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ENGINEERING

SYSTEM SOLUTIONS

In this issue, we begin with a discussion on how face and bypass damper control for Unit Ventilators provides better humidity management than valve-controlled chilled water systems when dealing with increased classroom ventilation rates. We also have a brief introduction to McQuay's vertical self-contained system – a flexible system to consider for your next building project.

For those of you who didn't catch our first issue, you'll find our newsletter on our website at www.mcquay.com. Also on our website, check out our "What's New" page for the latest literature on McQuay Applied Rooftop Systems, Vision™ Customized Air Handlers, Vertical Self-Contained Air Conditioning Systems, and Heating and Cooling Coils.

McQuay provides semi-custom system solutions for commercial HVAC applications. This newsletter is written specifically for the HVAC engineering community. We welcome your comments, feedback, and article suggestions.

Dave Laurenz
Director of Sales
McQuay International

Classroom Humidity Management with Face and Bypass Damper-Controlled Unit Ventilators

What's it all about? Why it's better.

For many years, Unit Ventilators have provided precise temperature control for classrooms. Designed to keep the air circulating in the room while adding fresh air and maintaining a comfortable temperature for students, Unit Ventilators must do more from a performance standpoint than what is required from a fan or a vent.

About half of the time, classrooms are typically cooled by outdoor air, even in cold climates. Thus, it is essential that Unit Ventilators deliver maximum outdoor air when classrooms need "natural" cooling. The face and bypass damper is the "traffic light" in these units. It allows all air to go through the heating/cooling coil for fast warm-up or cool-down, in addition to allowing a portion of the air to go through the coil and a portion to bypass the coil at conditions other than design. It also allows all air to bypass the coil when only ventilation cooling is required (Figure 1).

ASHRAE Standard 62.1-1999 calls for a ventilation rate in schools of 15 cfm per pupil. For a 30 student classroom, this would require 450 cfm of outdoor air. As a result, during the cooling season, such an increased amount of damp unconditioned humid outside air can cause humidity build-up and its many related problems. The effect is intensified at part-load conditions with a muggy outdoor air environment because, during most of the time cooling is actually required, the design cooling conditions do not occur.

On a valve-controlled chilled water system, the relationship between coil capacity and gpm is not a linear one (see Figure 2). In fact, if only 50% of the design capacity is needed, it is quite possible that only one quarter of the flow might be required, which will result in a 20°F water temperature rise. At this reduced flow, sensible cooling quickly raises the coil temperature and reduces its ability to remove moisture from the air. Consequently, a valve-controlled chilled water coil is not very effective at maintaining a comfortable humidity level at part-load conditions.

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McQuay® International

Classroom Humidity Management, continued from page 1.

Figure 1

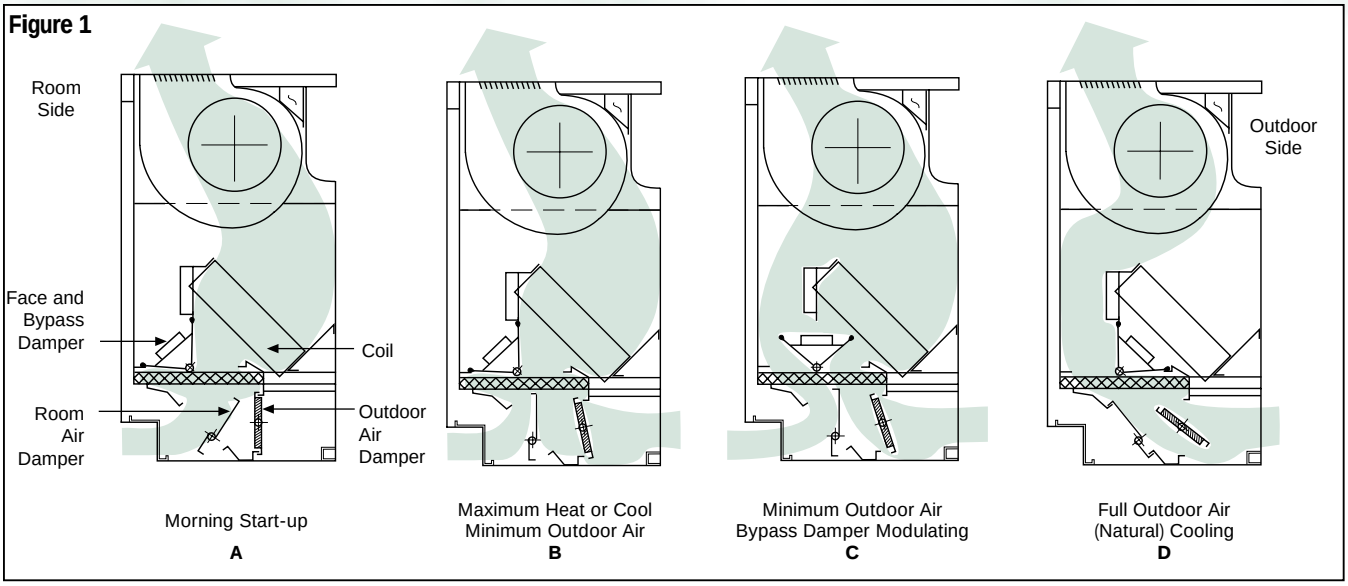
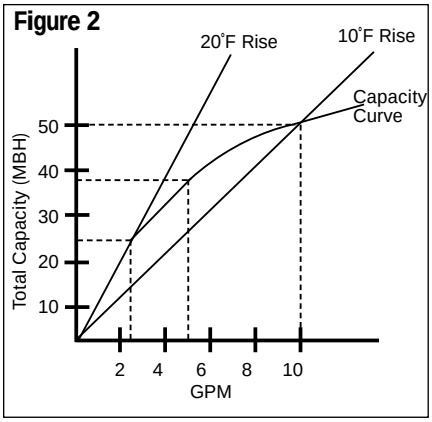


Figure 2



But face and bypass damper control, coupled with draw-through unit construction, offers maximum dehumidification and optimal temperature control all of the time. On a draw-through unit, the fans are located after the heating/cooling coil, just like a central station air handler, which keeps indoor and outdoor air separated until it is optimal to mix them (Figure 1). In most part-load conditions, the majority of the humid outdoor air passes through the cold coil where the moisture is removed, providing maximum condensate removal, and the previously treated room air bypasses the coil. In this scenario, humid outdoor air is not bypassed around the coil until the amount of air passing through the coil decreases below the amount of outdoor air that is being introduced into the unit.

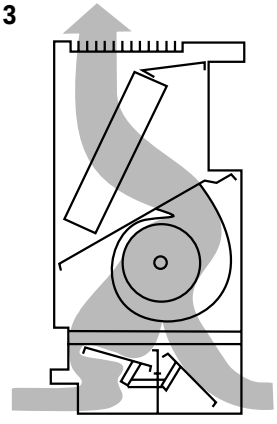
On the other hand, with blow-through construction (Figure 3), the amount of humid outdoor air that is bypassed around the coil at part-load conditions is directly proportional to the percentage of the total air stream being bypassed. Thus, the amount of moisture removed at part loads is reduced.

As an example, the tables on the next page represent the two most popular sizes of chilled water Unit Ventilators, the nominal 1250 cfm and 1500 cfm sizes. The tables compare the composition of the air streams *through* the coil and air streams *bypassing* the coil at various bypass air percentages for draw-through and blow-through unit ventilators using 450 cfm of outdoor air.

At part load, significant differences are evident in the room air and outdoor air compositions of the two unit types. This shows that the most effective way of maintaining an acceptable humidity level with a chilled water Unit Ventilator system is *to use a face and bypass damper-controlled draw-through unit.*

The advantages of this type of control and unit type are even more far reaching. In addition to *superior humidity control*, face and bypass damper control offers a variety of benefits including:

Figure 3



- **An inherent modulating effect:** Face and bypass damper control eliminates the dilemma of control valve sizing. Many valve control applications do not provide proportional control because of the tendency to over-size the valve.
- **Constant system head on pumps:** With no control valve in the system and constant flow through the units, you have a stable system with overall lower total head. Modulating control valves are one of the most restricted points in a system, and elimination of these valves reduces total head against which the pump must operate.
- **Easier system to balance:** With fluctuating head pressure on the pumps virtually eliminated, balancing of the system to assure the correct quantity of water in all circuits is assured.
- **Reduced chance of coil freeze-ups:** A side benefit in cold climates, with constant flow of water through the coil, the chance of freezing a coil is minimized, versus a valve controlled situation where water flow is stopped in the coil.

When selecting a Unit Ventilator, look for the features that will provide the classroom with the most precise, energy-efficient temperature control possible. A Unit Ventilator with face and bypass damper control and draw-through construction offers the best control, not only of temperature, but of humidity as well. The learning environment – not to mention your relationship with school administrators – will improve considerably.

1250 cfm Draw-through Unit						
% By-pass Air	Bypass Air Stream (cfm)			Air Stream Through Coil (cfm)		
	Total Air	Room Air	Out-door Air	Total Air	Room Air	Out-door Air
0	0	0	0	1250	800	450
10	125	125	0	1125	675	450
20	250	250	0	1000	550	450
30	375	375	0	875	425	450
40	500	500	0	750	300	450
50	625	625	0	625	175	450
60	750	750	0	500	50	450
70	875	800	75	375	0	375
80	1000	800	200	250	0	250
90	1125	800	325	125	0	125
100	1250	800	450	0	0	0

1250 cfm Blow-through Unit						
% By-pass Air	Bypass Air Stream (cfm)			Air Stream Through Coil (cfm)		
	Total Air	Room Air	Out-door Air	Total Air	Room Air	Out-door Air
0	0	0	0	1250	800	450
10	125	80	45	1125	720	405
20	250	160	90	1000	640	360
30	375	240	135	875	560	315
40	500	320	180	750	480	270
50	625	400	225	625	400	225
60	750	480	270	500	320	180
70	875	560	315	375	240	135
80	1000	640	360	250	160	90
90	1125	720	405	125	80	45
100	1250	800	450	0	0	0

1500 cfm Draw-through Unit						
% By-pass Air	Bypass Air Stream (cfm)			Air Stream Through Coil (cfm)		
	Total Air	Room Air	Out-door Air	Total Air	Room Air	Out-door Air
0	0	0	0	1500	1050	450
10	150	150	0	1350	900	450
20	300	300	0	1200	750	450
30	450	450	0	1050	600	450
40	600	600	0	900	450	450
50	750	750	0	750	300	450
60	900	900	0	600	150	450
70	1050	1050	0	450	0	450
80	1200	1050	150	300	0	300
90	1350	1050	300	150	0	150
100	1500	1050	450	0	0	0

1500 cfm Blow-through Unit						
% By-pass Air	Bypass Air Stream (cfm)			Air Stream Through Coil (cfm)		
	Total Air	Room Air	Out-door Air	Total Air	Room Air	Out-door Air
0	0	0	0	1500	1050	450
10	150	105	45	1350	945	405
20	300	210	90	1200	840	360
30	450	315	135	1050	735	315
40	600	420	180	900	630	270
50	750	525	225	750	525	225
60	900	630	270	600	420	180
70	1050	735	315	450	315	135
80	1200	840	360	300	210	90
90	1350	945	405	150	105	45
100	1500	1050	450	0	0	0

McQuay Vertical Self-Contained Systems

The Right Consideration For Your Building Project

Water-cooled, vertical self-contained systems, complete with microprocessor based controls, are a primary product for McQuay. They are engineered for VAV, 100% outside air, dehumidification, and for water and air economy cycles.

Built for longevity and offering the most cabinet sizes, features, and options available, McQuay self-contained systems allow specifiers to customize selections at affordable first costs. The result is exceptionally high operating efficiencies and construction savings of $1.00 to $2.50 per square foot versus chilled water systems.

McQuay self-contained systems are often recognized as floor-by-floor, water-cooled, VAV air conditioning systems that can operate independently according to the needs of the space they serve. By segmenting the cooling within a building, an owner can reduce energy costs and more accurately proportion utility costs among tenants.

Operating efficiencies are maximized by as many as six scroll compressors combined with water-cooled condensing, a water or air economy cycle and VAV operation. The result is overall design efficiencies of 0.65 KW/ton and unit EERs of 14.0. Specifiers can use 5 available compressor horsepower sizes within each unit to optimize system performance and achieve part load efficiencies as low as 0.45 KW/ton.

Two series of self-contained units are available from McQuay. The SWP is primarily intended for new construction projects and is shipped as a complete package to the job site. With sizes ranging from 15 to 145 tons cooling capacity, one unit per floor should accommodate most applications. There is no requirement for insulated chilled water piping or large machine rooms. In addition, the units are available with right or left hand piping and clockwise or counterclockwise fan rotation, giving the engineer the flexibility to fit the unit into the equipment room without compromising system performance.

SWP

For retrofit applications, McQuay's SWT offers a knockdown design that allows it to be negotiated into the building in 3 separate sections without breaking refrigerant lines. This eliminates the need to braze, evacuate, and charge the system with refrigerant in the field. Existing chilled water piping can be used for the condenser water supply via quick connect Victaulic couplings. Wiring is also quick connect to save installation time and money.

McQuay Vertical Self-Contained Systems continued from page 3.

SWT

Because of their proximity to tenant occupied spaces, it is vital that self-contained units operate more quietly than alternative air conditioning systems. McQuay units are constructed of heavy-gauge, welded metal with spring-isolated fan and motor assemblies to reduce vibration. An acoustically designed supply air plenum with thick, high density insulation lined with perforated metal further reduces noise and vibration. The fan discharge is aerodynamically designed to gradually expand air into the ductwork for reduced turbulence. Overall, the units can achieve sound levels in the NC-35 range and have been recognized by renowned acoustic consultants for their low noise levels.

SWP and SWT vertical self-contained systems are designed for reliability, serviceability and redundancy. McQuay is the only manufacturer to have critical components such as compressors, filter dryers, site glasses, direct expansion valves, condensers, and water valves with actuators out of the supply air stream, permitting preventative maintenance and adjustment while the unit is operating.

Consider McQuay vertical self-contained systems for your next building project. See how easy it is to take advantage of these systems and their benefits. For more information, contact your local McQuay representative, or check out our website at www.mcquay.com/whatsnew for a free brochure.

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