gradient exists between outdoor air and exhaust air (50°F vs 72°F) for heating recovery, the HRV will operate. Assuming a 60% thermal efficiency and balanced flows, the HRV can warm the incoming air to 63.2°F. This reduces the heating coil delta-T to 6.8°F, cutting the heating coil load by more than half.

Scenario 3: Outdoor air dry-bulb is 68°F. Exhaust side dry-bulb is 72°F. Without an HRV, the DOAS heating coil would energize and warm the outdoor air from 68°F to 70°F. Because the DOAS is in heating mode and a favorable temperature differential exists for heat recovery, the HRV

will operate. Assuming a 60% thermal efficiency and balanced flows, if the HRV runs at capacity, it can warm the air from 68°F to 70.4°F. Since this will cause the air to exceed the DOAS discharge setpoint of 70°F, the HRV will modulate its capacity to prevent the overheating. In the case of a heat wheel, that modulation involves slowing down the rotation speed of the wheel. If input kW was specified that modulation will also be reflected in a reduced power draw for the device.

If there are no heating or cooling coils present in the DOAS, the ERV will run “wild,” transferring energy between the incoming OA and outgoing exhaust air, because there are no control setpoints. There is no communication between the zone thermostats and the DOAS ERV so under some conditions the supply air off the ERV will impose an additional load on the zones, while at other times this DOAS supply air will assist the zone terminals in meeting the zone loads. As a general rule you should always have heating and cooling coils in the DOAS to maintain precise control of the incoming ventilation air.

FAQ #2: I am modeling a Packaged RTU equipped with a Ventilation Reclaim device and Airside Economizer. How is the Ventilation Reclaim device controlled such that it does not warm the incoming OA and defeat the use of economizer to provide free cooling?

Answer: Ventilation reclaim device operation is disabled whenever the OA conditions are favorable for economizer operation. The OA is simply bypassed around the reclaim device and provided as normal to the zones to provide free cooling. The reclaim device only operates whenever it can assist the cooling and heating coils to meet the loads. The following factors apply:

- If the system mode is cooling and exhaust-side vs OA side conditions are not favorable for the reclaim device to cool or dehumidify the OA air stream, then the reclaim device is off and air is bypassed around the reclaim device.
- If the system mode is heating and exhaust side vs OA side conditions are not favorable for the reclaim device to warm the OA air stream, then the reclaim device is off and air is bypassed around the reclaim device.
- If the system has both an outdoor air economizer and a reclaim device, then the outdoor air economizer has priority. If the system mode is cooling and conditions are such that the economizer can provide partial or full free cooling, then the reclaim device is off. If any air is flowing through the reclaim device branch of the OA intake, it is bypassed around the reclaim device.

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eDesign Suite Software Current Versions (North America)

Program Name	Current Version	Functionality
 Hourly Analysis Program (HAP)	v5.11	Peak load calculation, system design, whole building energy modeling, LEED® analysis
 Building System Optimizer	v1.60	Rapid building energy modeling for schematic design
 Block Load	v4.16	Peak load calculation, system design
 Engineering Economic Analysis	v3.06	Lifecycle cost analysis
 Refrigerant Piping Design	v5.00	Refrigerant line sizing
 System Design Load	v5.11	Peak load calculation, system design



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