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Networked Coil Loops

Introduction to Coil Loops

Exhaust-air energy recovery is a strategy that has long been used to reduce a building's HVAC energy use. One technology that has been used for decades is the coil loop. Figure 1 is a diagram from a 1983 Trane® engineering bulletin. While the pneumatic controller has been replaced with direct digital controls, the overall concept has not changed.

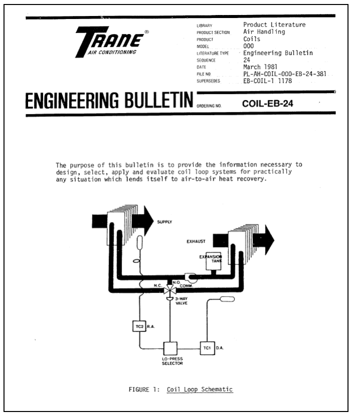
During cold weather, when the building is occupied, a portion of the exhaust air heat is captured by the hydronic fluid passing through the coil tubes. The hydronic fluid is then pumped to another coil that is located in the outdoor airstream. As the outdoor air enters the building for ventilation it is preheated using energy recovered from the exhaust air. During warm weather, the reverse happens: heat is removed from the outdoor airstream (pre-cooling this air) and transferred to the cooler exhaust air before it leaves the building.

Advantages of Coil Loops

More recently, air-to-air plate exchangers and energy-recovery wheels have been commercialized to give engineers and building owners options for exhaust-air energy recovery with higher total effectiveness. However, coil loops are still commonly used, often due to the following distinct advantages:

- **Outdoor-air intake and exhaust outlet do not need to be located in close proximity.** The energy recovered by a coil loop can easily be transported around the building to be used where it is needed. This can be a particularly valuable benefit in an existing building where relocating ductwork might not be feasible. The exhaust air may leave from several locations spread around building, while the outdoor-air intake may be centralized, maybe even on the opposite end of the building. A coil loop allows for exhaust-air energy recovery without needing to relocate the exhaust-air outlets or outdoor-air intakes. While other energy-recovery technologies might be more efficient (especially during cooling mode), they require the outdoor and exhaust airstreams to be located in close proximity, often side-by-side.
- **Avoid cross-leakage of exhaust air.** Laboratories require large amounts of exhaust air. Many are conditioned with 100-percent outdoor air that is required to replace the air being exhausted from the building. Coil loops are used in these applications since they allow for energy to be recovered from the exhaust airstream without the risk of exhaust air transferring back into the outdoor airstream (cross-leakage). The outdoor air heat exchanger never comes into contact with the exhaust airstream, as it does when using an energy-recovery wheel or plate exchanger. Additionally, the outdoor-air intake(s) can be located far away from the exhaust-air outlet(s) because the fluid is pumped between the two coils. ASHRAE® Standard 90.1, and many energy codes, require energy recovery from lab exhaust air and coil loops are oftentimes the only viable solution.
- **Ease of retrofit.** Another application for coil loops is when retrofitting an existing building for **electrification of heat**. Switching to an all-electric heating solution introduces a new peak electric demand during the winter months. Therefore, it is important to reduce the peak heating load and exhaust-air energy recovery with coil loops is one way to do this without rearranging ductwork.

Figure 1. Coil loop diagram from the 1983 Trane® engineering bulletin (COIL-EB-24)



TRANE® AIR CONDITIONING

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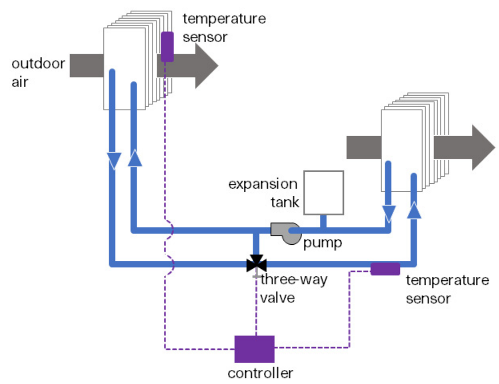
The purpose of this bulletin is to provide the information necessary to design, select, apply and evaluate coil loop systems for practically any situation which lends itself to air-to-air heat recovery.

FIGURE 1: Coil Loop Schematic



Networked Coil Loops

The old diagram from 40 years ago (Figure 1) still holds true: coil loops can be applied with one outdoor-air coil and one exhaust-air coil (1:1). However, in many commercial or institutional buildings, there is a network of these coils located throughout the building (Figure 2).

Examples of a networked coil loop in buildings include:

- In a laboratory building, it is common to have one— or a few— central air handlers on the roof ejecting exhaust air, but multiple 100-percent outdoor air handlers located throughout the building (outdoor-air coils >> exhaust-air coils).
- In a commercial building, the opposite is often the case: more exhaust-air coils than outdoor-air coils (outdoor-air coils << exhaust-air coils).

These two scenarios have brought renewed interest in networked coil loops.

In addition, the advancement of air-handling unit controls and building automation have made control integration of networked coil loops less complex and more efficient. (No longer is operation limited by an independent central loop controller because of pneumatics!) This EN discusses what can be expected for performance from an exhaust-air energy recovery coil loop, and how it can be optimized.

Optimize Coil Loop Performance by Selecting the Best Coils for the Application

When optimizing the design of a coil loop, the first items to review are the hydronic coils. Each coil needs to be selected and optimized for the application. Coils are available with various enhanced fin designs, fin spacing options, options to improve fluid flow turbulence and improve heat transfer, circuiting options, and various tube diameters. All of these options help to optimize heat transfer for an energy-efficient coil loop.

The primary energy cost of a coil loop is the added air pressure drop of the coils in the airstreams. This increases fan energy usage. There are a number of factors that affect pump energy use, but keep in mind that the fluid pressure drop through the coil impacts pump energy use.

Selecting coils based solely on the highest amount of heat recovered likely will not result in the most efficient overall system, as this will significantly increase fan power and/or pump power. On the other hand, selecting coils for the lowest air or fluid pressure drop will not result in the most efficient system. And note that strictly specifying a specific tube diameter, circuiting arrangement, or fin design will also miss out on the most optimal choice. **It's best to start with a realistic goal for quantity of heat recovered and then optimize the coil selections for reasonable air and fluid pressure drops.**

For each coil in the loop, the following are the options to consider:

- Tube diameter
- Coil circuiting
- Fin design/type
- Fin density
- Face area
- Number of rows of tubes
- Options to increase turbulence

The physical length of the coil face (along with the air and fluid flow rates) determines which tube diameter and circuiting arrangement will result in the best balance of heat recovered, air pressure drop, and fluid pressure drop (Figure 3).

An optimized, networked coil loop will most likely use different coil types—each selection based on airflow and physical size constraints. Hydronic coils are the most flexible for sizing to fit a given installation, compared to other exhaust-air energy recovery devices. If the airflows in a networked coil loop vary, but all the coils are of the same tube diameter, circuiting arrangement, number of rows, and number and type of fins, the coil loop is likely not optimized.

When optimized coils are selected, a sensible energy recovery ratio between 0.45 and 0.60 can be expected. The recommendations in Figure 4 assumes close to equal outdoor and exhaust airflows and that an optimum coil tube diameter, circuiting arrangement, and fin type are selected, with the only variables being the number of rows and the coil face area (face velocity). There are other variables with respect to the application and coil geometry, so the purpose of this chart is to define maximum recovery expectations for coil face area and number of rows.

Air pressure drop for the targeted sensible energy recovery ratio range will likely be between 0.4 and 1.4 in. H_2O, it can vary greatly depending on installation constraints and project goals.

Figure 2. Examples of a networked coil loop in buildings

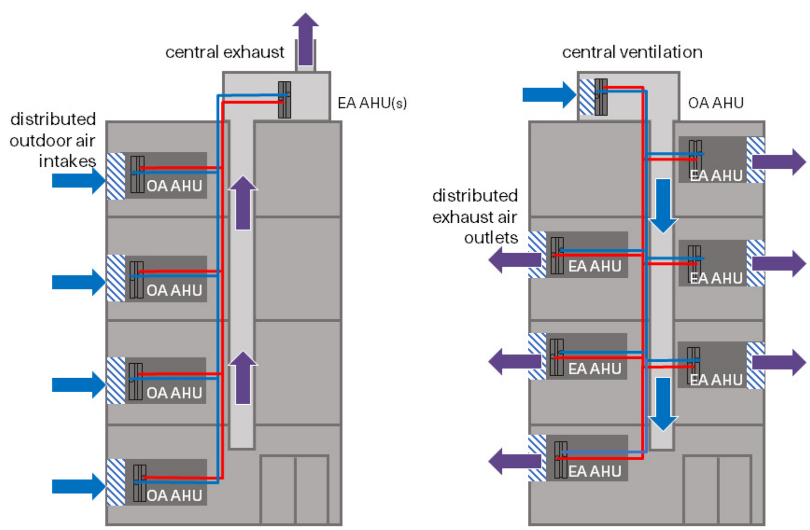
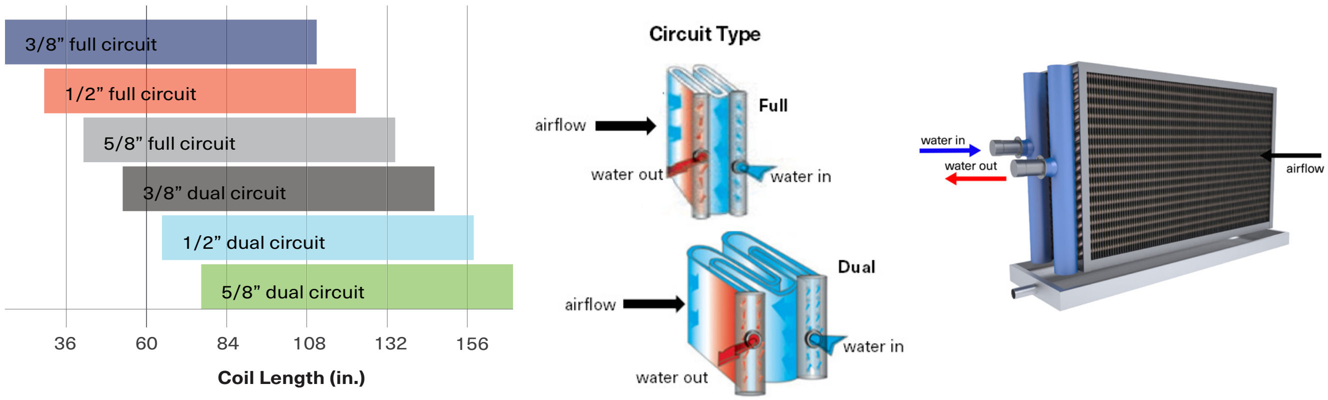


Figure 3. Recommended tube diameter and circuiting arrangement for an optimized coil loop

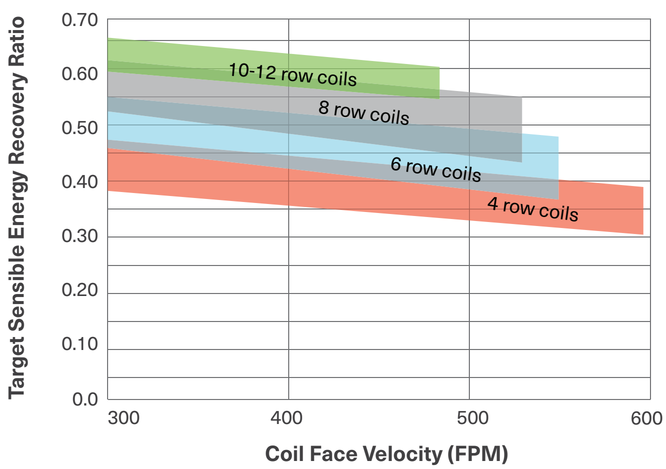


Fluid pressure drop for optimized coils should typically be between 15 and 30 ft. H_2O. But if the goal is to achieve the highest sensible energy recovery ratio possible, this pressure drop will be higher. And in very cold climates, the fluid pressure drop will increase dramatically if 40 percent (or more) glycol concentration is needed.

Condensation on the Exhaust-Side Coil Improves Performance

During heating operation, cooling the exhaust air below its dew point—and thereby condensing water vapor out of the air—increases the amount of heat recovered. However, this condensation is unlikely to occur unless humidifiers are used to raise the indoor humidity level during cold weather or if a process is releasing large amounts of water vapor into the building. Laboratories, which are a common application for coil loops, often use humidifiers during the winter.

Figure 4. Recommended coil size (face velocity) and rows for an optimized coil loop



Note: Target performance range based on air pressure drop of 0.4 to 1.4 in. H_2O and fluid pressure drop of 15 to 30 ft. H_2O

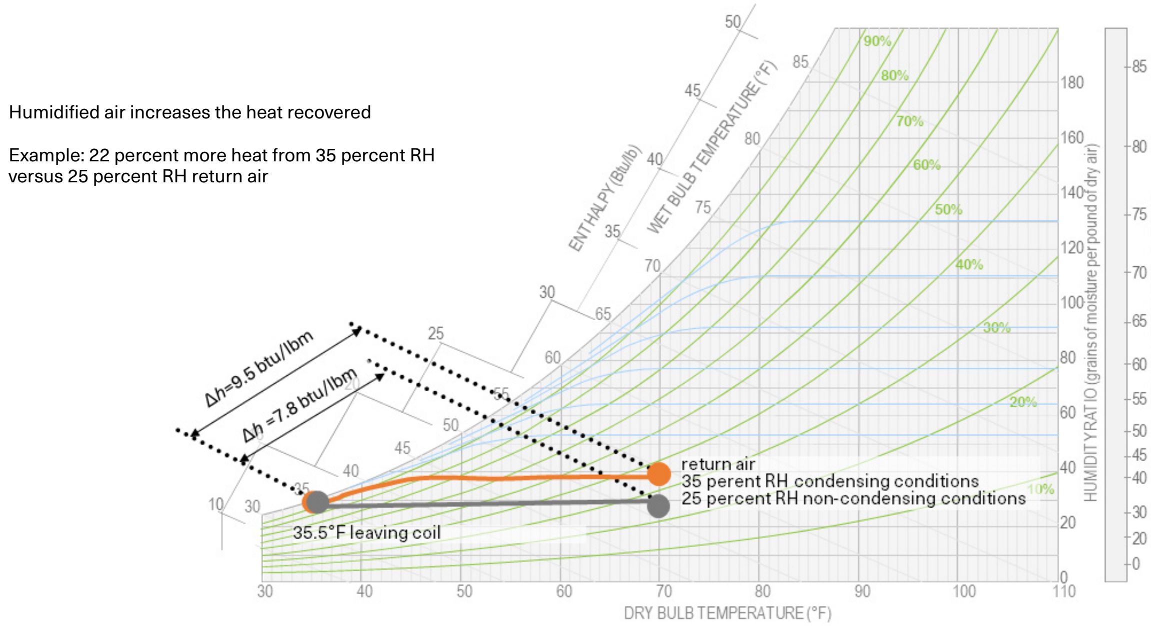
As an example, a space that is conditioned to 70°F dry bulb and 35 percent relative humidity (RH) has a corresponding dew-point temperature of 41°F. Cooling the exhaust air down to a dry-bulb temperature of 35.5°F (below its dew point) will cause water vapor to condense out of the air and onto the exhaust-side coil surface. This latent work (condensation) results in 22 percent more energy extracted from the exhaust air than if the exhaust air was at a 32°F dew point (70°F dry bulb and 25 percent RH) and cooled to the same temperature (Figure 5). This additional energy extracted from the exhaust air results in more sensible heat added to the outdoor airstream.

Optimize Coil Loop Performance by Considering Frost Limitations

While condensation increases the amount of heat recovered, controls are needed to prevent this condensate from freezing (ice) on the surface of the exhaust-side coils, which would impede airflow and potentially damage the coil. The objective of frost control is to prevent frost and ice, not to prevent condensation.

If the dew-point temperature of the exhaust air is higher than 32°F, the objective is to prevent ice from forming on the coil. In this case, it is beneficial to design the coil loop to condense water from the exhaust air, but in order to prevent ice from forming, the fluid entering the exhaust-side is prevented from dropping below 32°F.

Figure 5. Condensation results in more energy extracted from the exhaust airstream



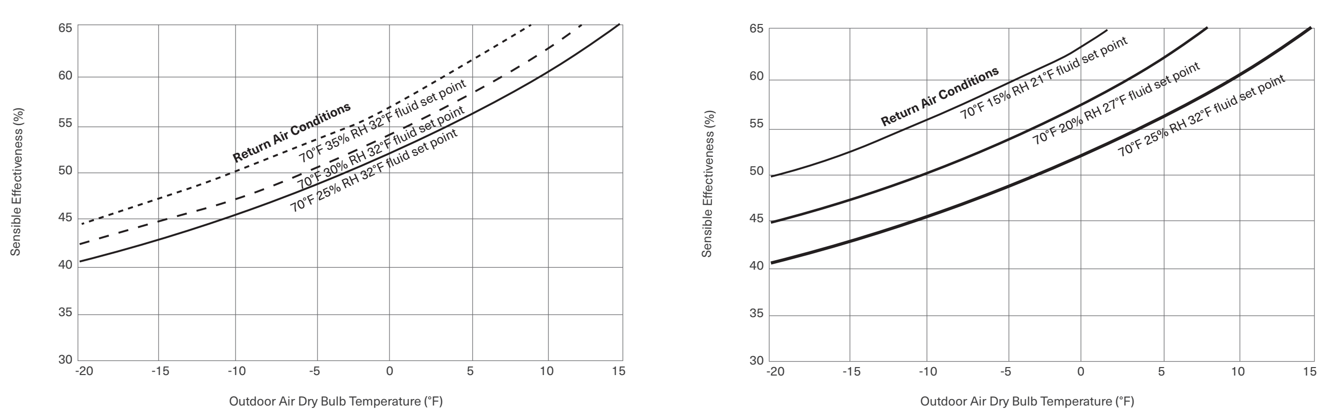
If the frost-point temperature of the exhaust air is below 32°F, the objective is to prevent frost from forming on the coil. In this case, the temperature of the fluid entering the exhaust-side coil must be limited to the frost-point temperature of the entering air: at 70°F dry bulb and 20 percent RH, this is 27°F, and at 70°F dry bulb and 15 percent RH, this is 21°F.

The fluid temperature entering the exhaust-side coil can be regulated using a three-way valve to blend warmer fluid returning from the exhaust-side coil with cold fluid returning from the outdoor-air coil (as shown in Figure 1). Both the dry-bulb temperature and relative humidity of the entering exhaust air are measured and used to calculate the corresponding dew-point (or frost-point) temperature. The setpoint for the three-way valve is then dynamically reset based on current exhaust-air conditions, rather than using a fixed 32°F setpoint.

Frost or ice prevention may be required at the building's peak design heating load, when the entering outdoor air is the coldest. The two charts in Figure 6 show the highest sensible effectiveness possible before frost or ice begins to form. Optimizing the coil loop to achieve a higher effectiveness than this limit will not result in more energy recovered at peak heating load conditions, because the frost prevention controls will limit the amount of heat recovered to prevent the fluid temperature entering the exhaust-side coil from getting too cold.

For example, if the winter design outdoor temperature is -10°F and the exhaust-air conditions are 70°F dry bulb and 20 percent RH, the maximum sensible effectiveness is 50 percent. **Note that this is dependent on the humidity level of the exhaust airstream, not the coil selection.** Therefore, adding rows and fins to achieve an effectiveness higher than 50 percent will not reduce the design heating load, but will increase both the cost of the coil and fan and pump energy use.

Figure 6. Highest sensible effectiveness possible before ice (left) and frost (right) begins forming



Example networked coil loop selection

Consider an existing laboratory building that uses centralized exhaust and distributed outdoor air handlers (like depicted in the left-hand diagram in Figure 2):

- Two exhaust-side AHUs ejecting 30,000 scfm each (60,000 scfm in total)
- Six supply-side AHU's bringing in 66,000 scfm of outdoor air in total
  - Two AHUs bringing in 6,000 scfm each
  - Two AHUs bringing in 10,000 scfm each
  - Two AHUs bringing in 17,000 scfm each
- Winter design conditions: outdoor air is 0°F and exhaust air is 70°F dry bulb and 35 percent RH

Design criteria 1: Minimum sensible energy recovery ratio of 0.50. With an entering outdoor-air temperature (DBT_1) of 0°F, and an entering exhaust-air temperature (DBT_3) of 70°F, achieving at least a 0.50 sensible energy recovery ratio requires the air leaving the outdoor-air coil (DBT_2) be no lower than 35°F dry bulb:

- sensible energy recovery ratio = $(DBT_1 - DBT_2) / (DBT_1 - DBT_3)$
- $0.50 = (0°F - DBT_2) / (0°F - 70°F)$, therefore $DBT_2 = 35°F$

Heating 66,000 scfm of outdoor air from 0°F to 35°F requires a minimum of 2,506 MBh heat recovered from the exhaust airstreams:

- 1.085 × 66,000 scfm × (35°F – 0°F) = 2,506,000 Btu/h = 2,506 MBh

Note that because the outdoor and exhaust airflows are not equal in this example, a 0.50 sensible energy recovery ratio corresponds to a sensible effectiveness ($\varepsilon_{sensible}$) of 55 percent:

- $\varepsilon_{sensible} = (CFM_{supply} / CFM_{minimum}) \times (DBT_1 - DBT_2) / (DBT_1 - DBT_3)$
- $\varepsilon_{sensible}$ = (66,000 scfm / 60,000 scfm) × (0°F – 35°F) / (0°F – 70°F) = 0.55 or 55%

Design criteria 2: Limited space for the outdoor-air coils. Outdoor air handlers serving a laboratory contain additional components, such as cooling coils, humidifiers, or high-efficiency filters. Therefore, the outdoor-air coil for a coil loop might be constrained to an existing coil face velocity (450 to 500 fpm, for example) to minimize added cost and footprint of the air handler.

Design criteria 3: Reduce fan power of the outdoor air handlers. Outdoor air handlers serving a laboratory have internal static pressure losses associated with the additional components mentioned previously. Often, a goal is to limit the air pressure drop of the outdoor-air coil to avoid needing to increase the fan motor size or to keep below the 0.6 in. H_2O credit allowed by ASHRAE® Standard 90.1 (Section 6.5.3.1.1 in the 2019 version).

Suggested approach for selecting coils. Based on the charts in Figure 6, with exhaust air entering the coil at 70°F dry bulb and 35 percent RH, the maximum sensible effectiveness that can be achieved before frost begins to form is 56 percent. This corresponds to a maximum sensible energy recovery ratio of 0.51, so the design criteria of 0.50 should be achievable.

The exhaust-air coils in this example will need to be selected with a close approach (~4°F), which is the difference between the entering fluid temperature (32°F) and the air temperature leaving the coil (~36°F). This is a closer approach than will be required of the outdoor-air coils. Therefore, the cost required for additional coil face area and rows is best spent on the exhaust-air coils.

Laboratory exhaust air handler fans can generate a lot of noise, often requiring silencers installed at low air face velocity to minimize sound transmission to the space. For this reason, using a larger face area for the exhaust-air coils may not dictate an increase in the size of the air handler casing.

Assuming some flexibility to increase coil face area in the exhaust air handlers, the minimum heat recovered from the exhaust airstreams (2,506 MBh in total, or 1,253 MBh for each exhaust air handler, and a 32°F fluid temperature entering the exhaust-air coils are used by coil selection software to find an optimized coil, by varying the coil face area and number of rows (Table 1).

For this example, at heating design conditions, the fluid flow rate for the overall loop is 460 gpm. This flow rate is then distributed to the outdoor-air coils in the six outdoor air handlers.

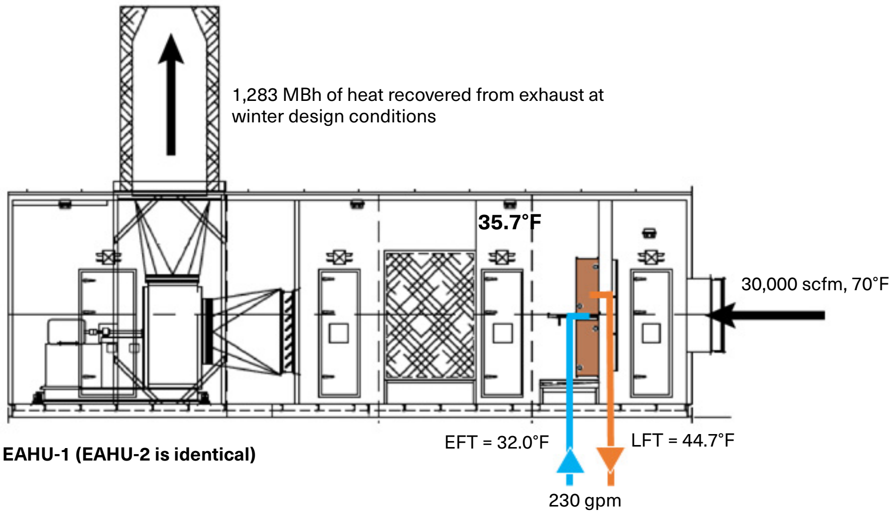
Based on Figure 4, to achieve a 0.50 sensible energy recovery ratio with a coil face velocity between 450 and 500 fpm (due to limited space in the outdoor air handlers) the outdoor-air coils will require either six or eight rows.

Using the fixed face areas, and starting with six rows (to keep the air pressure drops lower), the outdoor-air coils are then optimized by varying coil type, fin type, and fin spacing (Table 2).

As mentioned previously, an optimized networked coil loop will include coils of varying types and sizes. As in this example, this does not result in the same leaving-air temperature or leaving fluid temperature for every coil. The goal is to distribute the energy extracted from the exhaust air to the outdoor-air coils using the least required pump and fan energy.

This example coil loop meets the stated design criteria by having a sensible energy recovery ratio of 0.51, at heating design conditions, with air pressure drop for each outdoor-air coil being less than 0.6 in. H_2O. In addition, the fluid pressure drop for each coil is no more than 20 ft. H_2O.

Table 1. Example optimized exhaust-air coil selections, at heating design conditions



Exhaust air recovery coil details

Unit	Model	Tube Diameter	Circuit Type	Rows	Fin Type	Fins per Foot	Total Face Area	Qty	Coil Height	Coil Length
EAHU-1 & 2	Trane WD	5/8 in.	Double	8	Prima Flo H	144	69.27 ft^2	2	37 in.	133 in.

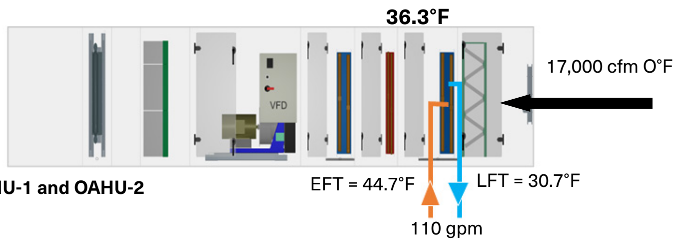
Winter design air performance data

Unit	Air Flow scfm	Face Velocity fpm	Air Pressure Drop in. H_2O	Entering		Leaving		Capacity		
				DB °F	WB °F	DB °F	WB °F	Total MBH	Sens MBH	Latent MBH
EAHU-1 & 2	30,000	433	0.93	70.0	54.4	35.7	35.6	1,283	1,120	163

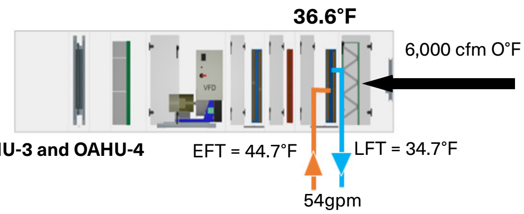
Winter design fluid performance data

Unit	Fluid Flow gpm	Fluid Velocity ft/s	Fluid Pressure Drop ft. H_2O	Entering °F	Leaving °F	Capacity MBH	Fluid
EAHU-1 & 2	230	2.54	12.9	32.0	44.7	1,283	30% ethylene glycol

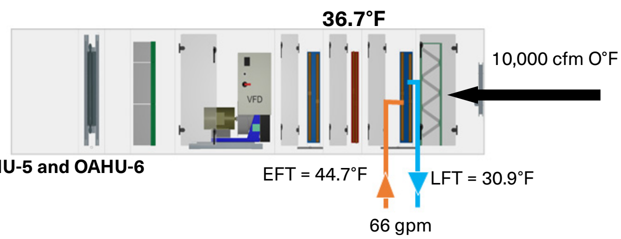
Table 2. Example optimized outdoor-air coil selections, at heating design conditions



OAHU-1 and OAHU-2



OAHU-3 and OAHU-4



OAHU-5 and OAHU-6

Outdoor air recovery coil details

Unit	Model	Tube Diameter	Circuit Type	Rows	Fin Type	Fins per Foot	Total Face Area	Qty	Coil Height	Coil Length
OAHU-1 & 2	Trane W	5/8 in.	Single	6	Prima Flo E	135	33.53 ft^2	1	55 in.	87 in.
OAHU-3 & 4	Trane 3U	3/8 in.	Double	6	Omega Flo H	112	12.11 ft^2	1	32 in.	55 in.
OAHU-5 & 6	Trane UW	1/2 in.	Single	6	Delta Flo H	130	20.81 ft^2	1	43 in.	69 in.

Winter design air performance data

Unit	Air Flow scfm	Face Velocity fpm	Air Pressure Drop in. H_2O	Entering DB °F	Leaving DB °F	Capacity Total MBH
OAHU-1 & 2	17,000	507	0.55	0.0	36.3	671
OAHU-3 & 4	6,000	495	0.55	0.0	36.6	238
OAHU-5 & 6	10,000	481	0.55	0.0	36.7	398

Winter design fluid performance data

Unit	Fluid Flow gpm	Fluid Velocity ft/s	Fluid Pressure Drop ft. H_2O	Entering °F	Leaving °F	Capacity MBH	Fluid
OAHU-1 & 2	110	3.29	20.0	44.7	30.7	671	30% ethylene glycol
OAHU-3 & 4	54	3.52	19.9	44.7	34.7	238	30% ethylene glycol
OAHU-5 & 6	66	3.33	19.8	44.7	30.9	398	30% ethylene glycol

Capacity control for an optimized coil loop

Complex control methods are not required to optimize the performance of a networked coil loop. Like most chilled-water or hydronic hot-water distribution systems, a variable-speed coil loop pump can be modulated to maintain pressure in the loop at a desired setpoint and the loop is balanced to ensure that each outdoor-air coil receives its required fluid flow rate (Figure 7). The pumps are similar in type and control as other pumps, which may be located in the same mechanical room or penthouse.

The coils in the outdoor air handlers are equipped with modulating, two-way control valves, which are used to vary the amount of heat recovered. These valves are similar in type and control as other valves used on chilled- or hot-water coils in the same air handler, and are controlled by the same air handler unit controller. This simplifies implementation since the controlled devices (valves) and control methods for the coil loop are familiar.

Capacity control in heating mode. Capacity control of the outdoor-air coil is often required during heating mode to prevent recovering too much heat. This occurs in two different scenarios:

- Capacity control is needed to avoid overheating the supply air when the entering outdoor air is not very cold, and full heat-recovery capacity from the coil loop is not needed. When the outdoor-air temperature is above approximately 40°F, the two-way valve on each outdoor-air coil modulates further closed to prevent overheating the air above the air handler's current supply-air temperature setpoint (55°F, for example). The variable-speed pump controller responds to the partially-closed valves by reducing the pump speed, reducing the fluid flow rate in the loop.
- Capacity control is needed to avoid frost or ice formation on the exhaust-air coils when the entering outdoor air is very cold. When conditions are such that the potential for frosting exists, the two-way valve on each outdoor-air coil modulates further closed to prevent the coil from exceeding its maximum recovery capacity. The temperature of the fluid returning from the outdoor-air coils will be below the minimum exhaust fluid temperature (32°F for the example). The three-way mixing valve is used to blend warmer fluid returning from the exhaust-air coils with this very cold fluid returning from the outdoor-air coils (Figure 8). This mixing valve modulates to keep the fluid temperature entering the exhaust-air coils above the minimum setpoint (32°F in this example). Since the fluid flow rate through the exhaust-air coils is at (or very near) the design flow rate, this is the maximum amount of energy that can be recovered from the exhaust airstreams.

In a conventional 1:1 coil loop (Figure 1), the single three-way valve can be used for both capacity control and frost prevention; no additional two-way valves are needed. However, in a networked coil loop with multiple outdoor-air coils, a two-way valve is needed for each outdoor-air coil (in addition to the central three-way valve) to ensure the fluid heated by the exhaust air is distributed to each of the outdoor-air coils and the optimum amount of energy is recovered.

Supplemental heat. For this example laboratory building, the outdoor air handlers are required to deliver 55°F air year-round. This may require supplemental heat if the coil loop cannot provide all the needed capacity.

Add heat with additional coil. One solution is to add a hot-water coil located immediately downstream of the outdoor-air coil (see left-hand diagram in Figure 9). This supplemental coil is used, when needed, to warm the air to the air handler's current supply-air temperature setpoint (55°F for this example) using hot water supplied by either a boiler or heat pump.

Add heat into loop. An alternative solution is to add heat to the coil loop fluid before it enters the outdoor-air coils (see right-hand diagram in Figure 9, and Figure 10). This has the advantage of reducing the number of coils in the air handler, and also avoiding the need to install hot-water pipes to each air handler. However, this approach greatly reduces the amount of heat recovered and will not be able to achieve a 0.50 sensible energy recovery ratio, as required in this example.

Figure 7. Networked coil loop flow diagram with control valves

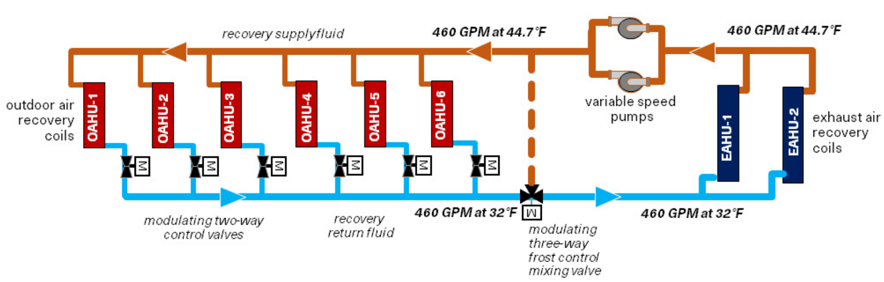


Figure 8. Frost prevention in a networked coil loop

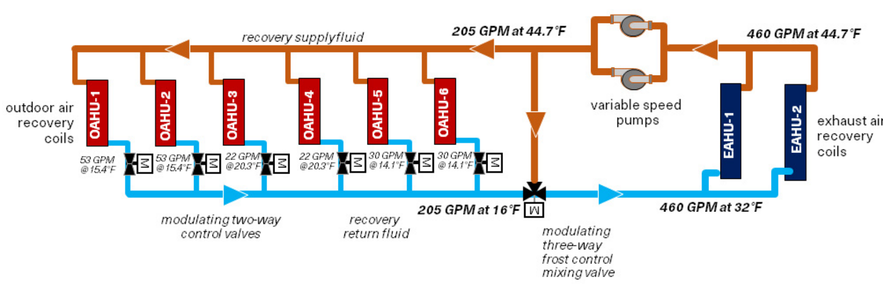
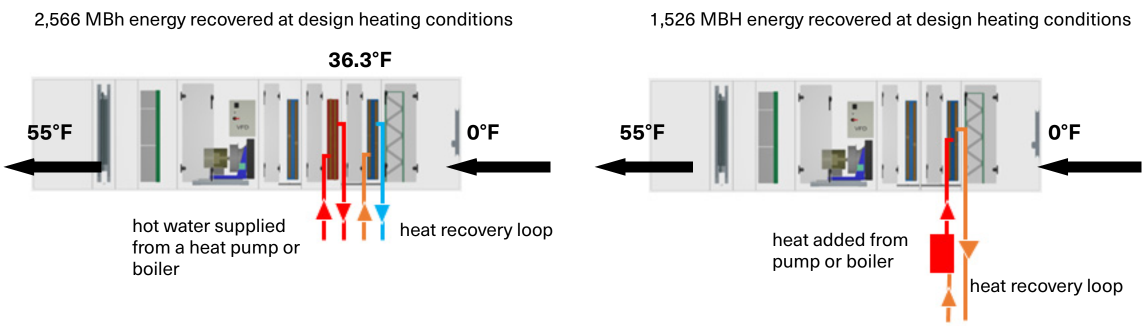


Figure 9. Supplemental heating methods

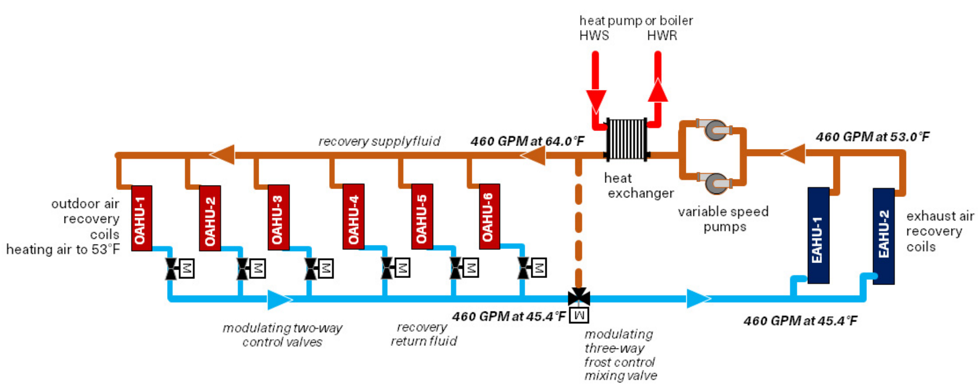


Hot-water coil located downstream of recovery coil | **Heat added to the coil loop**

Table 3. Example coil loop performance with supplemental heat added to the loop

Unit	Air Flow scfm	Face Velocity fpm	Air Pressure Drop in. H_2O	Entering		Leaving		Capacity		
				DB °F	WB °F	DB °F	WB °F	Total MBH	Sens MBH	Latent MBH
EAHU-1 & 2	30,000	433	0.93	70.0	54.4	46.7	44.0	763	763	0

Figure 10. Supplemental heat added to fluid in the loop



Loop heating penalty. Adding heat to the fluid in the loop raises the overall loop temperature. This reduces the amount of heat that can be recovered, since it is more difficult for this warmer fluid to extract heat from the exhaust air (see Table 3 and Figure 10, as compared to Table 1). In this example, the total amount of heat recovered at design heating conditions drops by 40 percent to 1,526 MBh (763 MBh from each exhaust air handler) and the sensible heat recovery ratio drops to 0.30 (equates to a sensible effectiveness of 33 percent).

Capacity control in cooling mode. Modulating the capacity of a coil loop in cooling mode is not required. However, the coil loop pump(s) should be turned off to avoid transferring unwanted heat to the entering outdoor air during this mode. This occurs when the entering outdoor-air temperature drops below the entering exhaust-air temperature. At these conditions, operating the coil loop pump would transfer unwanted heat from the warmer exhaust air to the cooler outdoor air.

Oftentimes, in cooling mode, the coil loop pump is not activated until the entering outdoor-air temperature rises to a few degrees above the exhaust-air temperature (above 80°F when the exhaust air is 75°F, for example). When the temperatures are this close, the amount of heat transferred is relatively small and operating the coil loop pump is less efficient than providing this cooling capacity using the chiller-water system.

Equal versus different fluid flow rates. The coil loop selected for this example laboratory uses the same fluid flow rate at both cooling and heating design conditions. However, if the fluid pressure drop at heating design conditions is very high, it may be desirable to reduce the fluid flow rate during cooling operation to best optimize performance. In other applications, the fluid flow rate might be higher at cooling design conditions to increase sensible effectiveness. In either of these cases, the coil loop pump(s) will be controlled to different pressure setpoints in cooling versus heating mode.

For the example depicted in this EN, the fluid pressure drops are relatively low, so the same fluid flow rate is used at both heating and cooling design conditions.

Table 4 includes this example coil loop's performance at cooling design conditions. The sensible energy recovery ratio is 0.50, which equates to a sensible effectiveness of 56 percent.

Table 4. Example optimized coil loop performance, at cooling design conditions

Cooling design exhaust coil air performance data

Unit	Air Flow scfm	Face Velocity fpm	Air Pressure Drop in. H_2O	Entering DB °F	Leaving DB °F	Capacity Sens MBH
EAHU-1 & 2	30,000	433	0.79	72.0	84.9	421

Cooling design exhaust coil fluid performance data

Unit	Fluid Flow gpm	Fluid Velocity ft/s	Fluid Pressure Drop ft. H_2O	Entering °F	Leaving °F	Capacity MBH	Fluid
EAHU-1 & 2	230	2.54	11.9	85.5	81.4	421	30% ethylene glycol

Cooling design outdoor coil air performance data

Unit	Air Flow scfm	Face Velocity fpm	Air Pressure Drop in. H_2O	Entering DB °F	Leaving DB °F	Capacity Total MBH
OAHU-1 & 2	17,000	507	0.55	95.0	83.7	214
OAHU-3 & 4	6,000	495	0.55	95.0	83.7	76
OAHU-5 & 6	10,000	481	0.55	95.0	83.6	127

Cooling design outdoor coil fluid performance data

Unit	Fluid Flow gpm	Fluid Velocity ft/s	Fluid Pressure Drop ft. H_2O	Entering °F	Leaving °F	Capacity MBH	Fluid
OAHU-1 & 2	110	3.29	17.0	81.4	85.8	214	30% ethylene glycol
OAHU-3 & 4	54	3.52	16.6	81.4	84.5	76	30% ethylene glycol
OAHU-5 & 6	66	3.33	17.2	81.4	85.7	127	30% ethylene glycol

Conclusion

Recovering energy from a building's exhaust air using a coil loop can be a flexible and efficient solution, especially when trying to reduce the peak heating load. To help maximize efficiency, the coil selections need to be optimized for the application. This will result in different type and size of coils for different airflows.

With today's building automation, control and monitoring of coil loop performance can be integrated without complicated control techniques. Control of the coil loop is similar to capacity control of conventional hydronic cooling and heating coils, as the same valve and pump types and control methods are used. The heat-recovery coils should be part of the air handler's control sequence to ensure reliable operation and optimize energy recovery.

To help maximize the amount of energy recovered, supplemental heating should be accomplished using a downstream heating coil. Alternatively, heat can be added to the fluid in the loop, but this will reduce the amount of heat recovered.

This all makes coil loops more efficient and easier to implement than 40 years ago.

By Ronnie Moffitt, Trane. To subscribe or view previous issues of the Engineers Newsletter visit trane.com. Send comments to ENL@trane.com.

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