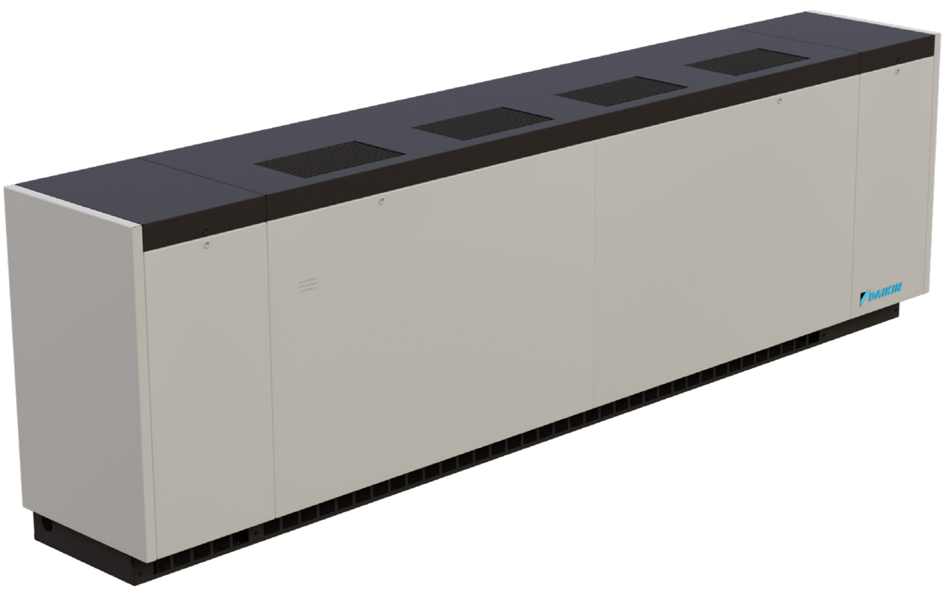
Catalog 1662

Classroom Unit Ventilators

Models AZQ, AZR, and AZU Self-Contained Floor Units
Size 024 (2 Ton) to 054 (4 1/2 Ton)

MicroTech® Control (“K” Vintage)



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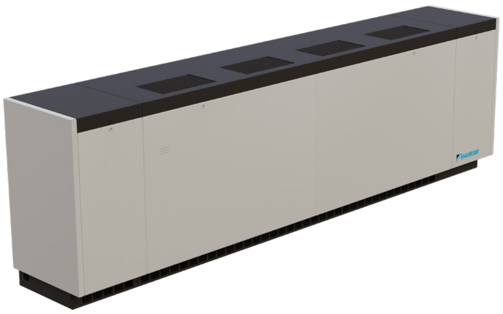
Classroom Unit Ventilators



For nearly a century schools have relied on unit ventilators to keep classrooms comfortable.

Students learn more readily in a quiet, well-ventilated environment. That is why Herman Nelson invented the unit ventilator in 1917. Daikin Applied continues to set the industry standard for performance, features and quality. Today Daikin Applied remains committed to continuing the Herman Nelson-AAF-McQuay legacy as the industry leader and meeting the changing requirements of schools with the highest quality unit ventilator products available.

We realize that keeping expenditures down is a high priority for school administrators and school boards.

Daikin Applied unit ventilators are inexpensive to install and operate, and they are designed and built to provide years of trouble-free service.

Quiet Operation

Daikin Applied unit ventilators are engineered and manufactured to deliver quiet, continuous comfort. We developed our GentleFlo air moving system to minimize operating sound levels—even as demands for more fresh air require units to operate longer and work harder.

The Right Amount of Fresh Air and Cooling

Daikin Applied unit ventilators deliver required amounts of fresh air to meet ventilation requirements, and added cooling capacity to maintain consistent comfort for students and teachers. Our Economizer Operation, Demand Control Ventilation (DCV) and Part Load, Variable Air options allow you to closely match comfort requirements and reduce operating costs.

Precise Temperature and Dehumidification Control

Daikin Applied unit ventilators feature precise temperature and dehumidification control to keep students and teachers comfortable while making maximum use of “free” outdoor-air cooling to reduce operating costs. They utilize a draw-thru air design that contributes to even heat transfer and uniform discharge air temperatures into the classroom. Coupled with our MicroTech® active dehumidification control strategy, they provide precise control of temperature and humidity levels.

Low Installation Costs

New construction installations are easily accomplished with Daikin Applied unit ventilators because they avoid the added cost and space required for expensive ductwork. Retrofit installations are also economical because new units fit the same space occupied by existing ones. Factory installed MicroTech controls provide easy, low cost integration into the building automation system of your choice.

Low Operating Costs

Daikin Applied unit ventilators minimize energy usage by utilizing a two-stage compressor and multi-speed fan to better match changing room loads. They take maximum advantage of “free” cooling opportunities to reduce operating costs. During unoccupied periods and at night, units operate sparingly to conserve energy.

Easy To Maintain, Modular Design

Daikin Applied unit ventilators are designed to provide easy access for maintenance and service personnel to all serviceable components. Most tasks are easily handled by a single person.

Built To Last

Our proven institutional design can withstand the rigors of the classroom environment. It features an extra-sturdy chassis and double-wall damper on the inside; scuff resistant finishes and tamper prevention features on the outside. In fact, many units installed over 30 years ago continue to provide quiet, reliable classroom comfort.

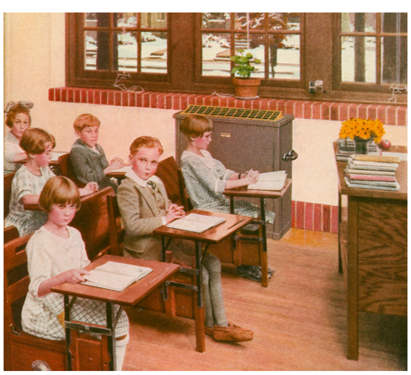
MicroTech Control For Superior Performance, Easy Integration

Daikin Applied unit ventilators can be equipped with MicroTech unit controllers for superior performance. Factory integrated and tested controller, sensor, actuator, and unit options promote quick, reliable start-up and minimize costly field commissioning. MicroTech controls provide easy, low-cost integration into most building automation systems. Daikin Applied's MicroTech UV controller has on-board BACnet communications, with optional LonTalk®, allowing users to communicate control and monitoring information to your BAS, without the need for costly gateways.

AHRI Performance Data

Unit Size	Compressor Capacity	Fan Speed	Nominal Airflow	Cooling Performance	
				Total Capacity	Efficiency
			CFM	Btuh	EER
024	**Full**	**High**	1000	22300	10.5
036	**Full**	**High**	1250	39000	10.4
044	**Full**	**High**	1500	45100	11.2
054	**Full**	**High**	1500	51100	10.3

Notes: Full load cooling conditions: Indoor 80°F db/67°F wb-Outdoor; 95°F db/75°F wb and high-speed fan.



Since 1917

... and setting the standard today

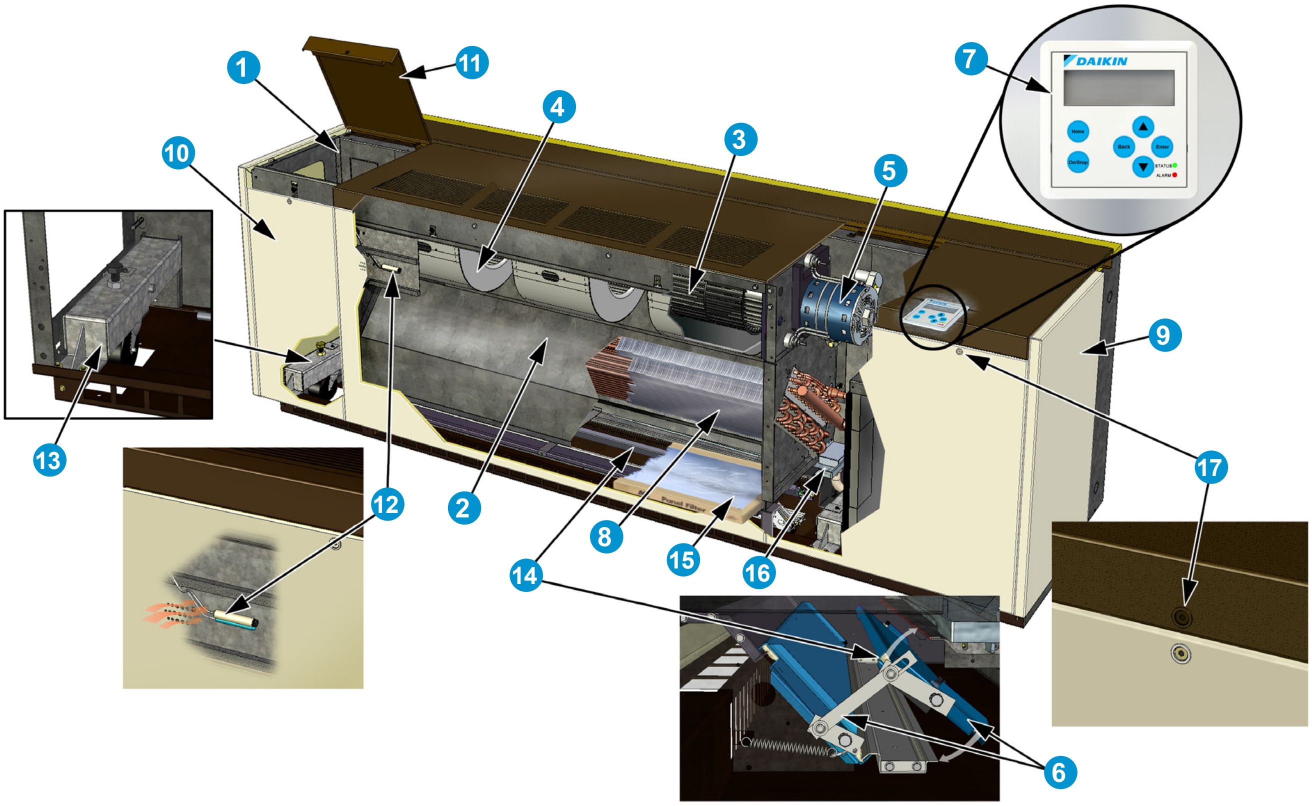
Features and Benefits

The Model AZ Floor Unit

Our Model AZ is a vertical, floor-standing unit that utilizes refrigerant for cooling, and hot water, steam or electric heat for heating. The Model AZ also can be supplied as a cooling/ventilating only unit.

The Model AZ is just right for new construction and for retrofit applications. Older buildings with baseboard radiant heat or other hydronic heating systems can be easily adapted to work efficiently with Model AZ units.

The major features of this model are shown below and described in more detail on the following pages.



1 Welded one-piece chassis
- offers superior strength, durability, and vibration reduction.

2 Unique draw-thru design
- provides uniform air distribution across the coil for even discharge air temperatures.

3 Quiet, aerodynamic fans
- utilize GentleFlo technology for exceptionally quiet unit operation.

4 Accessible fan section
- improves balance, alignment and simplifies maintenance.

5 Fan motor
- located out of air stream and away from heating coil reduces heat exposure to prolong life.

6 Outside air/return air dampers & linkage
- provides superior mixture of outdoor air and room air for precise temperature control.

7 MicroTech controls (optional)
- provide superior comfort control and easy integration into the building automation system of your choice.

8 Advanced heat transfer coil
- design provides extra capacity.

9 Sturdy cabinet construction
- includes hidden reinforcement, a non-glare textured surface, and a tough, scuff and mar resistant finish to stand up to the abuses of a classroom environment.

10 Sectionalized front access panels
- provide easy access to unit interior. Panels are easily removed by a single person. Front side panels can be removed while unit is running.

11 Two hinged top access doors
- provide easy access to the motor, electrical, and refrigeration components.

12 Sampling chamber for unit-mounted sensor
- provides accurate sensing of room temperature.

13 Optional adjustable caster
- (Left and right ends)

14 Insulated double-wall outdoor air damper
- seals tightly without twisting.

15 Full-length air filter
- is efficient and easy to replace. All air delivered to classroom is filtered.

16 Galvanized steel drain pan or optional stainless steel

17 Tamper resistant fasteners on access panels

GentleFlo Delivery

Daikin Applied unit ventilators are engineered and manufactured to deliver quiet, continuous comfort. We developed our GentleFlo air moving system to minimize operating sound levels – even as demands for more fresh air require units to operate longer and work harder. GentleFlo features include:

- Fan wheels are large, wide and rotate at a low speed to reduce fan sound levels. They are impact-resistant and carefully balanced to provide consistent performance.
- Offset, aerodynamic fan wheel blades move air efficiently (Figure 1).
- Precision tolerances help reduce flow and pressure turbulence, resulting in lower sound levels.

- Fan housings incorporate the latest logarithmic-expansion technology for smoother, quieter air flow (Figure 2).
- A large, expanded discharge opening minimizes air resistance, further lowering sound levels.
- Fan construction contributes to equal outlet velocities and promotes quiet operation.
- Fan shafts are of ground and polished steel to minimize deflections and provide consistent, long-term operation.
- Fan assemblies are balanced before unit assembly, then tested after assembly (and rebalanced if necessary) to provide stable, quiet operation.

Figure 1: GentleFlo Fan Technology

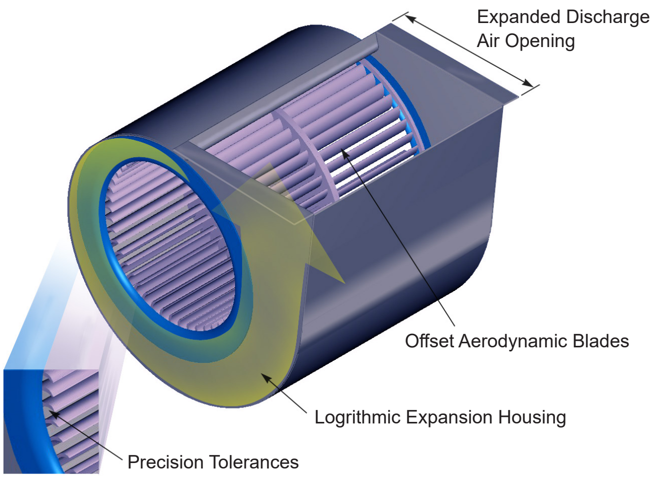
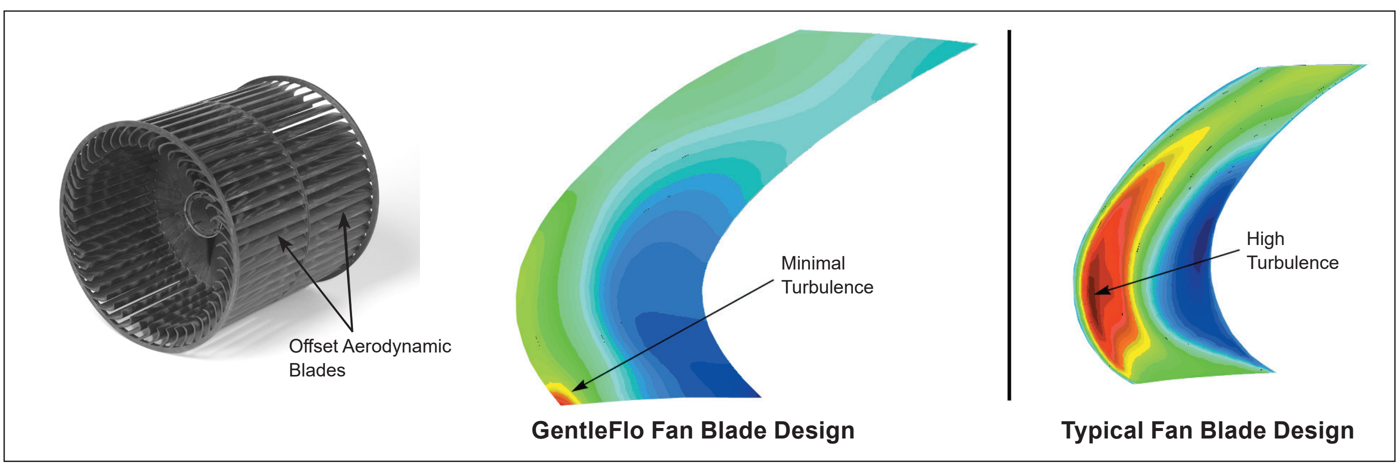


Figure 2: GentleFlo Reduces Turbulence



The Right Amount of Fresh Air and Cooling

Daikin Applied unit ventilators deliver required amounts of fresh air to meet ventilation requirements and added cooling capacity to maintain consistent comfort for students and teachers. Our Economizer Operation, Demand Control Ventilation (DCV) and Part Load, Variable Air options allow you to match classroom comfort requirements even more closely, and reduce operating costs.

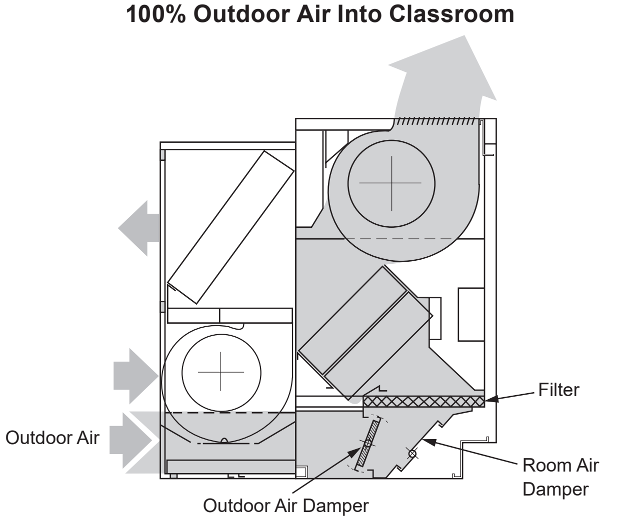
This means that you can be confident that your school is meeting ventilation standards for Indoor Air Quality and that your students are receiving adequate air to be attentive to instruction. At the same time, you are saving money in early morning hours, between classes or after hours when classrooms are heated and cooled but not always fully occupied.

Economizer Operation

It is well recognized that cooling, not heating, is the main thermal challenge in school classrooms. The typical classroom is cooled by outdoor air over half the time, even in cold climates. It is therefore essential that unit ventilators efficiently deliver outdoor air when classroom conditions call for "free" or economizer cooling.

With Daikin Applied unit ventilators, you can have outdoor air whenever it is needed. Economizer operation is facilitated by the outdoor air damper, which automatically adjusts the above-minimum outside air position to provide free cooling when the outdoor air temperature is appropriate (Figure 3). On units equipped with MicroTech controls, three levels of economizer control are available.

Figure 3: Full Economizer Mode



Part-Load Variable Air Control

Part load variable air control can be used to automatically adjust the unit ventilator fan speed based upon the room load and the room temperature. This MicroTech control option provides higher latent cooling capabilities and quieter operation during non-peak load periods by basing indoor fan speed upon room load.

Lower fan speeds in conjunction with our GentleFlo fan technology contributes to a very quiet classroom environment.

Room-temperature PI control loops determine the speed of the fan, which varies according to the room load. It also provides a built-in delay to prevent overshooting for better comfort control. The outdoor air damper's minimum-air position is adjusted with the fan speed to bring in a constant amount of fresh air.

Demand Control Ventilation

Daikin Applied unit ventilators can be equipped to use input from a CO_2 controller to ventilate the space based on actual occupancy instead of a fixed design occupancy. This Demand Controlled Ventilation (DCV) system monitors the amount of CO_2 so enough fresh outdoor air is introduced to maintain good air quality. The system is designed to achieve a target ventilation rate (e.g., 15 CFM/person) based on actual occupancy.

By using DCV to monitor the actual occupancy pattern in a room, the system can allow code-specific levels of outdoor air to be delivered when needed. Unnecessary over-ventilation is avoided during periods of low or intermittent occupancy, leading to improved energy efficiencies and cost savings.

Precise Temperature and Dehumidification Control

Daikin Applied unit ventilators provide precise temperature and dehumidification control to keep students and teachers comfortable while making maximum use of “free” outdoor-air cooling to reduce operating costs. They utilize a draw-thru fan design that contributes to even heat transfer and provides uniform discharge air temperatures into the classroom. MicroTech control strategies and 2-stage compressor operation, provide precise control of temperature and humidity levels under both part-load and full-load conditions.

Draw-Thru Design For Even Discharge Temperatures

The Daikin Applied draw-thru design sets our unit ventilators apart from most competitive models. With this system, fans draw air through the entire heat transfer element (Figure 4) rather than blowing it through highly concentrated areas of the coil element. The result is more uniform discharge air temperatures into the classroom and more efficient unit ventilator operation.

Figure 4: Draw-Thru Design Provides Even Discharge Air

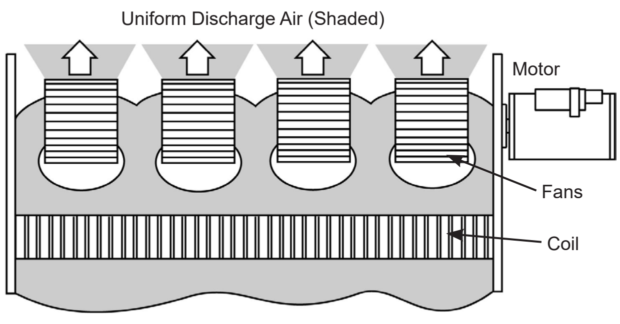
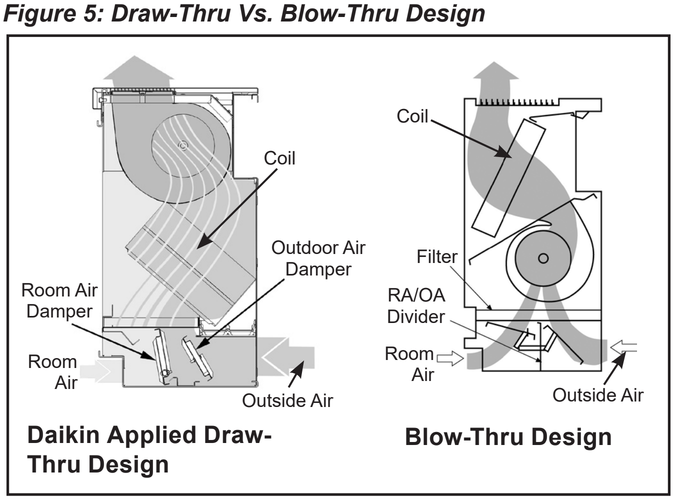


Figure 5: Draw-Thru Vs. Blow-Thru Design



Active Dehumidification (Reheat)

In high-humidity applications where valve-controlled, reheat units are used, the Active Dehumidification Control (ADC) sequence should be considered. During excessive humidity conditions, a humidity sensor directs the unit to continue cooling past the room setpoint to remove excess moisture. Hydronic heat or electric heat is then used to reheat the discharge air to maintain acceptable room temperatures.

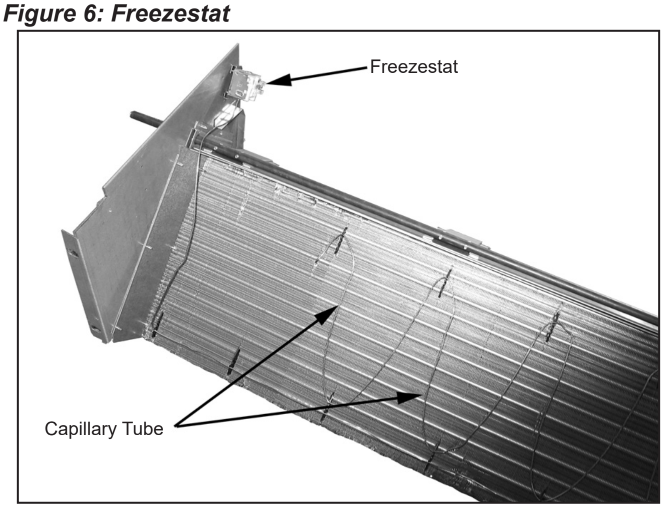
MicroTech controls minimize the amount of reheat needed to maintain relative humidity below a preset limit. Reheat is used only when required and in the most energy-efficient manner possible. See "Active Dehumidification Control (Reheat)" on page 67 for more information.

Increased Coil Freeze Protection

Daikin Applied units equipped with face and bypass damper control provide extra protection from coil freeze-up, because there is a constant flow of hot water through the coil, and water that is flowing typically does not freeze. Additionally, all Daikin Applied units feature a double-walled, insulated outdoor air damper with airtight mohair seals to prevent unwanted coil air from entering the unit.

Furthermore, a low-temperature freezestat is factory installed on all units with hydronic coils. Its serpentine capillary tube senses temperatures across the leaving air side of the coil, allowing the unit controller to react quickly to low-temperature conditions.

Figure 6: Freezestat



Low Installation Costs

Daikin Applied unit ventilators have many features that make them economical to purchase and to install in both new construction and retrofit applications. It is this attention to detail and understanding of school applications that make them the system of choice.

Perfect For Both New & Retrofit Applications

New construction installations are easily accomplished with Daikin Applied unit ventilators because they avoid the added cost and space required for expensive ductwork. Further savings can be realized because piping installations use less space than duct systems.

This is important in existing buildings and also in new construction where floor-to-floor heights can be reduced, saving on overall building costs.

Retrofit installations are economical because new units typically fit the same space occupied by existing ones, resulting in lower project cost and shorter project schedules.

Controls Flexibility

Multiple control options offer easy, low cost integration of Daikin Applied unit ventilators into the building automation system of your choice (See "Communication Types" on page 69).

MicroTech controls come with on-board BACnet MS/TP communications, with optional LonTalk, to communicate control and monitoring information to your BAS, without the need for costly gateways.

Low Operating Costs

Schools consume more than 10% of the total energy expended in the United States for comfort heating and cooling of buildings. As energy costs increase, educators are placed in a difficult position: caught between rising costs, lower budgets and the requirements to raise educational standards.

Fortunately, the technology and the system exists for schools to take control of their energy expenditures while providing a comfortable environment for learning. And that system is the Daikin Applied unit ventilator.

Consider these realities of school environments:

- Most heating energy in schools is expended to heat unoccupied spaces. Because lights, computers and students give off considerable heat, occupied spaces require little supplemental heat.
- The removal of heat is usually required in occupied classrooms, even when outside temperatures are moderately cold (i.e., 35 to 40°F).

Then consider how Daikin Applied unit ventilators, located in each classroom, take advantage of these realities to lower operating costs:

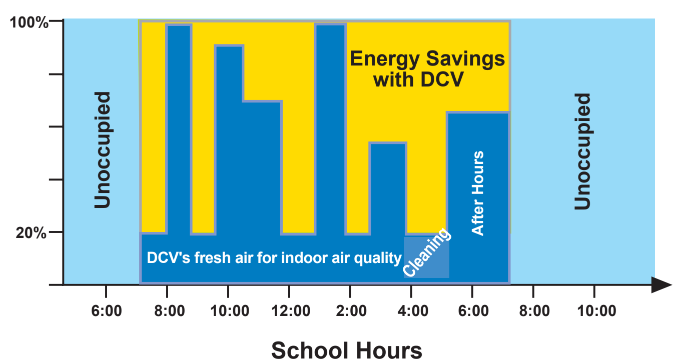
- They provide individual classroom control and comfort.
- They can be cycled on when the room is occupied and cycled off when it is not.
- They bring in fresh air from directly outside the classroom for high indoor air quality.
- During most of the school year, they use outdoor air to keep classrooms comfortable without the expense of mechanical cooling.

MicroTech Control Options Further Reduce Operating Costs

Many of the MicroTech control options available with Daikin Applied unit ventilators can further reduce operating costs. For example:

- **Economizer Operation:** Economizer operation automatically adjusts the above-minimum outside air position to provide free cooling when the outdoor air temperature is appropriate.
- **Demand Control Ventilation:** By using CO_2 levels to monitor the actual occupancy pattern in a room, the system can allow code-specific levels of outdoor air to be delivered when needed without costly over-ventilation during periods of low or intermittent occupancy (Figure 7).

Figure 7: Energy Savings with Demand Control Ventilation



- **Occupancy Mode Operation:** Units can be programmed to operate only sparingly during unoccupied periods and at night to conserve energy.

Two-Stage Compressor

Air conditioning units are usually sized for worse case conditions. During high load requirement the unit will operate in high fan speed and high compressor capacity. Most of the time there is not a full load on the compressor. Operation in lower load will be at medium or low fan speeds which will be at the lower displacement compressor stage. The two stage compressor will remain at low speed until more cooling is required. With the two-stage compressor, the unit will run on lower fan speeds most of the time improving comfort through better humidity control and quieter operation, while minimizing issues with over-sizing.

Other units utilizing single stage compressors operate at full compressor capacity all of the time regardless of fan speed.

Easy To Maintain

Daikin Applied unit ventilators are designed to provide easy access for maintenance and service personnel to all serviceable components. Most maintenance tasks are easily handled by a single person.

Accessible Fan Deck

The accessible fan deck provides access to fan wheels, motors, bearings, and other components for service, cleaning, or repair.

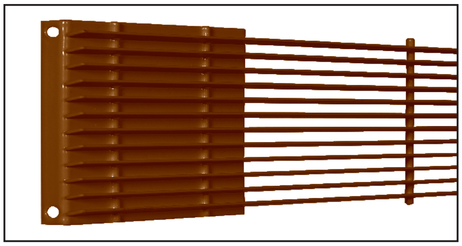
The fan deck's rotating element has one large, self-aligning end bearing and a permanently lubricated motor bearing for smooth operation. On most sizes the location of the fan shaft bearing is at the end of the shaft (out of the air stream).

Figure 8: Permanently Lubricated Long-Life Motor Bearing

Heavy-Duty Discharge Grille

The discharge grille on the top of the unit is made from extra-strength steel bar stock, promoting long life (Figure 9). It can be removed to facilitate cleaning of fans and fan housings. A built-in 10-degree angle provides proper air throw to blanket the room for proper air circulation and comfort.

Figure 9: Heavy-Duty Steel Discharge Grille



Easy Motor Removal

Unlike with many competitive models, the motor in Daikin Applied unit ventilators is separate from the fan assembly and is located out of the airstream at the end of the fan shaft—away from the hot coil—for easier maintenance and removal. Locating the motor away from the coil (Figure 10 on page 11) has the added benefit of extending motor life. Our direct-coupled motor and self-aligning motor mount facilitate motor change-out. The motor comes with a molex plug that fits all sizes and further simplifies removal.

Figure 10: Accessible Design

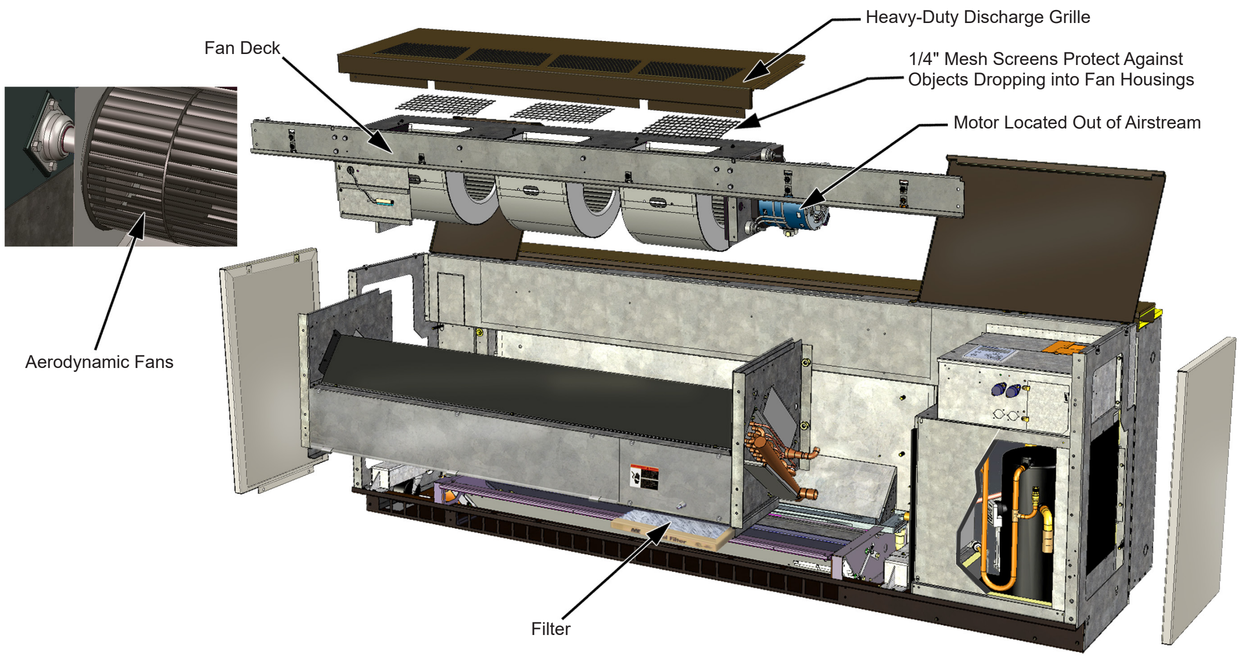
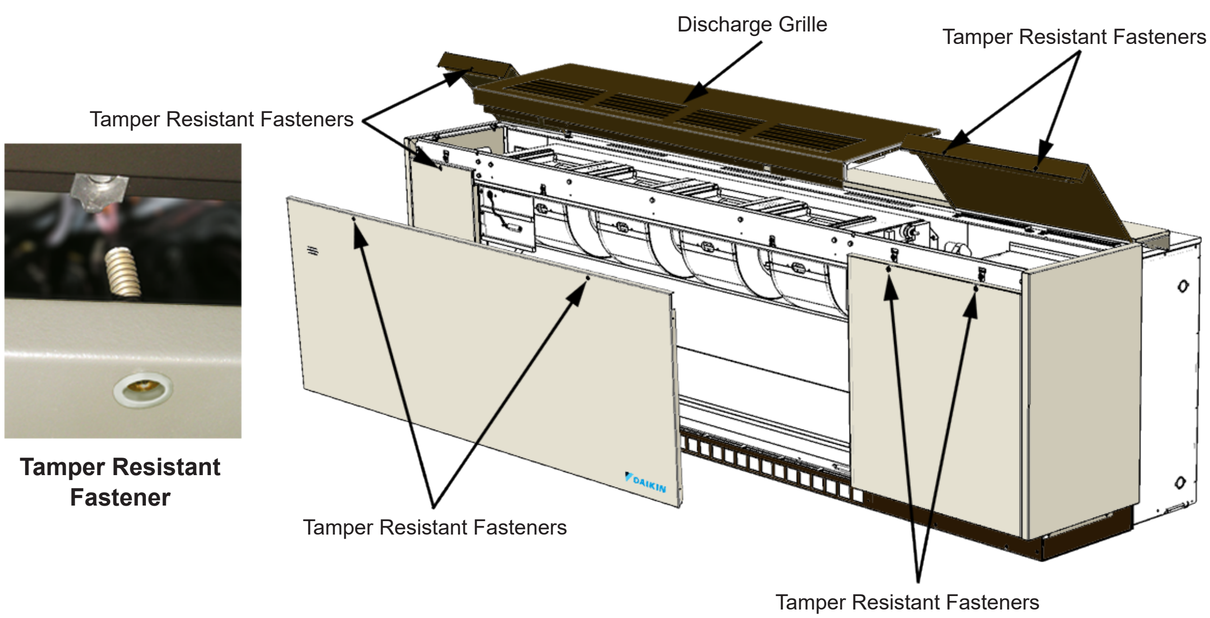


Figure 11: Easy Access with Tamper-Resistant Fasteners



Tamper-Resistant Fasteners

Front panels and top access doors are held in place by tamper-resistant, positive-positioning fasteners. They are quickly removed or opened with the proper tool, but deter unauthorized access to the unit's interior (See Figure 11 on page 11).

Sectionalized Access Panels and Doors

All units have three separate front panels and hinged top access doors, sized for convenient handling by a single person (See Figure 11 on page 11). The result is easy, targeted access to the component that needs servicing:

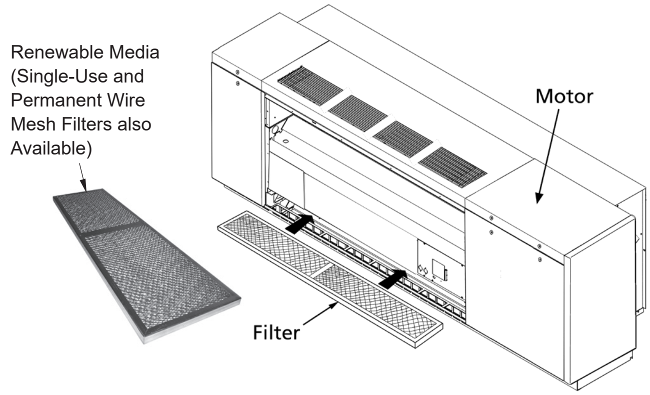
- Two end panels provide easy access to piping, temperature control components and the fan switch. Unlike units with full-length front panels, these can be removed without disturbing the normal operation of the unit.
- Hinged top access doors provide easy access into the end compartments to facilitate convenient servicing of the motor, electrical, and refrigeration components.
- Center front panel provides easy access to the filter and the fan shaft bearing on unit sizes 044 and 054.

Filter

Three filter types are offered:

- Units come standard with a single-use filter which is designed to be used once and discarded.
- Optional, permanent metal filters are available and can be removed for cleaning and reused numerous times.
- Renewable media filters, which consist of a heavy-duty, painted-metal structural frame and renewable media.

Figure 12: Easy Access to Filter



Built To Last

Our industrial-strength design provides the durability to withstand the rigors of the classroom environment. Its solid construction and rugged finish promotes continued alignment, structural strength and long-lasting beauty decades after the unit is installed. In fact, many units installed over 30 years ago continue to provide quiet, reliable classroom comfort.

Heavy Duty Frame Construction

Daikin Applied's exclusive, unitized frame (Figure 13 on page 13) is far superior to the fastener-type construction used by other manufacturers. Loosened fasteners can cause vibration, rattles and sagging panels. With unitized construction, there are no fasteners (screws or bolts) to come loose.

Other design features that promote trouble-free operation and long life include:

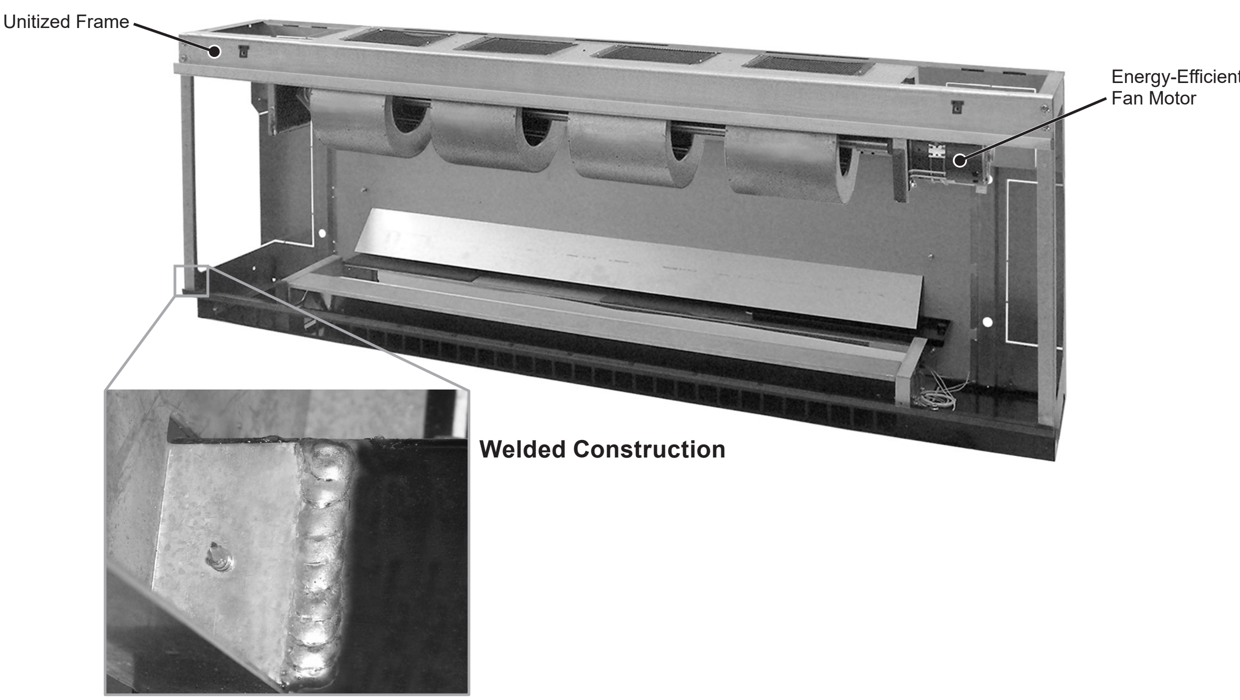
- A corrosion-resistant, galvanized-steel frame.
- Extra-strength, steel-bar discharge grille.
- Heavy-gauge-metal cabinet access panels and doors.
- An extra-strength pipe tunnel that stiffens the structure while adding aerodynamic air flow within the unit.
- Hidden reinforcement that provides additional built-in support for the top section as well as better support for the fan deck assembly.
- A rigid exterior that is strong enough to support maintenance personnel without fear of damaging the unit.

Rugged Exterior Finish

The superior finish of the unit ventilator's cabinets fosters long-lasting beauty as well as resistance to abuse and corrosion. We apply the very highest standards at every step of the finishing process to provide lasting quality:

- High-quality furniture steel is carefully inspected before painting. Scratches and marks that might show through are removed.
- After fabrication, the metal undergoes a five-stage cleaning and phosphatizing process to provide a good bonding surface and reduce the possibility of peeling or corrosion.
- A specially formulated, environmentally friendly, thermosetting urethane powder is applied electrostatically to the exterior panels. This film is oven-cured to provide correct chemical cross-linking and to obtain maximum scuff and mar resistance.
- The top of the unit is finished with a textured, non-glare and scuff resistant, charcoal bronze electrostatic paint. End and front panels are available in a pleasing array of architectural colors.
- The Oxford brown steel kickplate is coated and baked with a thermosetting urethane powder paint to blend with floor moldings and provide years of trouble-free service.
- Each unit is painstakingly inspected before boxing, then encapsulated in a clear plastic bag, surrounded by an extra-heavy-duty cardboard box and secured to a skid to help provide damage-free shipment.

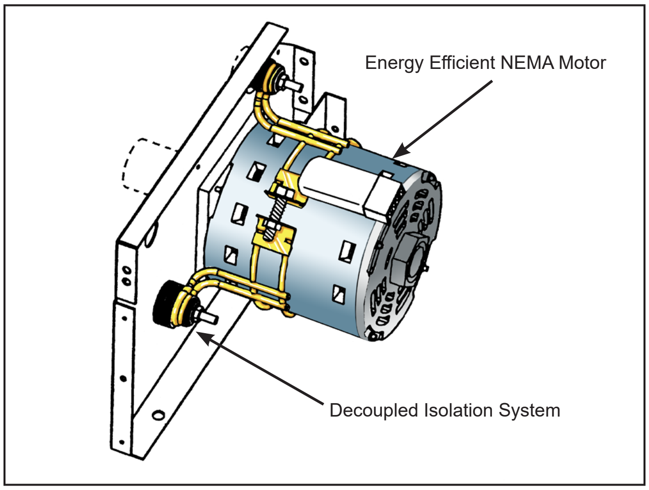
Figure 13: Heavy-Duty, Welded Chassis



Durable, Energy Efficient Fan Motors

Daikin Applied unit ventilators are equipped with 115/60/1 NEMA motors that feature low operating current and wattage (Figure 14).

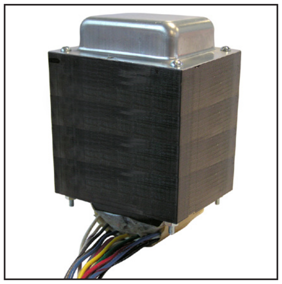
Figure 14: Energy-Efficient Fan Motor



Additional features of these motors include:

- Split-capacitor (PSC) design with automatic reset and thermal-overload protection.
- No brushes, contacts or centrifugal starting switches the most common causes of motor failure.
- A built-in, decoupled isolation system to reduce transmission of vibrations for quieter operation.
- A multi-tap, auto-transformer (Figure 15) provides multiple fan motor speed control through the speed switch. The motor is independent of supply voltage, which allows stocking of one motor (school district-wide) for various voltage applications.

Figure 15: Multi-Tap Auto-Transformer



Durable Damper Design

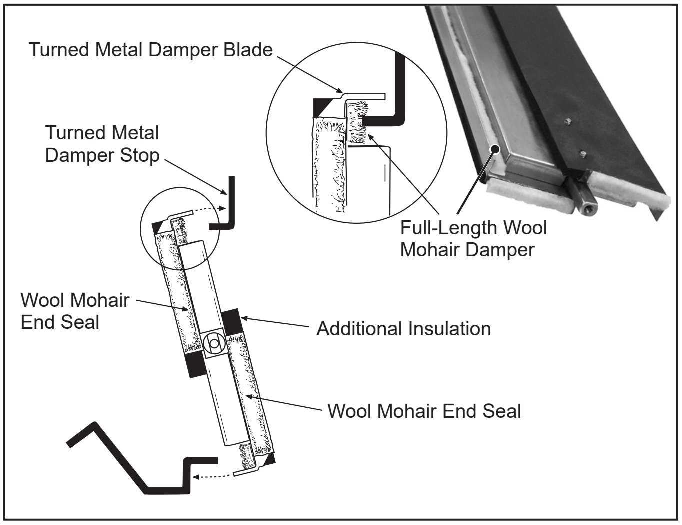
All dampers in Daikin Applied unit ventilators use the turned-metal principle on their long closing edges (Figure 16). Positive sealing is provided by embedding the edge into wool mohair (no metal to metal contact). There are no plastic gaskets to become brittle with time, sag with heat or age, or require a difficult slot fit to seal.

Nylon damper bearings foster quiet, maintenance-free operation.

Additional features include:

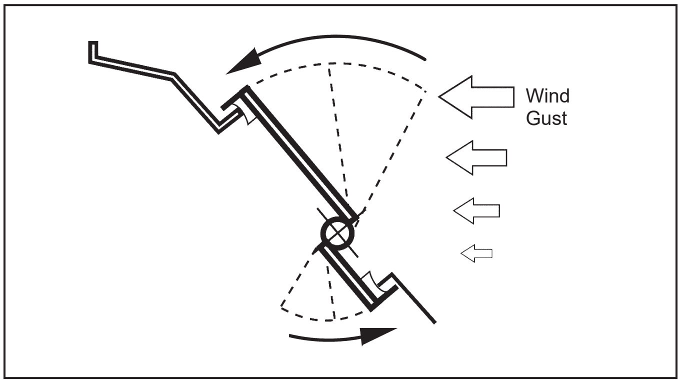
- Outdoor air dampers are made of galvanized steel to inhibit corrosion, with double-wall welded construction for rigidity and encapsulated insulation (Figure 16). Additional insulation is provided on the exterior of the outdoor air damper blade and on the outdoor air entry portion of the unit.

Figure 16: Outdoor Damper Seals Out Cold Weather



- Room air dampers are free-floating and designed to prevent intermittent gusts of cold air from blowing directly into the classroom on windy days (Figure 17). They are constructed of aluminum with built-in rigidity. The metal forming technique that is employed resists twisting and incorporates a full-length counter weight for easy rotation. The simple principle of an area exposed to a force is used to automatically close the damper, rather than open it, when gusts of cold air occur.

Figure 17: Room Air Damper Auto-Closed by Wind Gusts



General Data

Model Nomenclature

U	AZR	K	024	H	G	12	Z	B1	AL	22	G	I	B	3
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Category	Code Item	Code Option	Code Designation & Description			
Product Category	1	1	U	Unit Ventilators		
Model Type	2	2-4	AZU	Air Source DX, Valve Heating	AZQ	Air Source DX, Face & Bypass Heating
			AZR	Air Source DX, Valve Reheat		
Design Series	3	5	K	Design K		
Nominal Capacity	4	6-8	024	24,000	044	44,000
			036	36,000	054	54,000
Voltage	5	9	C	208/60/1	H	230/60/3
			G	230/60/1	K	460/60/3
			D	208/60/3		
Coil Options	6	10	G	Direct Expansion	9	Direct Expansion with Stainless Steel Drain Pan
Heating Options	7	11-12	12	3 Element Low Cap. Electric Heat	68	Steam Low Cap.
			13	6 Element Low Cap. Electric Heat	69	Steam High Cap.
			65	1 Row HW	00	None
			66	2 Row HW		
Hand Orientation	8	13	Z	Not Available		
Controls	9	14-15	##	MicroTech Controls (See Control Code Table Below)		

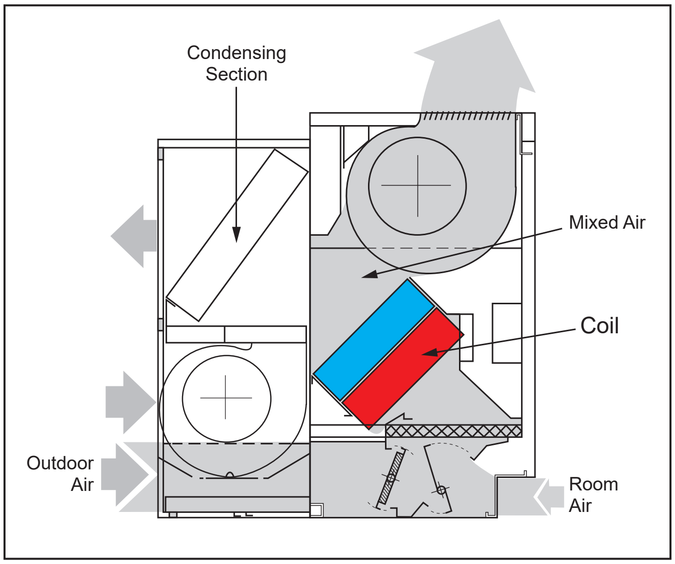
Control Features		Feature Selections							
Open Protocol	BACnet / Stand-Alone	•		•		•	•		
	LonMark		•		•			•	•
DCV	CO_2 Sensor			•	•		•		•
Factory Installed Keypad	LUI					•	•	•	•
		Control Code							
Economizer Control	Basic	B1	B5	B9	BD	BH	BL	BP	BT
	Expanded	E1	E5	E9	ED	EH	EL	EP	ET
	Leading-Edge	L1	L5	L9	LD	LH	LL	LP	LT

Category	Code Item	Code Option	Code Designation & Description			
Controls (cont.)	9	14-15	44	Electromechanical w/2-Position OA Damper for Remote Thermostat		
Discharge	10	16-17	AL	16-5/8" Top Bar Grille		
Return Air/ Outside Air	11	18-19	22	Return Air Bottom Front/Outdoor Air Rear		
Power Connection	12	20	G	Box with Switch		
Color	13	21	I	Antique Ivory	G	Soft Gray
			W	Off White	C	Cupola White
			B	Putty Beige		
SKU Type	14	22	B	Standard Delivery		
Product Style	15	23	3	R-32 Refrigerant		

Model Types

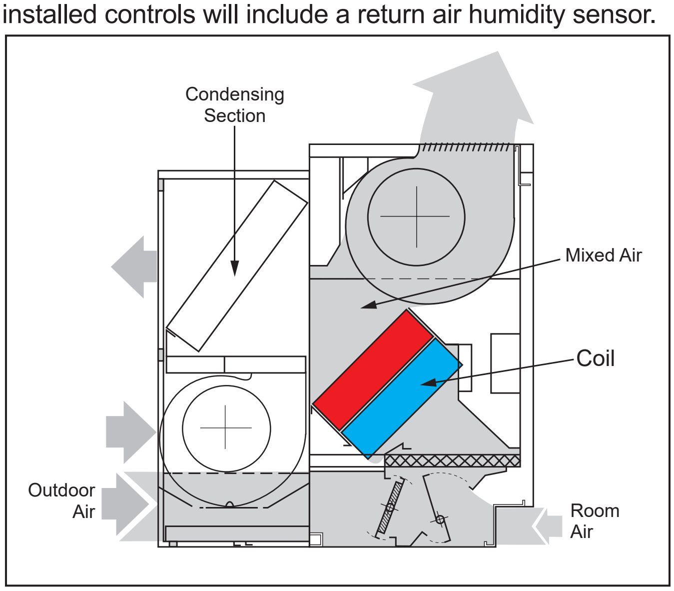
AZU – Valve Control

On model type AZU units the full airflow is directed across the coil(s) at all times. In the heating mode the discharge air temperature is controlled modulating the heating valve. In units with heat the heating coil will be positioned before the cooling coil. The exception to this rule is on units with electric heat or a steam coil, which are always installed after the cooling coil.



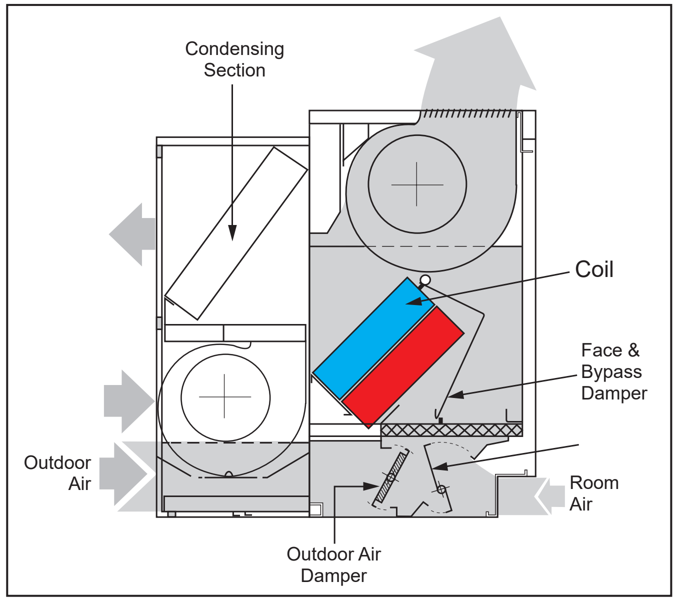
AZR – Valve Control, Reheat

On model type AZR units the full airflow is directed across the coil(s) at all times. In the heating mode the discharge air temperature is controlled by modulating the heating valve. Model AZR units will always have a heating coil positioned after the cooling coil to allow for dehumidification with reheat capability. Units with factory installed controls will include a return air humidity sensor.

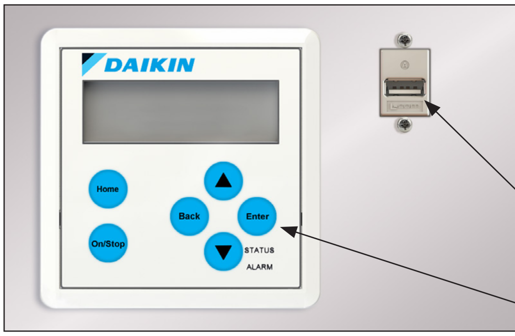


AZQ – Face & Bypass

The model type AZQ units include a face and bypass damper. In the heating mode the discharge air temperature is controlled by varying the portion of the airflow going across the active coil. By modulating the damper position a portion of the airflow is bypassed around the heating coil. In the cooling mode that damper will be positioned to provide full airflow across the coil. The AZQ models are available with hot water or steam heating coils.



MicroTech Controls



Daikin Applied unit ventilators equipped with MicroTech unit control can provide superior performance and easy integration into your building automation system of choice. MicroTech benefits include:

- Factory integrated and tested controller, sensor, actuator and unit options promote quick, reliable start-up and minimize costly field commissioning.
- High-performance features and advanced control options can quickly pay for themselves in saved energy costs and more comfortable classrooms.
- Select from three control levels: stand-alone, client-server or network control.
- Network control applications provide easy, low-cost integration of Daikin Applied unit ventilators into most building automation systems.
- Flexible BAS network communication options guard against controls obsolescence, keeping MicroTech controls viable for the life of your Daikin Applied equipment.

Three Control Levels

MicroTech unit controllers provide the flexibility to operate Daikin Applied unit ventilators on any of two levels:

- As stand-alone units, with control either at the unit or from a wall sensor
- Controlled as part of a network using a centralized building automation system
- In a client-server relationship, where client units follow the server unit for some or all functions

Stand-Alone Control

When operating in stand-alone mode, the MicroTech controller performs complete room temperature and ventilation control. Units can be operated in occupied, unoccupied, stand-by, or bypass (tenant override) modes. Occupied/unoccupied changeover can be accomplished:

- Automatically by an internal daily schedule (two occupied times and two unoccupied times for each of the seven days, and one holiday schedule)
- Using a field-wired occupancy sensor

If a school has more than one zone, separate, internally-programmed schedules are used to regulate each zone.

Client-Server Control

Designate the server and client units and we will factory configure and install the controllers so they are set up for a local peer-to-peer network between units (leaving only the network wiring between these units to be field installed).

Client units can be field-configured to be dependent or independent as follows:

- Dependent client units follow the server unit completely. They are ideal for large spaces that have even loads across the space (such as some libraries).
- Independent client units (default) use server setpoints and client sensors. The client follows the server unit modes, such as heat or cool, but has the flexibility to provide the conditioning required for its area within the space. Independent client units perform better in spaces where loads vary from one area of the space to the other (such as stairwells or cafeterias).

Network Control

MicroTech unit controllers provide easy integration into your building automation system of choice. All factory-installed options are handled by the unit controller. This simplifies the transmission of monitoring and setpoint data to the building automation system.

MicroTech controls have on-board BACnet communication, with optional LonTalk, to communicate control and monitoring information to your BAS, without the need for costly gateways (see "Communication Types" on page 69).

Flexible network communication options help you avoid control obsolescence over the life of your Daikin Applied equipment.

USB Interface

An optional USB-A port can be factory-configured. This option simplifies field access to the MicroTech controller. The USB interface can be used for downloading code, changing unit configuration, accessing external memory, or a field-connection to run the service tool. Technicians will have access to read all inputs, download code, setup/download trend data, and backup, restore, or change unit configuration.

SD Card

An optional SD card can be factory configured. The SD card allows storage of data trending and configuration parameters. For further details see page 74.

Economizer Modes

Economizer operation is facilitated by the outdoor air damper, which automatically adjusts the above-minimum outside air position to provide free cooling when the outdoor air temperature is appropriate. Three levels of economizer control are available:

Basic Economizer Operation: The MicroTech controller compare the inside and outside temperatures. If the temperature comparison is satisfactory, then free- air economizer operation is used to cool the space. Reheat units also come configured with an indoor humidity sensor.

Expanded Economizer Operation: In addition to comparing inside and outside temperatures, outdoor relative humidity is measured to calculate outside air enthalpy. If the enthalpy set point is not exceeded, and the temperature comparison is satisfactory, then free economizer operation is used to cool the space. This helps to minimize the entrance of humid outside air.

Leading-Edge Economizer Operation: The MicroTech controller compare both indoor and outdoor temperatures and indoor and outdoor relative humidities. Then it calculates both inside and outside air enthalpy to determine if free economizer operation can cool the space with non-humid outside air. This is a true enthalpy economizer—a first for unit ventilators.

Demand Control Ventilation

The optional unit mounted, single beam absorption infrared gas sensor has a sensing range of 0 – 2000 ppm and voltage output of 0 to 10 VDC (100 ohm output impedance). The pitot tube sensing device is located in the unit ventilator's return air stream. The optional CO_2 sensor is used with the UVC's Demand Control Ventilation feature to vary the amount of outside air based on actual room occupancy. With network applications, the unit mounted sensor can be overridden by a remote sensor through the network.

Figure 18: Optional CO_2 Sensor

Accessories

End Panels

Daikin Applied end panels can be used to match up Daikin Applied unit ventilators with existing furniture or units, or with field-supplied storage, sink and bubbler cabinet offerings

One-inch end panels (Figure 19) are typically used to finish off stand-alone floor units. Six-inch end panels, with kick plates, can be used to provide extra space needed for piping (Figure 20). All end panels are individually wrapped in plastic and boxed to help prevent damage during construction.

Figure 19: 1" End Panel

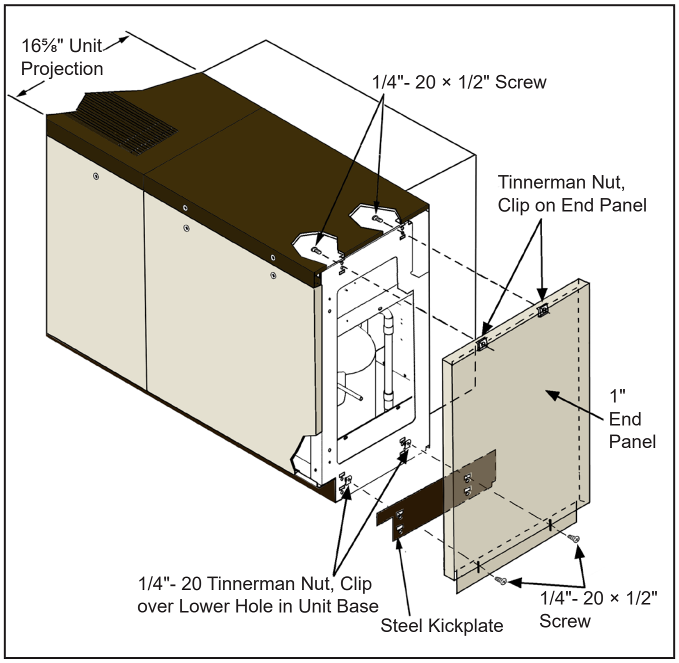
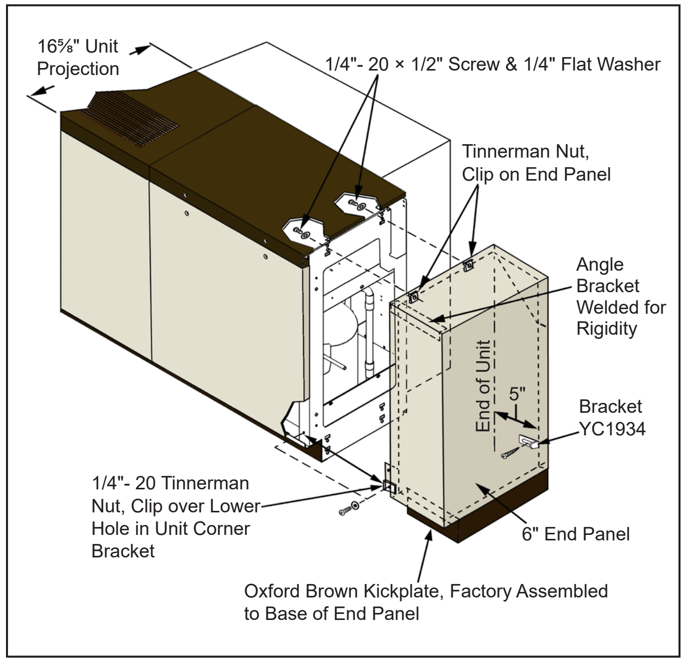


Figure 20: 6" End Panel



Wall Sleeves

The Daikin Applied wall sleeve and louver design is based on a "wet sleeve" concept. In brief, this means the design accommodates the penetration of some moisture into the rear outdoor section of the AZ unit with provisions for containment and disposal of this moisture to the outdoors. Therefore, proper Louver, Splitter and Wall Sleeve installation is critical.

The wall sleeve must be installed before the AZ self-contained unit ventilator can be placed. The recessed portion of the wall sleeve measures approximately 84", 96" or 108" wide by 28" high and may be recessed into the wall up to 11⅜" in depth. Consult approved Daikin Applied submittal drawings for the job to determine the proper amount of recess, if any, and recommended wall opening size.

The AZ unit chassis attaches to the wall sleeve threaded studs using 4-nuts and washers.

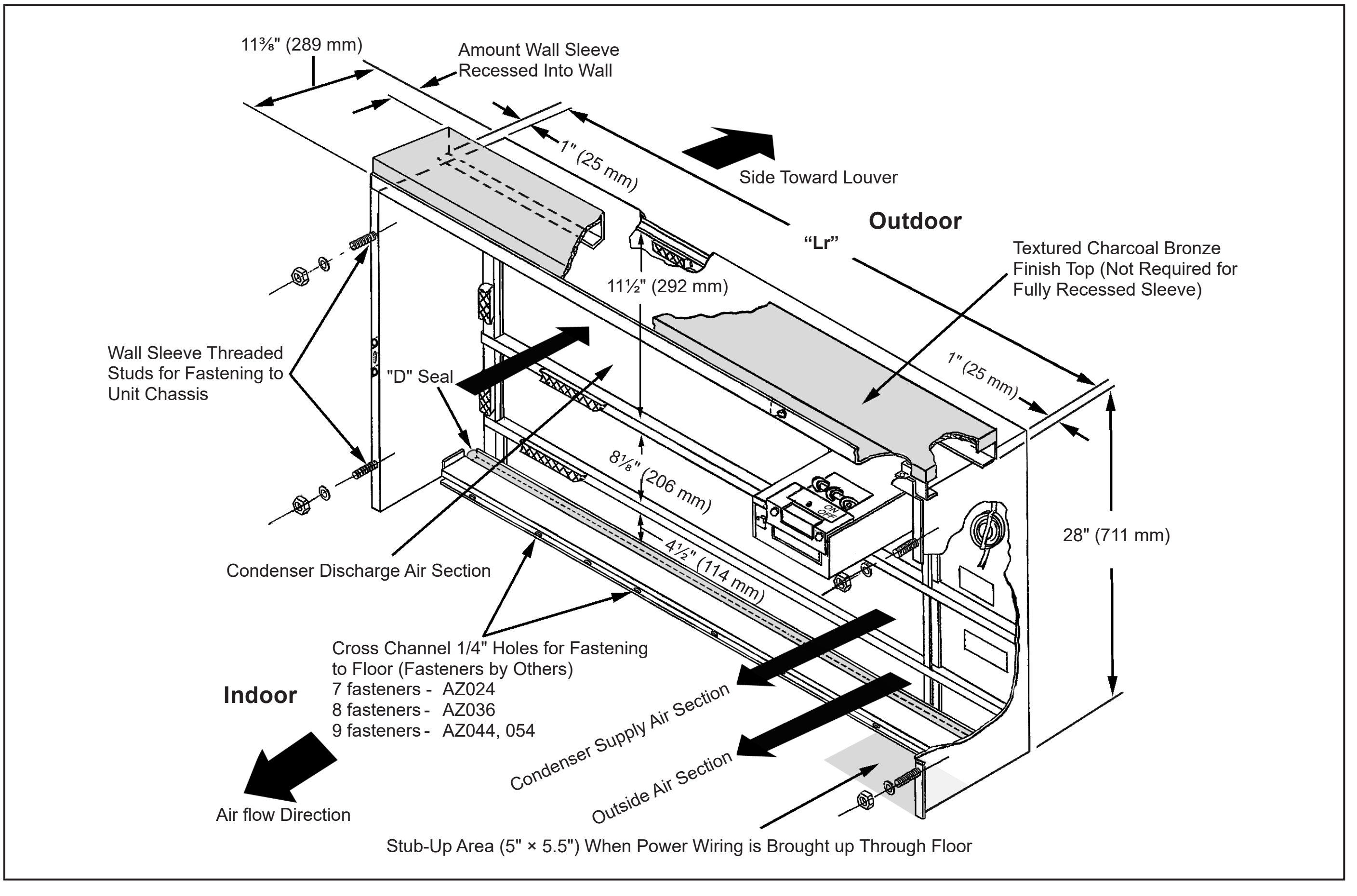
Table 1: Wall Sleeve Dimensions for Figure 21

Unit Size	Overall Length "L" (mm)	Sleeve Recess Length "Lr" (mm)
024	86 (2184)	84 (2145)
036	98 (2489)	96 (2450)
044, 054	110 (2794)	108 (2755)

Table 2: Recommended Rough-In Wall Opening

Unit Size	Recommended Wall Opening	
	Length (mm)	Height (mm)
024	84½" (2146)	28½ (724)
036	96½" (2451)	
044, 054	108½ (2756)	

Figure 21: Wall Sleeve Details (Recessed Type Shown)



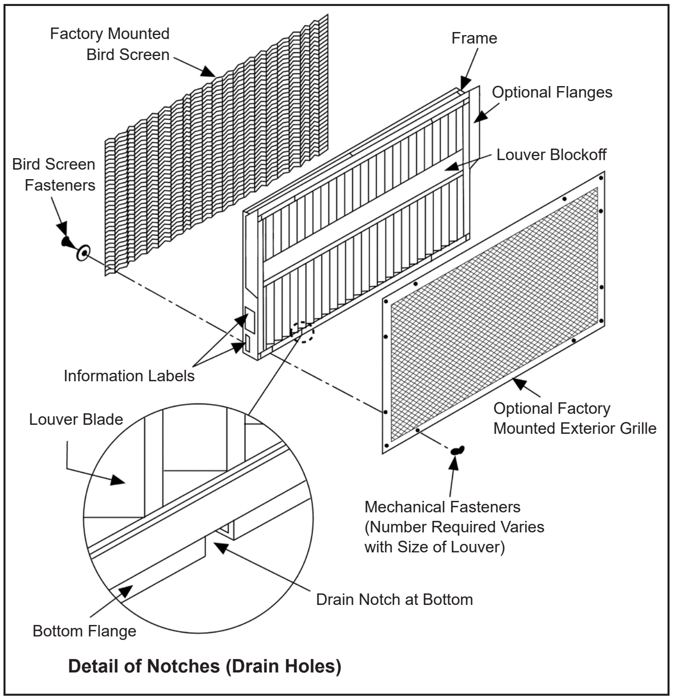
Wall Louvers & Grilles

The standard aluminum louver frame is divided in half horizontally, with make-up and discharge-air stream sections to reduce air recirculation within the vertical louver blade. The upper half of the louver has a blockoff on the exterior side to increase discharge air velocity and improve the throw of leaving air.

The vertical louver can be ordered with flanges that are attached on the outside of all four sides of the louver, resulting in a vertical dimension of 30" (762 mm). Weep holes exist behind the bottom flange of the louver. A diamond pattern expanded aluminum wire mesh (bird screen) is provided on the interior surface of the louver.

The vertical louver is fabricated from extruded 6063-T5 aluminum. The single piece blade has a turned edge along the entering and leaving surface to reduce visibility of the outdoor coil and fan section, and adds rigidity to the blade. The 72-degree offset bend near the middle of the blade creates an air-path turn that minimizes moisture carryover, with a total blade depth of 2¼" (57 mm) in direction of airflow.

Figure 22: Typical Wall Louver and Grille



The louver is available in the following colors:

- Natural aluminum finish (paintable 6063-T5 Aluminum)
- Autumn brown - thermosetting urethane powder coat paint electrostatically applied and oven-cured to provide correct chemical cross-linking.
- Dark bronze - thermosetting urethane powder coat paint electrostatically applied and oven-cured to provide correct chemical cross-linking.
- Clear anodized aluminum finish

Figure 23: Vertical Blade Louver Outside View, Without Flange

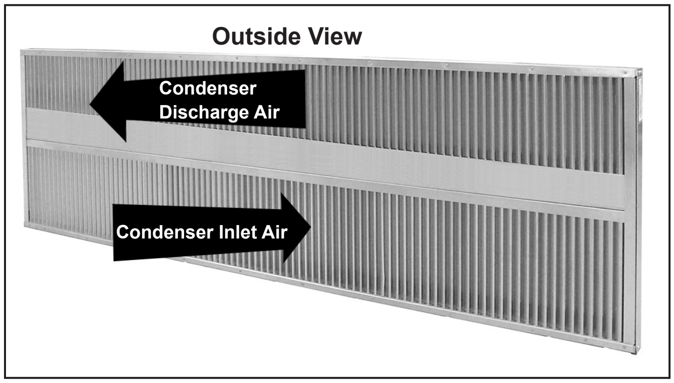
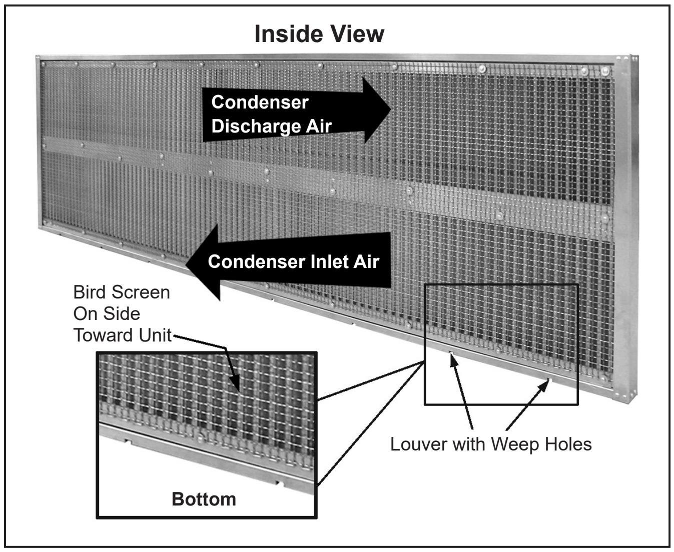


Figure 24: Vertical Blade Louver Inside View, Without Flange



Wall Intake Louvers & Grilles

Louvers are available with a vertical blade configuration, constructed of heavy-gauge (unpainted, painted, or clear anodized) aluminum.

- The louver is divided in half horizontally to prevent condenser air recirculation.
- A bird screen is provided on the leaving air side of the intake louver.
- Louvers can be supplied with or without flanges:
- Flanged louvers are typically used for a panel wall finish.
- Unflanged louvers are typically used for recessing into a masonry wall.
- An optional (factory-mounted) heavy-duty lattice exterior grille is available with horizontal and vertical lines that "line up" with the louver blades to present an aesthetic appearance.
- Louvers are available in both horizontal and vertical blade configurations.

Figure 25: Typical Wall Louver and Grille

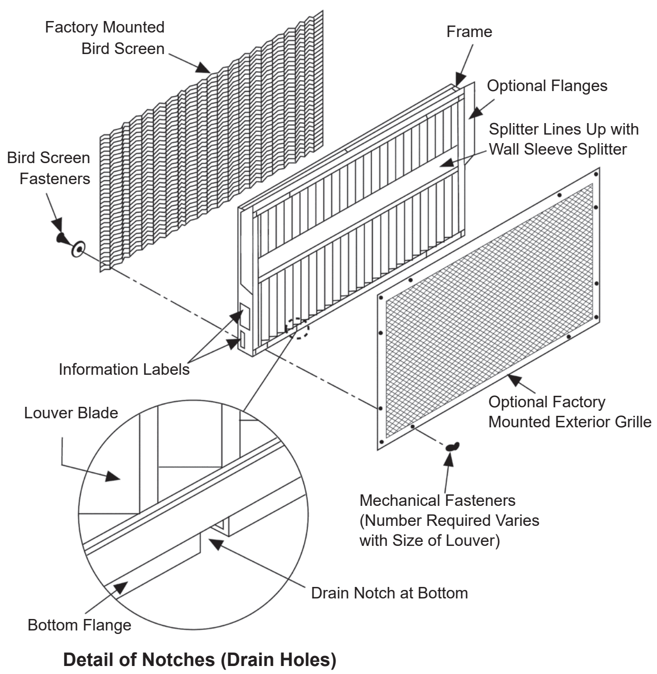


Figure 26: Vertical Blade Louver, Without Flange

Outside View

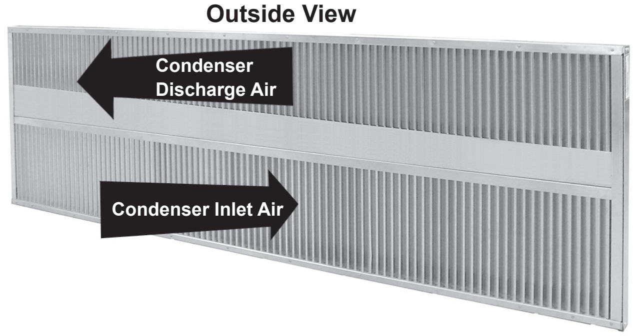


Figure 27: Grille Detail

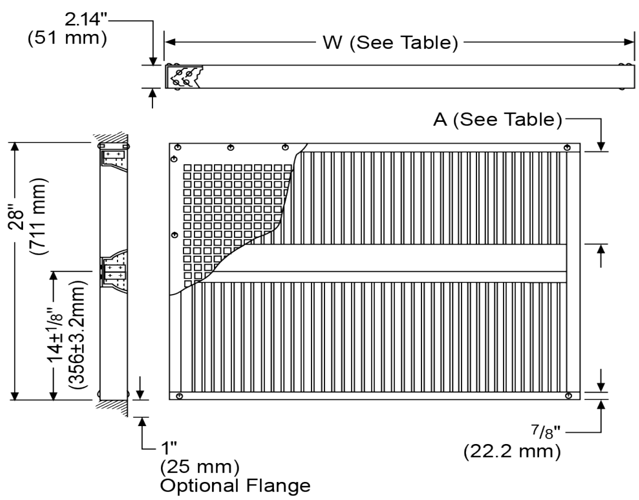


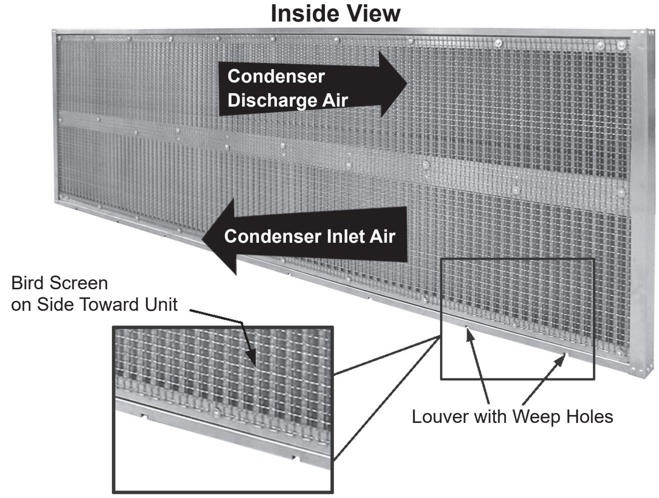
Table 3: Wall Louver Dimensions (W)

Unit Size	Louver Size (Height x W)	Discharge Air Opening (A)
024	28" × 84" (711 × 2134)	9" (229 mm)
036	28" × 96" (711 × 2438)	9" (229 mm)
044, 054	28" × 108" (711 × 2743)	7" (178 mm)

Note: All dimensions are approximate and subject to change without notice. Refer to approved submittal prints for rough-in details and construction purposes, and for recommended wall opening size.

Figure 28: Vertical Blade Louver, without Flange

Inside View

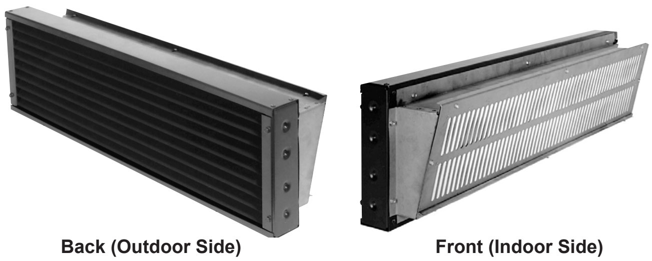


VentiMatic Shutter Room Exhaust Ventilation

Outdoor air introduced by the unit ventilator must leave the room in some way. In some states, exhaust vents are required by law or code to accomplish this. The VentiMatic Shutter is a more economical solution to the problem.

- The VentiMatic shutter is a continuously variable, gravity-actuated room exhaust vent (Figure 29). It operates in direct response to positive static air pressure created when ventilation air is brought into the room by the unit ventilator. It is a "one-way" shutter that opposes any flow of air into the room.

Figure 29: VentiMatic Shutter



The VentiMatic Shutter's ability to exhaust only the amount of air required results in considerable energy savings. In the heating mode, the unit ventilator will be able to bring in only the required percent minimum outdoor air. Unlike systems that rely on powered exhaust, no energy will be wasted heating excess outdoor air. In the cooling mode, the unit ventilator will be able to bring in 100% outdoor air for full natural or free cooling when it is energy effective.

Since it is not powered, VentiMatic Shutter operation is inherently silent. Unlike other non-powered vents, it opens at an extremely low positive pressure (0.005"). Its shutter flaps are made of temperature-resistant glass fabric impregnated with silicone rubber for flexibility and long life. This fabric retains its original properties down to -50°F.

VentiMatic Shutter Assembly

Notes:

1. Horizontal blade louver shown. Vertical blade louver also available with VentiMatic shutter.
2. Optional exterior grille matches unit ventilator louver in material and design. Mounted in wall louver.
3. Optional interior grille mounting hardware is not included.
4. Louver leaves seal against plate to prevent air infiltration.

Figure 30: VentiMatic Shutter Assembly with Optional Grille

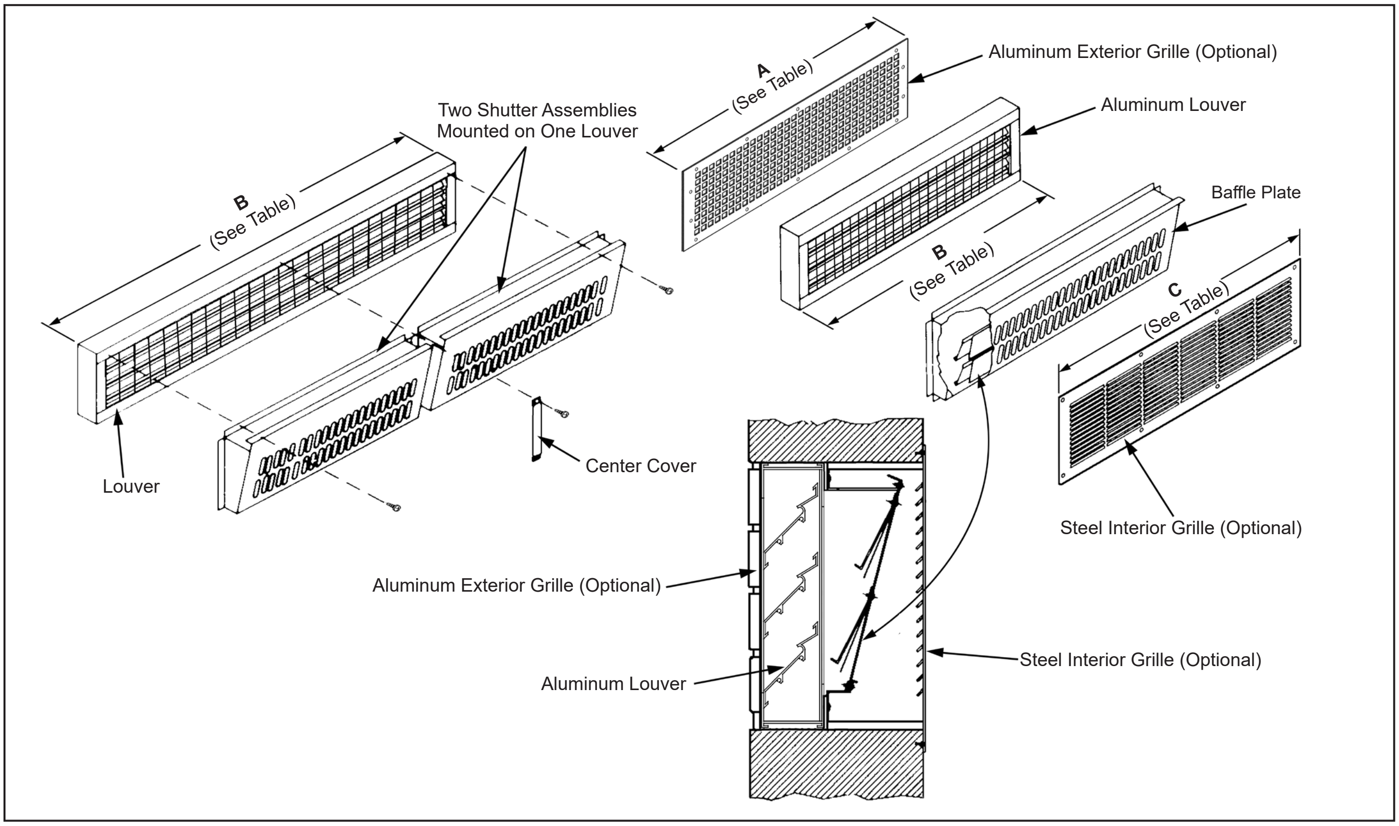


Table 4: VentiMatic Shutter Assembly Dimensions & Maximum Air Capacities

Exterior Grille "A"		Louver Width "B"		Interior Grille Width "C"		Recommended Wall Opening For Shutter				Max. Number of VentiMatic Shutters to Mount on Standard Louver		VentiMatic Shutter(s) Max. Air Capacity	
						Length		Width					
inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	24" (610mm) Shutter	36" (914mm) Shutter	CFM	L/s
23¾	603	24	610	27	686	24¼	616	10½	267	1	0	500	236
36¾	933	36	914	39	991	36¼	921			0	1	750	354
47¾	1213	48	1219	51	1295	48¼	1225			2	0	1000	472
59¾	1518	60	1524	63	1600	60¼	1530			1	1	1250	590
71¾	1822	72	1829	75	1905	72¼	1835			0	2	1500	708

Physical Data

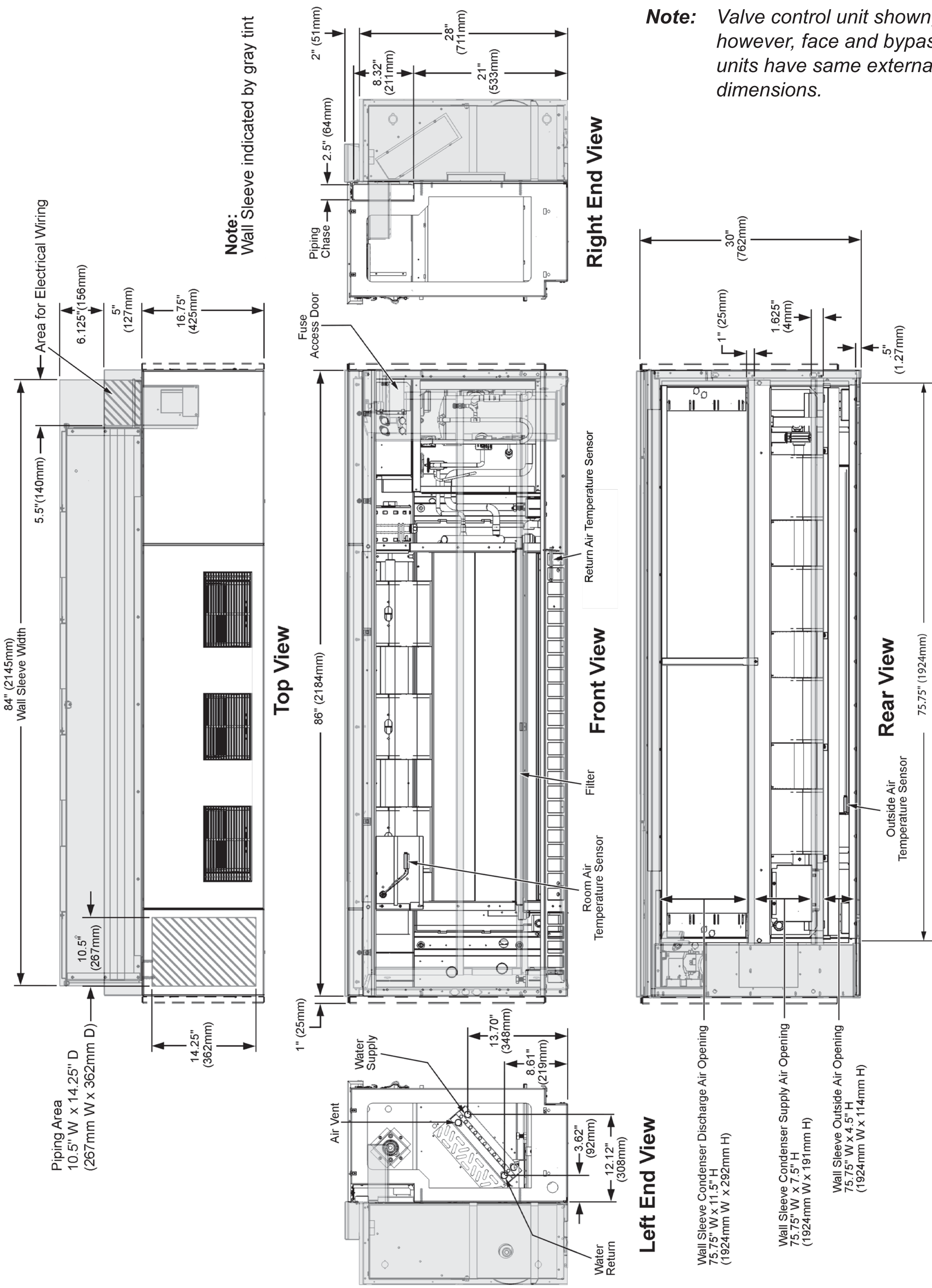
Table 5: AZ General Data

			024	036	044	054
Fan Data	Nominal CFM (L/s)	High Speed	1000 (472)	1250 (590)	1500 (708)	1500 (708)
		Medium Speed	750 (354)	1000 (472)	1050 (496)	1050 (496)
		Low Speed	650 (307)	800 (378)	850 (401)	800 (378)
	Number of Fans		3	4	4	4
	Size	Diameter - in (mm)	8.12 (206 mm)	8.12 (206 mm)	8.12 (206 mm)	8.12 (206 mm)
		Width - in (mm)	8.25 (210 mm)	8.25 (210 mm)	8.25 (210 mm)	8.25 (210 mm)
Room Fan Motor Horsepower			1/4	1/4	1/4	1/4
Outdoor Fan Motor Horsepower			1/3	1/3	3/4	3/4
Filter Data	Nominal Size	in	10 x 48½ x 1	10 x 60½ x 1	10 x 36½ x 1	10 x 36½ x 1
		(mm)	254 x 1232 x 25	254 x 1537 x 25	254 x 927 x 25	254 x 927 x 25
	Area - ft² (m²)		3.37 (.31)	4.2 (.39)	5.08 (.47)	5.08 (.47)
	Quantity		1	1	2	2
Shipping Weight	lb (kg)		885 (402)	975 (442)	1075 (448)	1075 (448)
Refrigerant Charge (R-32)	oz (lbs)		106 (6.63)	156 (9.75)	114 (7.13)	111 (6.94)
Coil Water Volume gal (L)	1 Row Coil		0.25 (0.95)	0.31 (1.17)	0.38 (1.44)	0.44 (1.67)
	2 Row Coil		0.45 (1.70)	0.57 (2.16)	0.69 (2.61)	0.82 (3.10)

Details and Dimensions

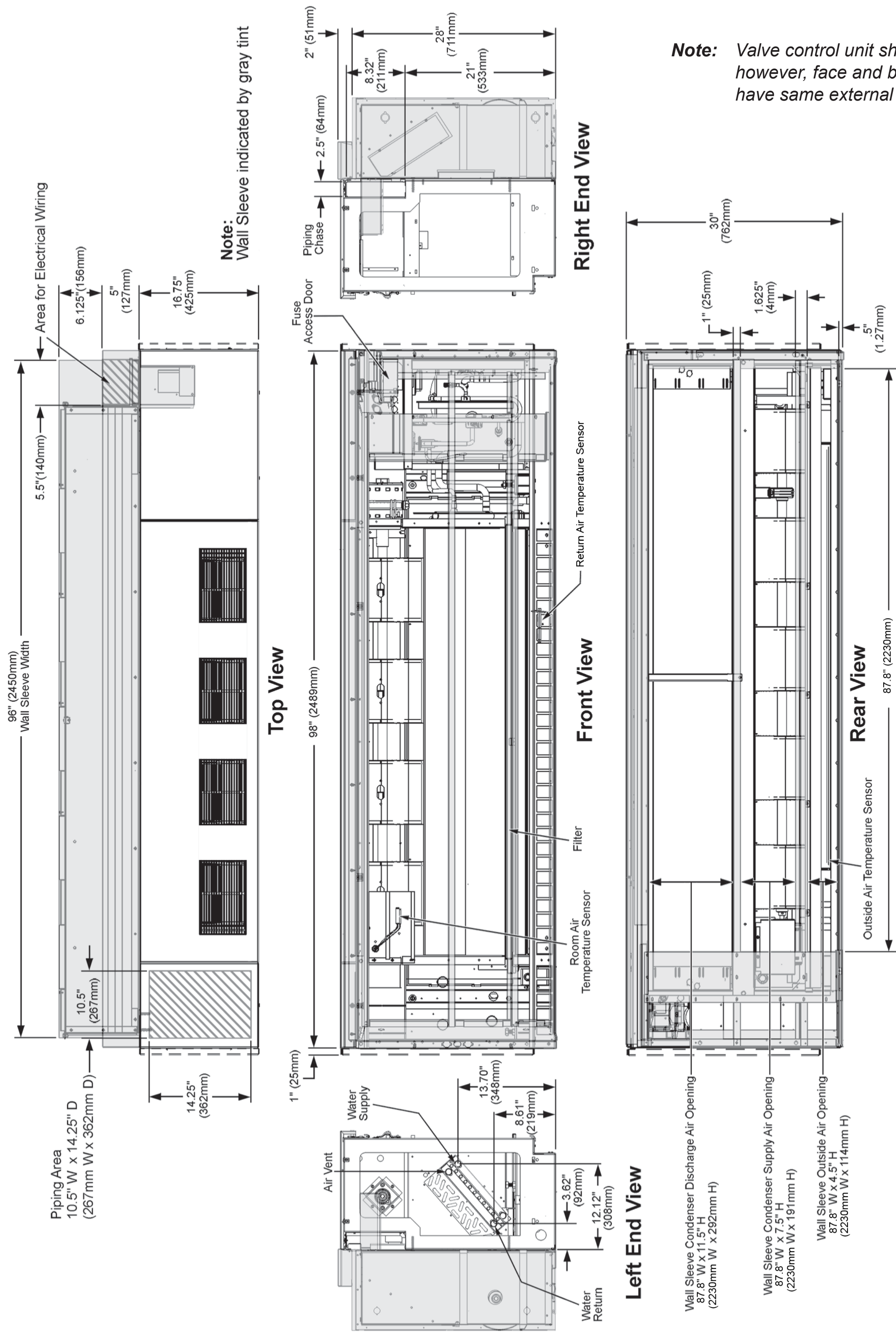
Model AZ Self-Contained – Size 024

Note: *Valve control unit shown, however, face and bypass units have same external dimensions.*



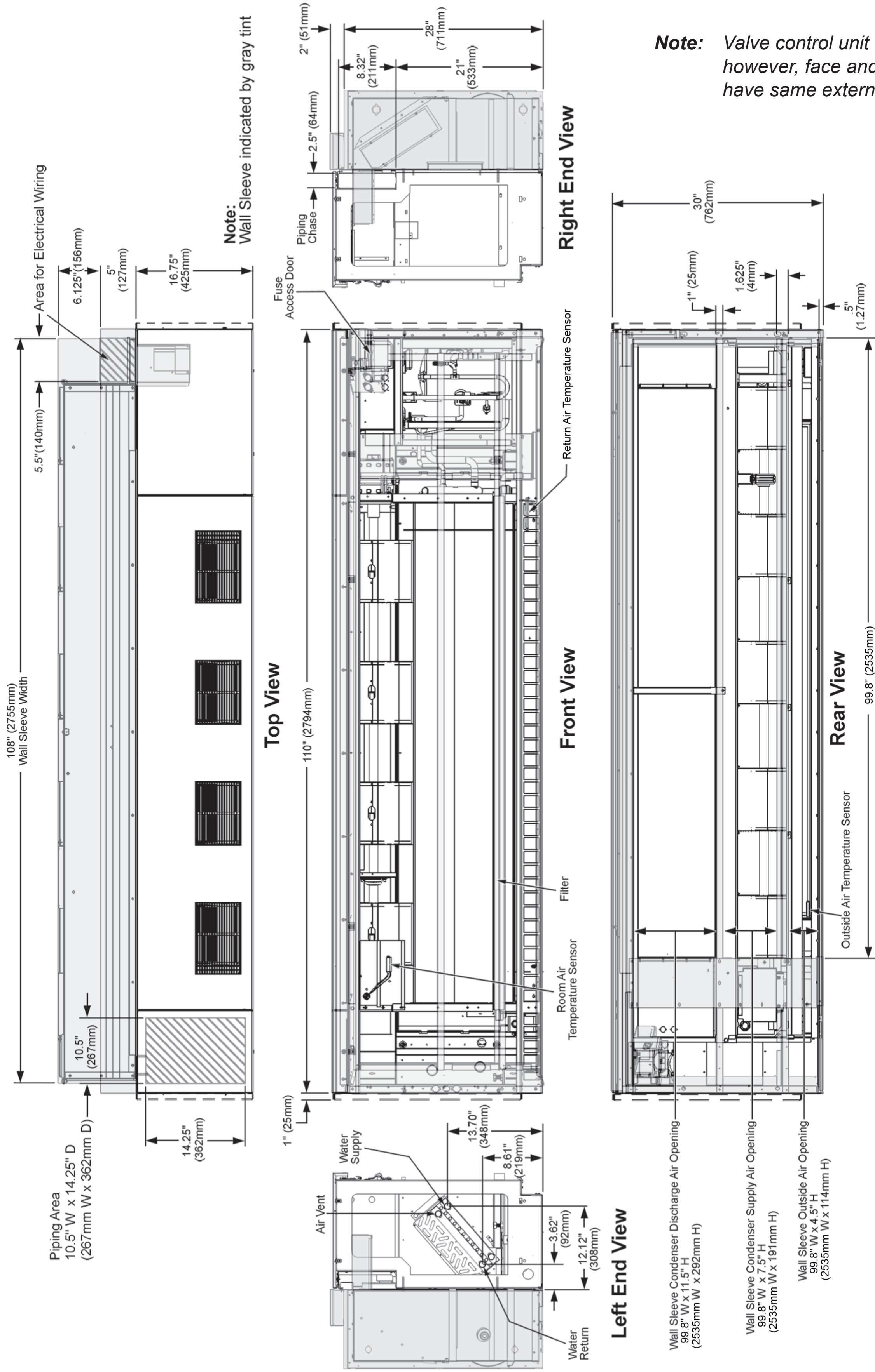
Model AZ Self-Contained – Size 036

Note: *Valve control unit shown, however, face and bypass units have same external dimensions.*



Model AZ Self-Contained – Sizes 044, 054

Note: *Valve control unit shown, however, face and bypass units have same external dimensions.*



AZU and AZQ Hot Water Coil Connection Locations

The following notes apply to hot water coil units:

1. All coils have same-end supply and return connections.
2. All coils have the supply and return connections in the left hand compartment.
3. Hot Water connections are on the left end.
4. Coil connections are 7/8" I.D. (female) and terminate 9" (229 mm) from the end of the unit.
5. Shading indicates portion of unit wall sleeve recessed into wall opening.
6. All dimensions are approximate.

Left End Views

Heating Coils

65 = 1-Row Hot Water Coil
66 = 2-Row Hot Water Coil
S = Supply
R = Return

Figure 31: Hot Water Coil Connections – 28" Type

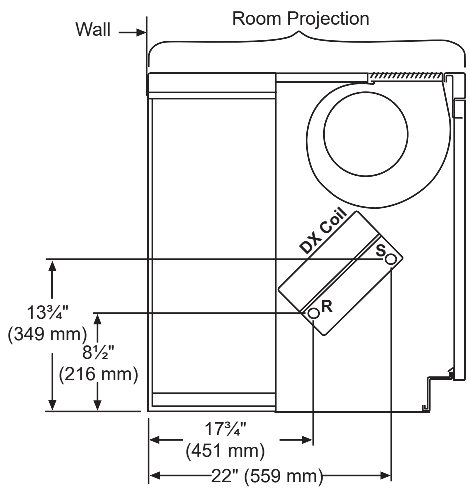


Figure 32: Hot Water Coil Connections – 21⅞" Type

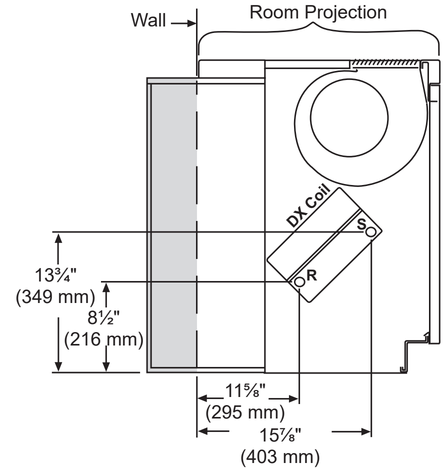


Figure 33: Hot Water Coil Connections – 19⅝" Type

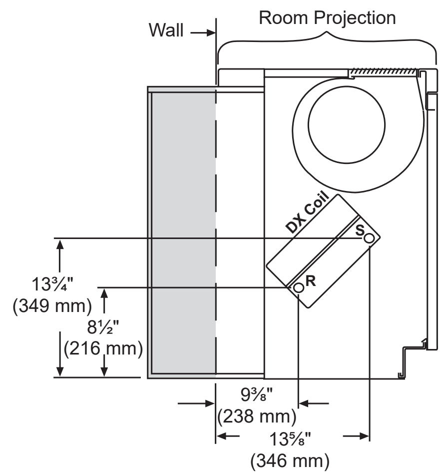
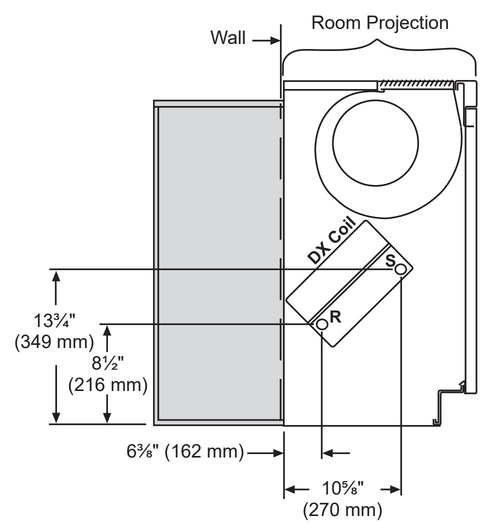


Figure 34: Hot Water Coil Connections – 16⅝" Type



AZR Hot Water Coil Connection Locations

The following notes apply to hot water coil units:

1 All coils have same-end supply and return connections.
2 All coils have the supply and return connections in the left hand compartment.
3 Hot Water connections are on the left end.
4 Coil connections are 7/8" I.D. (female) and terminate 9" (229 mm) from the end of the unit.
5 Shading indicates portion of unit wall sleeve recessed into wall opening.
6 All dimensions are approximate.

Left End Views

Heating Coils

65 = 1-Row Hot Water Coil
66 = 2-Row Hot Water Coil
S = Supply
R = Return

Figure 35: Hot Water Coil Connections – 28" Type

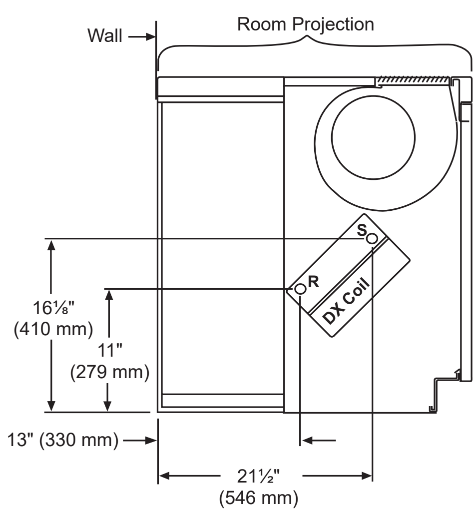


Figure 36: Hot Water Coil Connections – 21⅞" Type

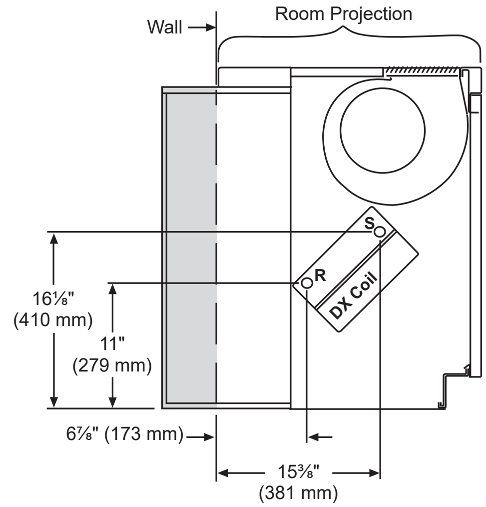


Figure 37: Hot Water Coil Connections – 19⅝" Type

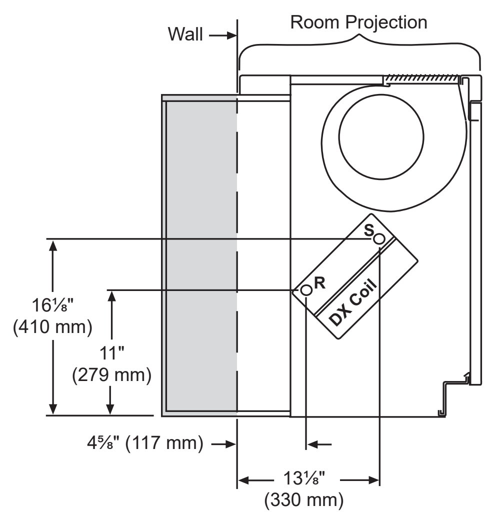
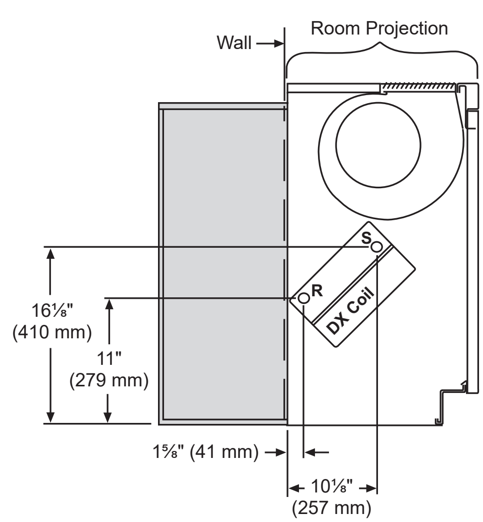


Figure 38: Hot Water Coil Connections – 16⅝" Type



AZU, AZR, and AZQ Steam Coil Connection Locations

The following notes apply to steam coil units:

1. All coils have same-end supply and return connections.
2. Steam coils have the supply and drain to steam trap connections in the left hand compartment.
3. Steam coils have a factory-installed pressure equalizing valve and a 24" (610 mm) long pressure equalizing line which terminates in a 1/2" M.P.T. fitting.
4. Steam coils are 1-1/8" female (sweat) connections and terminate 9" (229 mm) from the end of the unit.
5. Shading indicates portion of unit wall sleeve recessed into wall opening.
6. All dimensions are approximate.

Left End Views

Heating Coils

68 = Low Capacity Steam Coil

69 = High Capacity Steam Coil

S = Supply

Figure 39: Steam Coil Connections – 28" Type

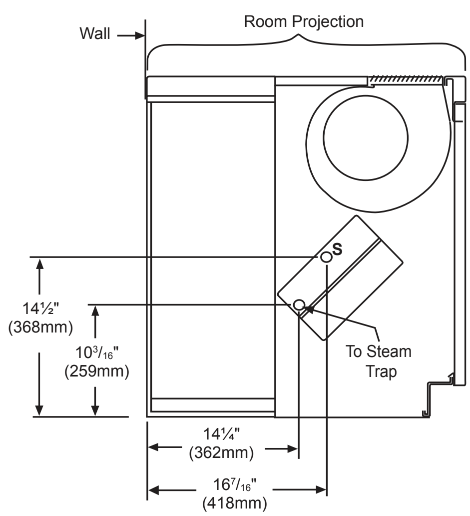


Figure 40: Steam Coil Connections – 21⅞" Type

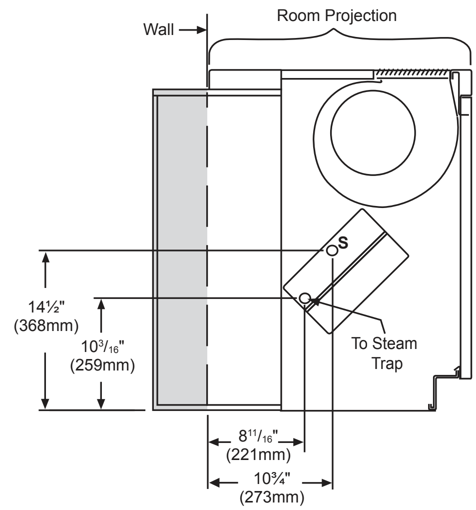


Figure 41: Steam Coil Connections – 19⅝" Type

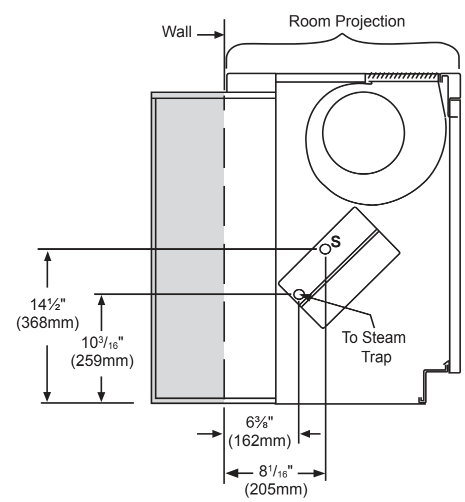
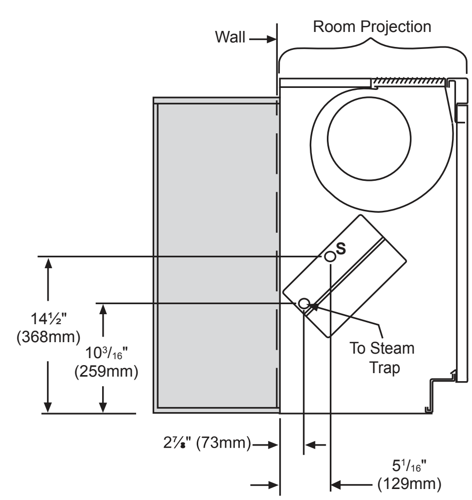


Figure 42: Steam Coil Connections – 16⅝" Type



End Panels

Figure 43: 1" (25 mm) End Panel Dimensions

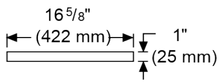
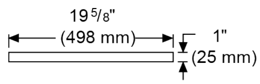
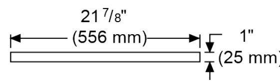
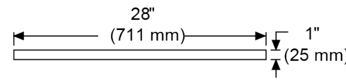
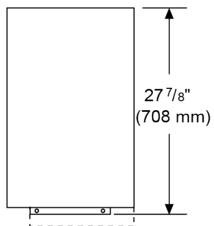
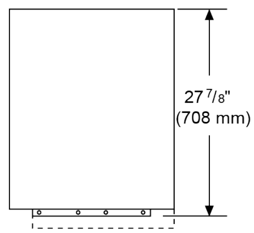
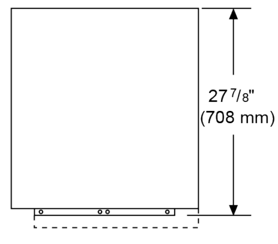
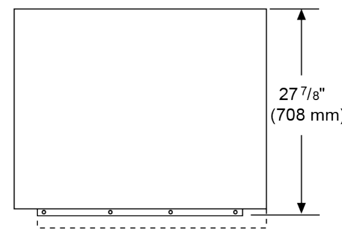
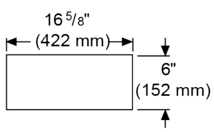
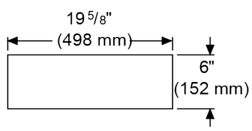
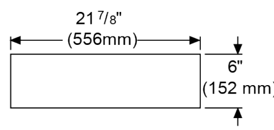
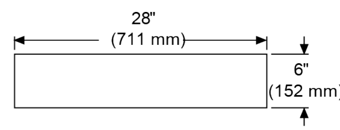
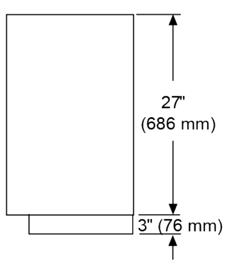
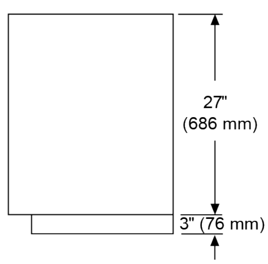
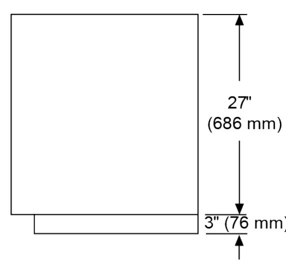
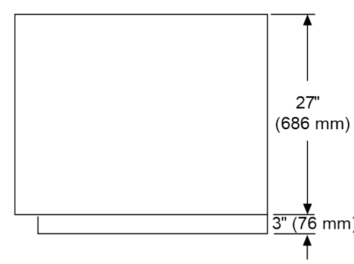
All Dim. in inches	16⅝" (422 mm) Deep End Panels	19⅝" (498 mm) Deep End Panels	21⅞" (556 mm) Deep End Panels	28" (711mm) Deep End Panels
Top View	 16 5/8" (422 mm) 1" (25 mm)	 19 5/8" (498 mm) 1" (25 mm)	 21 7/8" (556 mm) 1" (25 mm)	 28" (711 mm) 1" (25 mm)
End View with No Cut-Out	 27 7/8" (708 mm)	 27 7/8" (708 mm)	 27 7/8" (708 mm)	 27 7/8" (708 mm)

Figure 44: 6" (152 mm) End Panel Dimensions

All Dim. in inches	16⅝" (422 mm) Deep End Panels	19⅝" (498 mm) Deep End Panels	21⅞" (556 mm) Deep End Panels	28" (711 mm) Deep End Panels
Top View	 16 5/8" (422 mm) 6" (152 mm)	 19 5/8" (498 mm) 6" (152 mm)	 21 7/8" (556mm) 6" (152 mm)	 28" (711 mm) 6" (152 mm)
End View with No Cut-Out	 27" (686 mm) 3" (76 mm)	 27" (686 mm) 3" (76 mm)	 27" (686 mm) 3" (76 mm)	 27" (686 mm) 3" (76 mm)

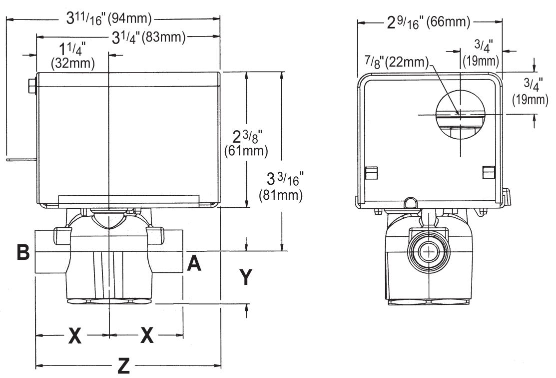
Valves

2-Way End of Cycle Valve

When piping the 2-Way End of Cycle valve, refer to label to determine the direction of flow. The valve should be installed so that there is a 2" (51 mm) minimum clearance to remove the actuator from the valve body. Provide unions for removal of unit coil and/or control valve as a future service consideration. Hot water connections may be same end as cooling coil connections, but are recommended to be opposite end to facilitate piping.

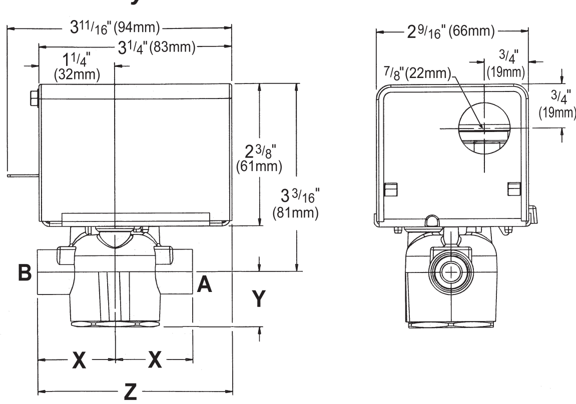
When using MicroTech controls, they must be opposite end. The End of Cycle valve accessory must be field installed on the unit for which it was selected.

Figure 45: 2-Way EOC Valve Dimensions



Connection	Cv	X	Y	Z
3/4" (19 mm) FNPT	7.5	111/16" (43 mm)	15/16" (24 mm)	3⅝" (92 mm)

Figure 46: 2-Way EOC Steam Valve Dimensions



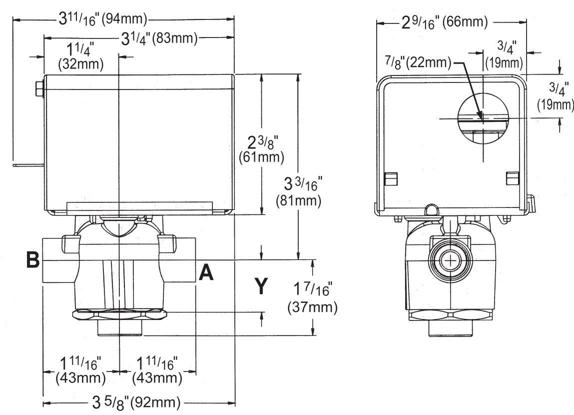
Connection	Cv	X	Y	Z
1" (25 mm) FNPT	8.0	1⅞" (47 mm)	1" (25 mm)	3 11/16" (94 mm)

3-Way End of Cylce Valve

When piping the 3-Way End of Cycle valve, refer to label to determine the direction of flow. The valve should be installed so that there is a 2" (51 mm) minimum clearance to remove the actuator from the valve body. Provide unions for removal of unit coil and/or control valve as a future service consideration. Hot water connections may be same end as cooling coil connections, but are recommended to be opposite end to facilitate piping.

When using MicroTech controls, they must be opposite end. The End of Cycle valve accessory must be field installed on the unit for which it was selected.

Figure 47: 3-Way EOC Valve Dimensions



Connection	Cv	Y
3/4" (19 mm) FNPT	5.0	15/16" (24 mm)

Table 6: EOC Actuator Specifications

Control	2 Position
Electrical	24 VAC, 50/60 Hz
Stroke	Power Stroke 9 to 11 seconds Spring return 4 to 5 seconds
Ambient	32°F to 125°F (0°C to 52°C)

Table 7: F&BP EOC Valve Body Specifications

	2-Way Valve	3-Way Valve
Connections	3/4" FNPT, 1" FNPT	3/4" FNPT
Static Pressure	300 psi (2100 kPa)	300 psi (2100 kPa)
Close-Off Pressure	13 & 15 psi (90 & 103 kPa)	13 psi (90 kPa)
Temperature	32°F to 200°F (0°C to 93°C)	32°F to 200°F (0°C to 93°C)

Modulating Valves

2-Way Modulating Hot Water Valve

Two-way modulating control valves for MicroTech are designed to regulate the flow of hot water. They consist of a nickel plated brass body and stainless steel ball valve and stem, with a spring return proportional actuator. The optional valve accessory is shipped separate from the unit ventilator for field installation to prevent shipping damage and to provide flexibility in making the field piping connection.

Table 8: 2-Way Actuator Specifications (HW)

Power Supply	24 VAC, ±20%, 50/60 Hz, 24 VDC, ±10%
Power Consumption Running	2 W
Power Consumption Holding	1 W
Transformer Sizing	4 VA (class 2 power source)
Electrical Connection	3ft [1m], 18 GA plenum cable with 1/2" conduit connector
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Feedback Output U	2 to 10 VDC, 0.5 mA max
Angle of Rotation	Max. 95°, 90°
Direction of Rotation (Motor)	reversible with built-in switch
Direction of Rotation (Fail-Safe)	reversible with CW/CCW mounting
Position Indication	visual indicator, 0° to 95° (0° is full spring return position)
Running Time (Motor)	95 sec
Running Time (Fail-Safe)	<25 sec
Ambient Humidity	max. 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP42, UL Enclosure Type 2
Housing Material	UL94-5VA
Agency Listings[1]	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	<35 dB (A)
Noise Level (Fail-Safe)	<62 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001

Note: [1] Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3TFRB24

Table 9: 2-Way Valve Body Specifications (HW)

Service	hot water, up to 60% glycol
Flow Characteristic	equal percentage
Controllable Flow Range	75°
Size [mm]	0.5" [15]
End Fitting	NPT female ends
Body	forged brass, nickel plated
Ball	stainless steel
Stem	stainless steel
Stem Packing	EPDM (lubricated)
Seat	Teflon® PTFE
Seat O-ring	EPDM (lubricated)
Characterized Disc	TEFZEL®
Body Pressure Rating [psi]	600
Media Temperature Range (Water)	0°F to 250°F [-18°C to 120°C]
Max Differential Pressure (Water)	50 psi (345 kPa)
Close-Off Pressure	200 psi
Leakage	0% for A to AB
Servicing	maintenance free

2-Way Modulating Hot Water Valve Specifications

Modulating Valve Selection

The unit ventilator control valve is expected to be able to vary the quantity of water that flows through the coil in a modulating fashion. Any movement of the valve stem should produce some change in the amount of water that flows through the coil. Oversized control valves cannot do this. For example, assume that when the control valve is fully open, the pressure drop through the coil is twice as great as the drop through the valve. In this case, the control valve must travel to approximately 50% closed before it can begin to have any influence on the water flow through the coil. The control system, no matter how sophisticated, cannot overcome this. Oversized control valves can also result in "hunting" which will shorten the life of the valve and actuator and possibly damage the coil.

To correctly select the proper Hot Water Modulating Valve:

1. Determine the flow of water and the corresponding pressure drop through the coil.
2. Obtain the pressure difference between the supply and return mains.
3. Select a valve size (Cv) from Table 11, on the basis of taking 50% of the available pressure difference (at design flow) between the supply and return mains at the valve location. The valve should have a pressure drop greater than that of the coil.

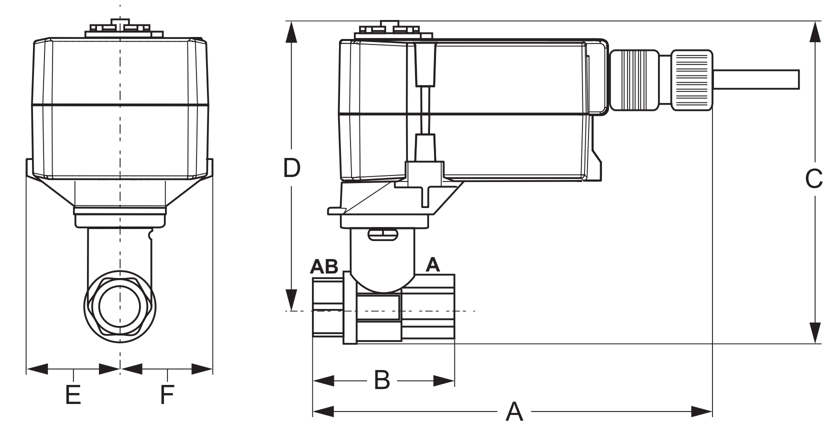


Figure 48: Formula to Calculate Cv

Q = Capacity in gallons per minute

Cv = Valve sizing coefficient determined experimentally for each style and size of valve, using water at standard conditions as the test fluid

ΔP = Pressure differential in psi

G = Specific gravity of fluid (water at 60°F = 1.0000)

$$Cv = Q\sqrt{\frac{G}{\Delta P}}$$

Table 10: 2-Way Modulating Valve Dimensions (HW)

Valve Part No.	Cv	Connection Size (inches)	A	B	C	D	E	F	Weight	
									Valve Body	Actuator
B209	0.8	1/2"	6.59" (167 mm)	2.38" (60 mm)	4.9" (124 mm)	4.32" (110 mm)	1.53" (38 mm)		0.4 lb (0.2 kg)	1.8 lb (0.8 kg)
B210	1.2									
B211	1.9									
B212	3.0		6.59" (167 mm)	2.38" (60 mm)	5.48" (139 mm)	4.71" (120 mm)	1.53" (38 mm)		0.7 lb. (0.3 kg)	
B213	4.7									
B214	7.4									

Note: *See "Table 8: 2-Way Actuator Specifications (HW)" on page 34" and "Table 9: 2-Way Valve Body Specifications (HW)" on page 34.*

Table 11: 2-Way Modulating Water Valve – Pressure Drop (HW)

2-Way CCV Part No.	Cv Maximum Rating	Connection Size	Pressure Drop Across the Valve									
			1 PSI	2 PSI	3 PSI	4 PSI	5 PSI	6 PSI	7 PSI	8 PSI	9 PSI	10 PSI
B209	0.8	1/2"	0.8	1.1	1.4	1.6	1.8	2.0	2.1	2.3	2.4	2.5
B210	1.2		1.2	1.7	2.1	2.4	2.8	2.9	3.2	3.4	3.6	3.8
B211	1.9		1.9	2.7	3.3	3.8	4.2	4.7	5.0	5.4	5.7	6.0
B212	3.0		3.0	4.2	5.2	6.0	6.8	7.3	7.9	8.5	9.0	9.5
B213	4.7		4.7	6.6	8.1	9.4	11	12	12	13	14	15
B214	7.4		7.4	10	13	15	17	18	20	21	22	23

2-Way Modulating Valve (Steam) - 1/2"

Two-way modulating control valves for MicroTech are designed to regulate the flow of steam. They consist of a nickel plated brass body and stainless steel ball valve and stem, with a spring return, proportional actuator. The optional valve accessory is shipped separate from the unit ventilator for field installation to prevent shipping damage and to provide flexibility in making the field piping connection.

Table 12: 2-Way Actuator Specifications (Steam)

Power Supply	24 VAC ± 20%, 50/60 Hz, 24 VDC ± 10%
Power Consumption Running	2 W
Power Consumption Holding	1 W
Transformer Sizing	4 VA (class 2 power source)
Electrical Connection	3ft [1m], 18 GA plenum cable with 1/2" conduit connector"
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Feedback Output U	2 to 10 VDC, 0.5 mA max
Angle of Rotation	Max. 95°, 90°
Direction of Rotation (Motor)	reversible with built-in switch
Direction of Rotation (Fail-Safe)	reversible with CW/CCW mounting
Position Indication	visual indicator, 0° to 95° (0° is full spring return position)
Running Time (Motor)	95 sec
Running Time (Fail-Safe)	<25 sec
Ambient Humidity	max. 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP42, UL enclosure type 2
Housing Material	UL94-5VA
Agency Listings[1]	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	<35 dB (A)
Noise Level (Fail-Safe)	<62 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001

Note: [1] Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

Table 13: Valve Body Specifications (Steam)

Service	high temperature hot water/low pressure steam, up to 60% glycol
Flow Characteristic	A-port equal percentage
Controllable Flow Range	75°
Size [mm]	0.5" [15]
End Fitting	NPT female ends
Body	nickel plated brass (DZR) P-CuZn35Pb2
Ball	stainless steel
Stem	stainless steel
Stem Packing	Vition O-ring
Seat	ETFE
Seat O-ring	EPDM (lubricated)
Characterized Disc	ETFE
Body Pressure Rating [psi]	600
Max Inlet Pressure (Steam)	15 psi
Media Temperature Range (Water)	60°F to 266°F [16°C to 130°C]
Media Temperature Range (Steam)	250°F [120°C]
Maximum Differential Pressure (Steam)	15 psi
Max Differential Pressure (Water)	60 psi partially open ball, 116 psi full open
Close-Off Pressure	200 psi
Leakage	0%
Servicing	maintenance free

2-Way Modulating Steam Valve Specifications

Modulating Steam Valve Selection

The steam modulating control valve is expected to vary the quantity of steam through the coil. Any movement of the valve stem should produce some change in the steam flow rate. To select a modulating steam valve:

1. Obtain the supply steam inlet pressure.
2. Determine the actual heat requirement of the space to be heated.

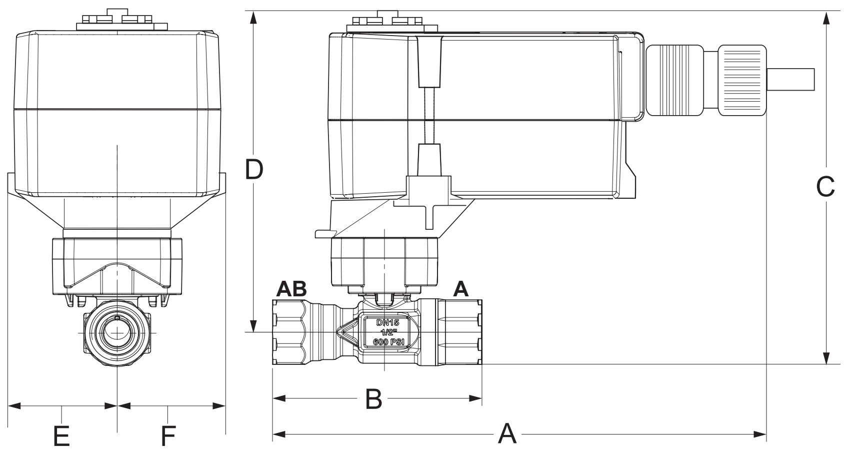


Table 14: 2-Way Modulating Steam Valve 1/2" – Dimensions

Valve Part No.	Cv	Connection Size (inches)	A	B	C	D	E	F	Weight	
									Valve Body	Actuator
B215HT073	0.73	1/2"	7.32" (186 mm)	3.33" (85 mm)	5.8" (147 mm)	5.3" (135 mm)	1.52" (39 mm)	1.52" (38.5 mm)	0.7 lb (0.3 kg)	1.8 lb (0.8 kg)
B215HT186	1.86									

Note: *See "Table 12: 2-Way Actuator Specifications (Steam)" on page 36" and "Table 13: Valve Body Specifications (Steam)" on page 36.*

Table 15: 2-Way Modulating Steam Valve 1/2" – Pressure Drop

2-Way CCV Part No.	Cv Maximum Rating	Connection Size	Pressure Drop Across the Valve					
			2 PSI	3 PSI	4 PSI	5 PSI	10 PSI	15 PSI
B215HT073	0.73	1/2"	10.99	13.71	16.11	18.33	28.03	36.74
B215HT186	1.86		22.34	34.93	41.06	46.70	71.42	93.60

3-Way Modulating Hot Water Valve

Three-way modulating control valves for MicroTech are designed to regulate the flow of hot water. They consist of a nickel plated brass body and stem with chrome plated brass ball valve, with a spring return, proportional actuator. The optional valve accessory is shipped separate from the unit ventilator for field installation to prevent shipping damage and to provide flexibility in making the field piping connection.

Table 16: 3-Way Actuator Specifications (HW)

Power Supply	24 VAC, ±20%, 50/60 Hz, 24 VDC, ±10%
Power Consumption Running	2 W
Power Consumption Holding	1 W
Transformer Sizing	4 VA (class 2 power source)
Electrical Connection	3ft [1m], 18 GA plenum cable with 1/2" conduit connector
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Feedback Output U	2 to 10 VDC, 0.5 mA max
Angle of Rotation	Max. 95°, 90°
Direction of Rotation (Motor)	reversible with built-in switch
Direction of Rotation (Fail-Safe)	reversible with CW/CCW mounting
Position Indication	visual indicator, 0° to 95° (0° is full spring return position)
Running Time (Motor)	95 sec
Running Time (Fail-Safe)	<25 sec
Ambient Humidity	max. 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP42, UL Enclosure Type 2
Housing Material	UL94-5VA
Agency Listings[1]	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	<35 dB (A)
Noise Level (Fail-Safe)	<62 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001

Note: [1] Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

Table 17: 3-Way Valve Body Specifications (HW)

Service	hot water, up to 60% glycol
Flow Characteristic	A-port Equal percentage; B-port modified linear for constant flow
Controllable Flow Range	75°
Size [mm]	0.5" [15]
End Fitting	npt female ends
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	nickel plated brass
Stem Packing	EPDM (lubricated)
Seat	Teflon PTFE
Seat O-ring	EPDM (lubricated)
Characterized Disc	TEFZEL
Body Pressure Rating [psi]	600
Media Temperature Range (Water)	0°F to 250°F [-18°C to 120°C]
Max Differential Pressure (Water)	50 psi (345 kPa)
Close-Off Pressure	200 psi
Leakage	0% for A to AB, <2.0% for B to AB
Servicing	maintenance free

3-Way Modulating Valve Specifications

Hot Water Modulating Valve Selection

The unit ventilator control valve is expected to be able to vary the quantity of water that flows through the coil in a modulating fashion. Any movement of the valve stem should produce some change in the amount of water that flows through the coil. Oversized control valves cannot do this. For example, assume that when the control valve is fully open, the pressure drop through the coil is twice as great as the drop through the valve.

In this case, the control valve must travel to approximately 50% closed before it can begin to have any influence on the water flow through the coil. The control system, no matter how sophisticated, cannot overcome this. Oversized control valves can also result in "hunting" which will shorten the life of the valve and actuator and possibly damage the coil.

To correctly select the proper Hot Water Modulating Valve:

1. Determine the flow of water and the corresponding pressure drop through the coil.
2. Obtain the pressure difference between the supply and return mains.
3. Select a valve size (Cv) from Table 19, on the basis of taking 50% of the available pressure difference (at design flow) between the supply and return mains at the valve location. The valve should have a pressure drop greater than that of the coil.

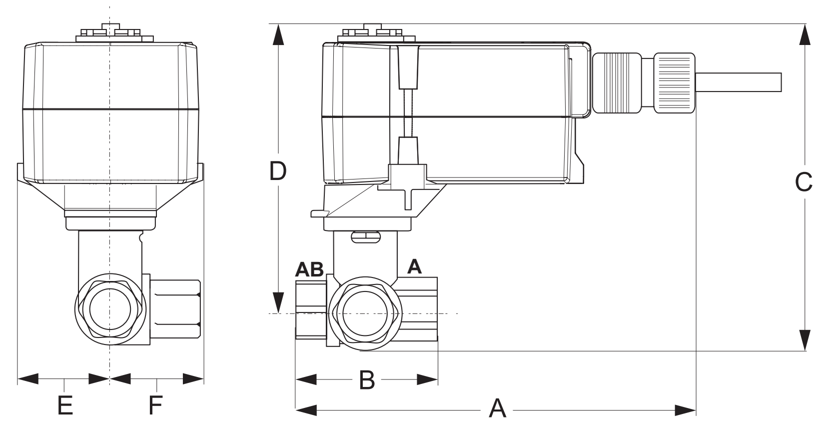


Figure 49: Formula to Calculate Cv

Q = Capacity in gallons per minute

Cv = Valve sizing coefficient determined experimentally for each style and size of valve, using water at standard conditions as the test fluid

ΔP = Pressure differential in psi

G = Specific gravity of fluid (water at 60°F = 1.0000)

$$Cv = Q\sqrt{\frac{G}{\Delta P}}$$

Table 18: 3-Way Modulating Valve 1/2" – Dimensions

<table>
<tr><th rowspan="2">Valve Part No.</th><th rowspan="2">Cv</th><th rowspan="2">Connection Size (inches)</th><th rowspan="2">A</th><th rowspan="2">B</th><th rowspan="2">C</th><th rowspan="2">D</th><th rowspan="2">E</th><th rowspan="2">F</th><th colspan="2">Weight</th></tr>
<tr><th>Valve Body</th><th>Actuator</th></tr>
<tr><td>B309(B)</td><td>0.8</td><td rowspan="6">1/2"</td><td rowspan="3">6.59"
(167 mm)</td><td rowspan="3">2.38"
(60 mm)</td><td rowspan="3">4.9"
(124 mm)</td><td rowspan="3">4.32"
(110 mm)</td><td rowspan="3">1.53"
(38 mm)</td><td rowspan="3">1.2"
(31 mm)</td><td rowspan="5">.07 lb.
(.03 kg)</td><td rowspan="6">1.8 lb.
(.08 kg)</td></tr>
<tr><td>B310(B)</td><td>1.2</td></tr>
<tr><td>B311(B)</td><td>1.9</td></tr>
<tr><td>B312(B)</td><td>3.0</td><td rowspan="3">6.59"
(167 mm)</td><td rowspan="2">2.38"
(60 mm)</td><td rowspan="2">4.9"
(124 mm)</td><td rowspan="2">4.71"
(120 mm)</td><td rowspan="2">1.53"
(38 mm)</td><td rowspan="2">1.29"
(33 mm)</td></tr>
<tr><td>B313(B)</td><td>4.7</td></tr>
<tr><td>B318(B)</td><td>7.4</td><td>2.73"
(69 mm)</td><td>5.5"
(140 mm)</td><td>4.8"
(122 mm)</td><td>1.53"
(38 mm)</td><td>1.47"
(37 mm)</td><td>.09 lb.
(.04 kg)</td></tr>
</table>

Note: See *"Table 16: 3-Way Actuator Specifications (HW)" on page 38*" and *"Table 17: 3-Way Valve Body Specifications (HW)" on page 38*.

Table 19: Modulating 3-Way Hot Water Valve 1/2" – Pressure Drop

2-Way CCV Part No.	Cv Maximum Rating	Connection Size	Pressure Drop Across the Valve									
			1 PSI	2 PSI	3 PSI	4 PSI	5 PSI	6 PSI	7 PSI	8 PSI	9 PSI	10 PSI
B309(B)	0.8	1/2"	0.8	1.	1.4	1.6	1.8	2.0	2.	2.3	2.4	2.5
B310(B)	1.2		1.2	1.7	2.	2.4	2.8	2.9	3.2	3.4	3.6	3.8
B311(B)	1.9		1.9	2.7	3.3	3.8	4.2	4.7	5.0	5.4	5.7	6.0
B312(B)	3.0		3.0	4.2	5.2	6.0	6.8	7.3	7.9	8.5	9.0	9.5
B313(B)	4.7		4.7	6.6	8.1	9.4	11	12	12	13	14	15
B318(B)	7.4		7.4	10	13	15	17	18	20	21	22	23

Performance and Selection

Quick Selection Procedure

The following procedure will provide you with a rough determination of unit capacity for cooling and/or heating based on the number of coil rows. Use capacity tables for final selection. Consult your local Daikin Applied representative for details on the computer selection programs Daikin Applied provides for this purpose.

Table 20: Hot Water Heating Capacity Btuh

Rows	60°F Entering Air Temperature; 160°F Entering Water Temperature; 6 GPM Water Flow		
	024	036	044, 054
1	49,500	57,000	66,000
2	62,000	74,100	97,200

Table 21: Quick Selection Table

Unit Size	Compressor Capacity	Fan Speed	Nominal Airflow	Cooling		Outdoor Temp.
				Total Capacity	Efficiency	
			CFM	Btuh	EER	DB / WB
024	Full	High	1000	22300	10.5	95 / 75
	Part	Med	750	19700	17.4	82 / 65
	Part	Low	650	19300	17.9	82 / 65
036	Full	High	1250	39000	10.4	95 / 75
	Part	Med	1000	33200	16.3	82 / 65
	Part	Low	800	30700	15.7	82 / 65
044	Full	High	1500	45100	11.2	95 / 75
	Part	Med	1050	36900	17.7	82 / 65
	Part	Low	850	33200	16.7	82 / 65
054	Full	High	1500	51100	10.3	95 / 75
	Part	Med	1050	43500	17.4	82 / 65
	Part	Low	850	40900	16.6	82 / 65

Note: Cooling Conditions: Indoor 80°F db/67°F wb (26.7°C/19.4°C)

Selection Procedure

Step 1: Determine Design Conditions

Determine design indoor and outdoor air temperatures in accordance with established engineering practices, as outlined in the ASHRAE Guide or other authoritative source. Indoor temperatures of 80°F dry bulb, 67°F wet bulb for summer and 70°F dry bulb for winter usually are acceptable for design or peak load conditions, even though the expected operating conditions of the system may be somewhat different.

Step 2: Determine Heating and Cooling Loads

Calculate design winter heating losses and summer cooling loads in accordance with the procedures outlined by the ASHRAE Guide or other authoritative source. Perhaps the greatest consideration in calculating design loads is solar heat gain. August solar heat values might be used for summer cooling loads, but should not be used for ventilation air or "natural cooling" capacity calculations; since these cooling loads reach their maximum in the spring and autumn months. The natural cooling capacity is usually calculated for 55° or 60°F outdoor air temperature.

Table 22: Outdoor Air Ventilation Sensible Cooling Capacities Based On 75°F Room Temperature

Unit Series	Nominal CFM	Outdoor Air Temperature	
		55°F	60°F
024	1000	21.7 MBH	16.3 MBH
036	1250	27.1 MBH	20.3 MBH
044, 054	1500	32.6 MBH	24.4 MBH

Step 3: Determine Air Quantity Required

Air quantity for heating applications is determined from circulation of a definite number of room air volumes per hour. Table 23 gives the recommended number of room air changes per hour.

Table 23: Recommended Room Air Changes Per Hour

Type of Space	Recommended Number of Room Air Changes Per Hour
Classrooms, Offices	6 to 9
Laboratories, Shops	6 to 8
Cafeterias & Kitchens	4½ to 7

For rooms facing east, south or west, the higher values shown in the table should be used so adequate ventilation cooling will be available to prevent overheating during mild sunny weather. The following equation is helpful to determine the CFM air delivery for any given rate of circulation:

Equation 1: CFM For Given Rate Of Circulation

$$\frac{\text{Room Volume (cu ft)} \times \text{Room Changes per Hour}}{60} = \text{CFM}$$

In mechanical cooling applications, the total air quantity may be determined or verified by use of the sensible cooling load equation:

Equation 2: CFM Based On Sensible Cooling Load

$$\text{CFM} = \frac{\text{Q sensible (space)}}{1.086 \times \text{TD}}$$

Q sensible is the maximum sensible room load and T.D. is the temperature difference between the room design dry bulb temperature and the final or leaving-air dry bulb temperature. For these calculations, a T.D. of 20°F is usually assumed to be desirable to avoid delivering air too cold for comfort. This figure may be varied one or two degrees for reasons of practicality.

Note: *The sensible load used in the preceding equation is the space load and excludes the ventilation load.*

Most areas have ventilation codes which govern the amount of ventilation air required for school applications. For other than school applications or areas not having codes, the ASHRAE Guide may be used for authoritative recommendations and discussion of the relation between odor control and outdoor air quantities.

The minimum outdoor air quantity recommended by ASHRAE for K-12 classrooms is 10 CFM per person plus 0.12 CFM/ft^2. Lower percent minimum outdoor air settings are more economical. In the interest of economy, it may be desirable to use lower percent minimums if there are no ventilation codes.

Step 4: Select Unit Size

The unit should be selected to meet or exceed the CFM delivery requirement previously determined. All model types are available with nominal capacities of 1000, 1250, and 1500 CFM.

Cooling Capacity

Unit cooling capacity should be selected to equal or slightly exceed the sum of computed room sensible and latent heat gains (Room Total Capacity). When operating on the mechanical cooling cycle, the control system introduces a constant amount of outdoor air for ventilation. The latent and sensible heat gain from this outdoor ventilation air must be added to the room total cooling load before choosing the proper capacity unit.

Heating Capacity

Unit heating capacity should be selected to equal or slightly exceed the computed room heat loss. For units installed for 100% recirculation, it is good practice to increase the heating capacity by 15% to aid in quick room warm-up. This allowance is unnecessary for units delivering a minimum outdoor air of 20% or more, since the outdoor air damper remains closed until the room is up to temperature. The heat normally expended in heating the minimum-percent outdoor air up to room temperature is available for quick warm-up purposes.

The heating required to warm the outdoor ventilating air up to room temperature must also be calculated. The Total Capacity should be used in sizing, piping, boilers, etc.

Step 5: Freeze Protection

Constant pump operation is required whenever the outdoor air temperature is below 35°F. This will assist in providing protection against freeze up of the system water piping and coils. To reduce the possibility of water coil freeze up on valve-controlled units, the valve must be selected properly to provide adequate water flow. See "Hot Water EOC Valve Piping" on page 90. Carry out one of the following steps to help protect against freezing:

- Use antifreeze in the system.
- Open the hot water coil valve and close the outdoor air damper whenever a freezing condition is sensed at the coil.

Step 6: Units With Antifreeze

If ethylene glycol or propylene glycol is used, its effect upon heating capacities and its effect on water pressure drops through the coil and piping system must be considered, as follows:

1. Divide the heating loads determined in Step 2 by the applicable capacity correction factor shown in Table 24 or Table 25 to arrive at the calculated unit capacity required to take care of the capacity reduction caused by the glycol solution.

Table 24: Capacity Correction Factors for Ethylene Glycol

Ethylene Glycol% Weight	20%	30%	40%
Hot Water	0.94	0.90	0.84

Table 25: Capacity Correction Factors for Propylene Glycol

Propylene Glycol% Weight	20%	30%	40%
Hot Water	0.98	0.96	0.92

2. Determine the GPM required by entering the appropriate hot water capacity chart using the calculated unit capacity.
3. Determine the water pressure drop by multiplying the water pressure drop for the GPM determined above by the applicable pressure drop correction factor shown in Table 26 or Table 27 below.

Table 26: Pressure Drop Correction Factors for Ethylene Glycol

Ethylene Glycol% Weight	20%	30%	40%
Hot Water	1.08	1.11	1.19

Table 27: Pressure Drop Correction Factors for Propylene Glycol

Propylene Glycol% Weight	20%	30%	40%
Hot Water	1.07	1.11	1.15

Cooling Selection Example

Step 1: Determine Design Conditions

Assume the following design indoor and outdoor air temperatures are given:

- Outdoor design temperature = 96°F DB / 74°F WB
- Room design temperature = 76°F DB / 65°F WB

Step 2: Determine Cooling Loads

Assume the following cooling loads are given:

- Minimum total capacity (TC) = 37.8 MBH
- Minimum sensible capacity (SC) = 23.9 MBH
- Minimum outdoor air = 20%
- Room volume = 9,000 cubic feet
- Desired number of air changes per hour = 8

Step 3: Determine Air Quantity Required

"Equation 1: CFM For Given Rate Of Circulation" on page 41 indicates that to obtain eight room volumes per hour, a unit capable of delivering 1200 CFM standard air must be used, as follows:

$$\text{CFM} = \frac{(\text{Room Volume Ft}^3) \times (\text{Room Changes per Hour})}{80}$$

$$\text{CFM} = \frac{9000 \times 8}{60} = 1200$$

This indicates that a size 036 Unit Ventilator should be used, which delivers 1250 CFM.

Step 4: Select Unit Size

Determine the unit performance as follows:

Determine Entering Dry Bulb Temperature

The entering dry bulb (EDB) temperature is calculated using the following formula:

$$\text{EDB} = \text{Room DB} \times \frac{\%\text{RA}}{100} + \text{Outdoor DB} \times \frac{\%\text{OA}}{100}$$

$$\text{EDB} = 76(0.8) + (96)(0.2) = 80°\text{F}$$

Determine Entering Wet Bulb Temperature

The entering wet bulb (EWB) temperature is determined by calculating the Enthalpy (H) at saturation, then looking up the corresponding EWB (Table 28 on page 44). Enthalpy (H) is calculated as follows:

$$\text{Enthalpy (H)} = \text{Room Enthalpy} \times \frac{\%RA}{100} + \text{Outdoor Enthalpy} \times \frac{\%OA}{100}$$

Enthalpy (H) = 30.06 (0.8) + 37.66 (0.2) = 31.58 btu/lb

Referring to Table 28 on page 44, EWB for 31.58 btu/lb = 67°F

Look Up Capacities

Look up the Total and Sensible cooling capacity for a Size 036 unit at High Fan Speed from page 49. Interpolation between the values for Outdoor DB = 90°F and 100°F, at Entering Air Temperature DB/WB = 80/67, will yield the following results.

- 38.3 MBH (TC)
- 24.9 MBH (SC)

Leaving air temperatures dry bulb °F (LDB) and wet bulb °F (LWB) may be calculated as follows:

$$\text{LDB} = \text{EDB} - \frac{\text{SC(Btuh)}}{\text{CFM} \times 1.085} = 80 - \frac{24900}{1250 \times 1.085} = 61.6°\text{F}$$

$$\text{LWBH} = \text{EWBH} - \frac{\text{TC(Btuh)}}{\text{CFM} \times 4.5} = 31.62 - \frac{38320}{1250 \times 4.5} = 24.8$$

From Table 28 on page 44:

LWB at 24.8 H = 57.5°F.

Note: *Interpolation within each table and between sets of tables for each unit series is permissible.*

For conditions of performance beyond the scope of the catalog selection procedures, Daikin Applied offers computer selection programs for cooling, hot water and steam coils. Consult your local Daikin Applied representative for details.

Table 28: Enthalpy (H) at Saturation But Per Pound of Dry Air

Wet Bulb Temp. °F	Tenths of A Degree									
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	20.3	20.36	20.41	20.47	20.52	20.58	20.64	20.69	20.75	20.8
51	20.86	20.92	20.97	21.03	21.09	21.15	21.2	21.26	21.32	21.38
52	21.44	21.5	21.56	21.62	21.67	21.73	21.79	21.85	21.91	21.97
53	22.02	22.08	22.14	22.2	22.26	22.32	22.38	22.44	22.5	22.56
54	22.62	22.68	22.74	22.8	22.86	22.92	22.98	23.04	23.1	23.16
55	23.22	23.28	23.34	23.41	23.47	23.53	23.59	23.65	23.72	23.78
56	23.84	23.9	23.97	24.03	24.1	24.16	24.22	24.29	24.35	24.42
57	24.48	24.54	24.61	24.67	24.74	24.8	24.86	24.93	24.99	25.06
58	25.12	25.19	25.25	25.32	25.38	25.45	25.52	25.58	26.65	25.71
59	25.78	25.85	25.92	25.98	26.05	26.12	26.19	26.26	26.32	26.39
60	26.46	26.53	26.6	26.67	26.74	26.81	26.87	26.94	27.01	27.08
61	27.15	27.22	27.29	27.36	27.43	27.5	27.57	27.64	27.71	27.78
62	27.85	27.92	27.99	28.07	28.14	28.21	28.28	28.35	28.43	28.5
63	28.57	28.64	28.72	28.79	28.87	28.94	29.01	29.09	29.16	29.24
64	29.31	29.39	29.46	29.54	29.61	29.69	29.76	29.84	29.91	29.99
65	30.06	30.14	30.21	30.29	30.37	30.45	30.52	30.6	30.68	30.78
66	30.83	30.91	30.99	31.07	31.15	31.23	31.3	31.38	31.46	31.54
67	31.62	31.7	31.78	31.86	31.94	32.02	32.1	32.18	32.26	32.34
68	32.42	32.5	32.59	32.67	32.75	32.84	32.92	33	33.08	33.17
69	33.25	33.33	33.42	33.5	33.59	33.67	33.75	33.84	33.92	34.01
70	34.09	34.18	34.26	34.35	34.43	34.52	34.61	34.69	34.78	34.86
71	34.95	35.04	35.13	35.21	35.3	35.39	35.48	35.57	35.65	35.74
72	35.83	35.92	36.01	36.1	36.19	36.29	36.38	36.47	36.56	36.65
73	36.74	36.83	36.92	37.02	37.11	37.2	37.29	37.38	37.48	37.57
74	37.66	37.76	37.85	37.95	38.04	38.14	38.23	38.33	38.42	38.52
75	38.61	38.71	38.8	38.9	38.99	39.09	39.19	39.28	39.38	39.47
76	39.57	39.67	39.77	39.87	39.97	40.07	40.17	40.27	40.37	40.47
77	40.57	40.67	40.77	40.87	40.97	41.08	41.18	41.28	41.38	41.48
78	41.58	41.68	41.79	41.89	42	42.1	42.2	42.31	42.41	42.52
79	42.62	42.73	42.83	42.94	43.05	43.16	43.26	43.37	43.48	43.58
80	43.69	43.8	43.91	44.02	44.13	44.24	44.34	44.45	44.56	44.67
81	44.78	44.89	45	45.12	45.23	45.34	45.45	45.56	45.68	45.79
82	45.9	46.01	46.13	46.24	46.36	46.47	46.58	46.7	46.81	46.93
83	47.04	47.16	47.28	47.39	47.51	47.63	47.75	47.87	47.98	48.1
84	48.22	48.34	48.46	48.58	48.7	48.83	48.95	49.07	49.19	49.31
85	49.43	49.55	49.68	49.8	49.92	50.05	50.17	50.29	50.41	50.54

Hot Water Heating Selection

For proper temperature control, do not oversize the heating coil. Select the hot water coil that just slightly exceeds the required heating capacity. Hot water coils are offered in two capacities. The low-capacity (65) coil and the high-capacity (66) coil can be used as heating only or in conjunction with direct-expansion cooling coil.

Quick Selection Method Using MBH/ΔT

Once the unit size has been selected, the MBH/ΔT factor can be utilized to quickly and accurately determine coil size and minimum GPM, where:

ΔT = Entering Water Temp - Entering Air Temp

For example, assume an entering water temperature of 180°F, an entering air temperature of 55°F and a total heating load of 75 MBH. Then,

ΔT = 180 - 55 = 125 and, MBH/ΔT = 75/125 = 0.6

Assume we want to size for the 036 unit determined in the coil selection example previously given for cooling.

Referring to Figure 50 or Figure 51:

1. Enter each chart at MBH/ΔT = 0.6.
2. Move horizontally to the right to intersect the unit 036, 1250 scfm curve.
3. Project downward for GPM requirement.

It is quickly seen that the 1-row coil (Figure 50) does not meet the heating load. The 2-row coil (Figure 51) can meet the requirement with 3.4 GPM.

Figure 50: 1-Row Hot Water Coil

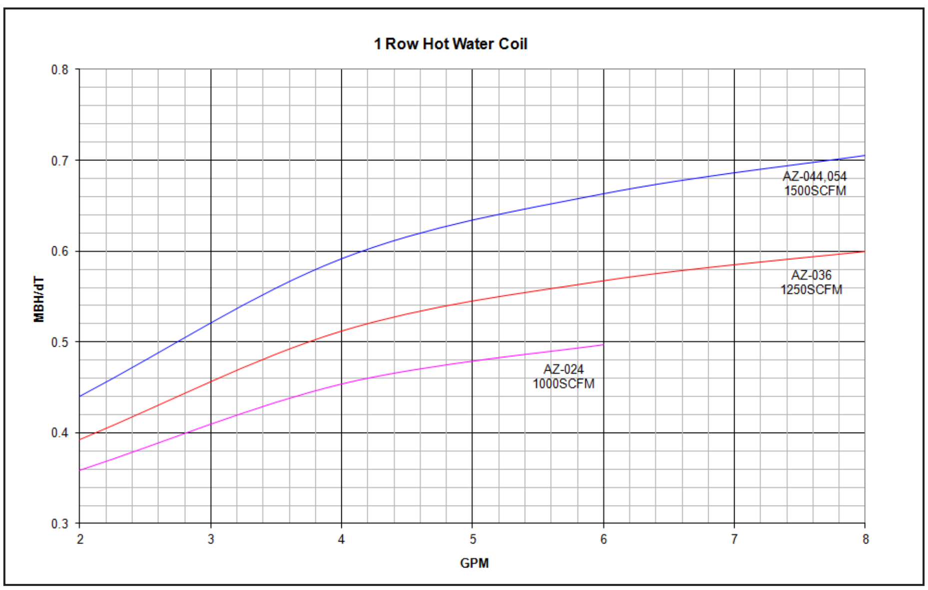
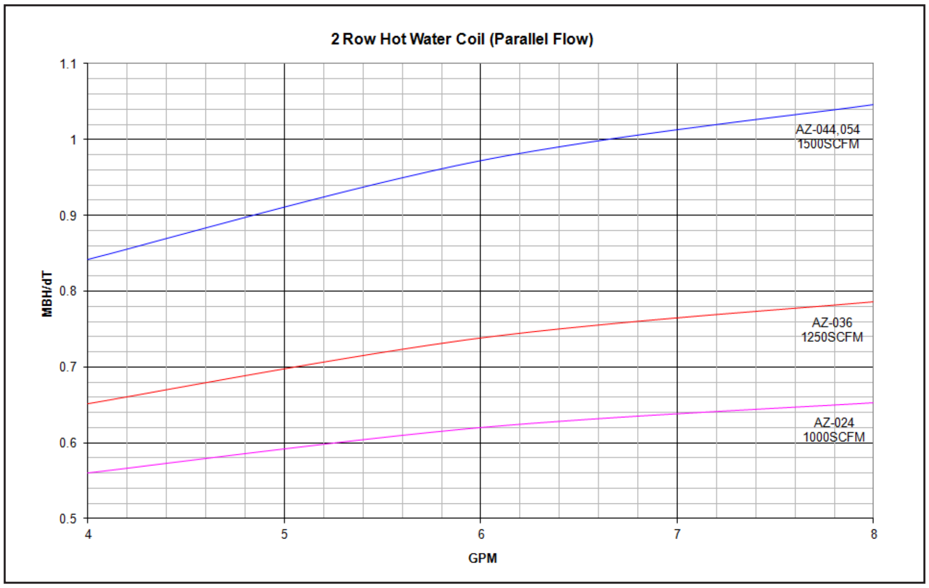


Figure 51: 2-Row Hot Water Coil (Parallel Flow)



Steam Heating Selection

The maximum allowable steam pressure, especially in public buildings, is often fixed by state or local boiler codes. Steam Capacity in Table 29 is based on steam supply pressure of 2 PSI gauge and steam temperature of 218.5°F.

To determine total capacity for conditions other than shown in the Steam Capacity Table 29, multiply the total capacity given by the proper constant from the Steam Capacity Correction Factor in Table 30.

Maximum steam pressure is 15 PSIG at coil inlet.

Traps are by others. Either float and thermostatic traps or thermostatic traps may be used.

Table 29: Steam Heating Capacities - 2# Steam Coils

Unit	Coil Capacity	Airflow SCFM	Entering Air Temperature °F																			
			-20		-10		0		10		20		30		40		50		60		70	
			MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db	MBH	LAT, db
1000	Std	1000	82.1	55.8	78.7	62.6	75.2	69.3	71.6	76.0	68.0	82.7	65.6	90.5	61.8	97.0	58.0	103.5	54.1	109.9	50.4	116.5
	High		98.3	70.6	94.1	76.8	89.9	82.9	85.6	89.0	81.3	95.0	77.0	101.0	72.3	106.7	67.7	112.4	63.0	118.1	58.4	123.9
1250	Std	1250	97.0	51.6	93.0	58.6	89.0	65.7	85.0	72.7	80.9	79.7	76.7	86.6	72.3	93.3	67.9	100.1	63.5	106.9	59.9	114.2
	High		122.6	70.4	117.6	76.7	112.5	83.0	107.3	89.2	102.1	95.3	96.8	101.4	91.2	107.3	85.6	113.2	80.0	119.0	74.4	124.9
1500	Std	1500	121.3	54.6	116.5	61.6	111.5	68.5	106.5	75.5	101.4	82.3	96.3	89.2	90.8	95.8	85.5	102.5	80.0	109.2	75.6	116.5
	High		140.0	66.0	134.3	72.5	128.5	79.0	123.6	86.0	117.7	92.4	111.8	98.7	105.5	104.8	99.2	111.0	92.8	117.1	86.6	123.2

Table 30: Steam Capacity Correction Factors

Steam Pressure PSIG	Entering Air Temperature Mixture, °F									
	-20	-10	0	10	20	30	40	50	60	70
0	0.97	0.97	0.97	0.96	0.97	0.97	0.97	0.96	0.96	0.96
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.02	1.03	1.03	1.03	1.04	1.05	1.05	1.05	1.05	1.05

Electric Heating Selection

Table 31: Electric Heat Capacities

Unit Type	AZQ, AZU, AZR					
CFM	1000 (024)		1250 (036)		1500 (044, 054)	
Number of Electric Elements	3	6	3	6	3	6
208 Volt Units						
kW	8.0	16.0	10.0	20.0	12.0	24.0
MBH	27.3	54.6	34.1	68.3	41.0	81.9
Final Air Temp F (70°F entering air temp)	95.2	120.3	95.2	120.3	95.2	120.3
Air Temperature Rise	25.2	50.3	25.2	50.3	25.2	50.3
230, 265, or 460 Volt Units						
kW	7.4	14.7	9.2	18.4	11.0	22.0
MBH	25.3	50.2	31.4	62.8	37.5	75.1
Final Air Temp F (70°F entering air temp)	93.2	116.2	93.2	116.2	93.2	116.2
Air Temperature Rise	23.2	46.2	23.2	46.2	23.2	46.2

Capacity Data

Size 024

Table 32: Size 024 (1000 SCFM) – 2nd Stage High Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	26000	18300	2.098	12.4
50	26200	18500	1.875	14.0
60	25900	18500	1.775	14.6
70	25200	18200	1.777	14.2
80	24300	17800	1.864	13.0
90	23000	17200	2.017	11.4
100	21600	16500	2.216	9.7
110	20100	15800	2.443	8.2
115	19300	15400	2.562	7.5

Note: Capacity Data at Full Load

Table 33: Size 024 (750 SCFM) – 1st Stage Medium Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	21600	14900	1.338	16.1
50	21800	15100	1.115	19.6
60	21500	15100	1.014	21.2
70	20900	14800	1.016	20.6
80	19900	14400	1.103	18.0
90	18700	13800	1.256	14.9
100	17300	13100	1.455	11.9
110	15700	12400	1.683	9.3
115	14900	12000	1.801	8.3

Note: Capacity Data at Part Load

Table 34: Size 024 (650 SCFM) – 1st Stage Low Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	21200	14700	1.288	16.5
50	21400	14900	1.065	20.1
60	21100	14800	0.964	21.9
70	20500	14500	0.966	21.2
80	19500	14100	1.053	18.5
90	18300	13500	1.206	15.2
100	16900	12800	1.405	12.0
110	15300	12100	1.633	9.4
115	14500	11700	1.751	8.3

Note: Capacity Data at Part Load

LEGEND			
Btu/h	British Termal Units per Hour	**EER**	Energy Efficiency Ratio
DB	Dry Bulb	**kW**	Kilowatts
EAT	Entering Air Temperature	**WB**	Wet Bulb

Size 036

Table 35: Size 036 (1250 SCFM) – 2nd Stage High Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	49800	31200	2.170	22.9
50	47500	30100	2.462	19.3
60	45600	29000	2.731	16.7
70	43700	28100	2.996	14.6
80	41900	27100	3.274	12.8
90	40000	26100	3.584	11.2
100	38000	25100	3.942	9.6
110	35700	23800	4.367	8.2
115	34400	23200	4.611	7.5

Note: Capacity Data at Full Load

Table 36: Size 036 (1000 SCFM) – 1st Stage Medium Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	41500	25400	0.870	47.7
50	39200	24200	1.162	33.7
60	37300	23200	1.431	26.1
70	35400	22300	1.696	20.9
80	33600	21300	1.974	17.0
90	31700	20300	2.284	13.9
100	29700	19300	2.642	11.2
110	27400	18000	3.067	8.9
115	26100	17400	3.311	7.9

Note: Capacity Data at Part Load

Table 37: Size 036 (800 SCFM) – 1st Stage Low Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	39000	23600	0.790	49.3
50	36700	22500	1.082	33.9
60	34800	21500	1.351	25.8
70	32900	20500	1.616	20.4
80	31100	19600	1.894	16.4
90	29200	18600	2.204	13.3
100	27200	17500	2.562	10.6
110	24900	16300	2.987	8.3
115	23600	15600	3.231	7.3

Note: Capacity Data at Part Load

LEGEND			
Btu/h	British Termal Units per Hour	**EER**	Energy Efficiency Ratio
DB	Dry Bulb	**kW**	Kilowatts
EAT	Entering Air Temperature	**WB**	Wet Bulb

Size 044

Table 38: Size 044 (1500 SCFM) – 2nd Stage High Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	60000	38200	1.906	31.5
50	56700	36400	2.403	23.6
60	53800	34800	2.827	19.0
70	51200	33400	3.205	16.0
80	48700	32200	3.565	13.7
90	46300	30900	3.932	11.8
100	43700	29600	4.336	10.1
110	40800	28200	4.802	8.5
115	39300	27400	5.067	7.8

Note: Capacity Data at Full Load

Table 39: Size 044 (1050 SCFM) – 1st Stage Medium Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	48600	30200	0.381	127.6
50	45300	28400	0.878	51.6
60	42400	26800	1.302	32.6
70	39800	25500	1.680	23.7
80	37300	24200	2.040	18.3
90	34900	23000	2.407	14.5
100	32300	21700	2.811	11.5
110	29400	20200	3.277	9.0
115	27900	19400	3.542	7.9

Note: Capacity Data at Part Load

Table 40: Size 044 (850 SCFM) – 1st Stage Low Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	44900	26900	0.281	159.8
50	41600	25100	0.778	53.5
60	38700	23500	1.202	32.2
70	36100	22200	1.580	22.8
80	33600	20900	1.940	17.3
90	31200	19700	2.307	13.5
100	28600	18300	2.711	10.6
110	25700	16900	3.177	8.1
115	24200	16100	3.442	7.0

Note: Capacity Data at Part Load

LEGEND			
Btu/h	British Termal Units per Hour	**EER**	Energy Efficiency Ratio
DB	Dry Bulb	**kW**	Kilowatts
EAT	Entering Air Temperature	**WB**	Wet Bulb

Size 054

Table 41: Size 054 (1500 SCFM) – 2nd Stage High Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	63700	41100	3.007	21.2
50	60900	39800	3.291	18.5
60	58500	38600	3.594	16.3
70	56400	37600	3.927	14.4
80	54400	36700	4.304	12.6
90	52300	35700	4.735	11.0
100	49800	34500	5.233	9.5
110	46900	33200	5.810	8.1
115	45100	32400	6.131	7.4

Note: Capacity Data at Full Load

Table 42: Size 054 (1050 SCFM) – 1st Stage Medium Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	53200	31700	1.122	47.4
50	50400	30400	1.406	35.9
60	48000	29300	1.709	28.1
70	45900	28300	2.042	22.5
80	43900	27300	2.419	18.2
90	41800	26300	2.850	14.7
100	39300	25100	3.348	11.7
110	36400	23800	3.925	9.3
115	34600	23000	4.246	8.1

Note: Capacity Data at Part Load

Table 43: Size 054 (850 SCFM) – 1st Stage Low Fan

Entering Air Temperature Outdoor DB °F	Cooling - EAT Indoor DB/WB °F - 80/67° F			
	Total (Btu/h)	Sensible (Btu/h)	Power Input (kW)	EER
40	50600	29900	1.087	46.6
50	47800	28600	1.371	34.9
60	45400	27400	1.674	27.1
70	43300	26400	2.007	21.6
80	41300	25500	2.384	17.3
90	39200	24500	2.815	13.9
100	36700	23300	3.313	11.1
110	33800	22000	3.890	8.7
115	32000	21200	4.211	7.6

Note: Capacity Data at Part Load

LEGEND			
Btu/h	British Termal Units per Hour	**EER**	Energy Efficiency Ratio
DB	Dry Bulb	**kW**	Kilowatts
EAT	Entering Air Temperature	**WB**	Wet Bulb

Electrical Data

Table 44: AZU & AZQ – Size 024

Volt/Hz/Phase	Voltage Range Min.	Voltage Range Max.	Indoor Fan FLA	Outdoor Fan FLA	Compressor RLA	Compressor LRA	Heating Option Heat Type		Heater kW	Rated Heater Amps	Power Supply MCA	Power Supply Maximum Fuse
208/60/1	197	228	3.2	2.8	11.1	67.5	None, HW Steam		–	–	20.98	30
			3.2	2.8	11.1	67.5	Elec. Heat[1] (AZU Only)	Low (3 elem.)	8.0	38.5	53.50	60
			3.2	2.8	11.1	67.5		High (6 elem.)	16.0	76.9	101.50	110
230/60/1	207	253	3.2	2.8	11.1	67.5	None, HW Steam		–	–	20.98	30
			3.2	2.8	11.1	67.5	Elec. Heat[1] (AZU Only)	Low (3 elem.)	7.3	33.3	47.00	50
			3.2	2.8	11.1	67.5		High (6 elem.)	14.7	66.7	88.75	90
208/60/3	197	228	3.2	2.8	7.8	28.0	None, HW Steam		–	–	16.85	20
			3.2	2.8	7.8	28.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	8.0	22.2	33.13	35
			3.2	2.8	7.8	28.0		High (6 elem.)	16.0	44.4	60.88	70
230/60/3	207	253	3.2	2.8	7.8	28.0	None, HW Steam		–	–	16.85	20
			3.2	2.8	7.8	28.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	7.3	19.2	29.38	30
			3.2	2.8	7.8	28.0		High (6 elem.)	14.7	38.5	53.50	60
460/60/3	414	506	3.2	1.5	4.3	29.0	None, HW Steam		–	–	11.71	15
			3.2	1.5	4.3	29.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	7.3	9.6	18.04	20
			3.2	1.5	4.3	29.0		High (6 elem.)	14.7	19.2	30.04	35

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 45: AZR – Size 024

Volt/Hz/Phase	Voltage Range Min.	Voltage Range Max.	Indoor Fan FLA	Outdoor Fan FLA	Compressor RLA	Compressor LRA	Heating Option Heat Type		Heater kW	Rated Heater Amps	Power Supply MCA	Power Supply Maximum Fuse
208/60/1	197	228	3.2	2.8	11.1	67.5	None, Steam		–	–	20.98	30
			3.2	2.8	11.1	67.5	Elec. Heat[1]	Low (3 elem.)	8.0	38.5	69.10	70
			3.2	2.8	11.1	67.5		High (6 elem.)	16.0	76.9	117.10	125
230/60/1	207	253	3.2	2.8	11.1	67.5	None, Steam		–	–	20.98	30
			3.2	2.8	11.1	67.5	Elec. Heat[1]	Low (3 elem.)	7.3	33.3	62.60	70
			3.2	2.8	11.1	67.5		High (6 elem.)	14.7	66.7	104.35	110
208/60/3	197	228	3.2	2.8	7.8	28.0	None, Steam		–	–	16.85	20
			3.2	2.8	7.8	28.0	Elec. Heat[1]	Low (3 elem.)	8.0	22.2	44.60	45
			3.2	2.8	7.8	28.0		High (6 elem.)	16.0	44.4	72.35	80
230/60/3	207	257	3.2	2.8	7.8	28.0	None, Steam		–	–	16.85	20
			3.2	2.8	7.8	28.0	Elec. Heat[1]	Low (3 elem.)	7.3	19.2	40.85	45
			3.2	2.8	7.8	28.0		High (6 elem.)	14.7	38.5	64.98	70
460/60/3	414	506	3.2	1.5	4.3	29.0	None, Steam		–	–	11.71	15
			3.2	1.5	4.3	29.0	Elec. Heat[1]	Low (3 elem.)	7.3	9.6	23.71	25
			3.2	1.5	4.3	29.0		High (6 elem.)	14.7	19.2	35.71	40

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 46: AZU & AZQ – Size 036

Volt/Hz/Phase	Voltage Range		Indoor Fan FLA	Outdoor Fan FLA	Compressor		Heating Option				Power Supply	
	Min.	Max.			RLA	LRA	Heat Type		Heater kW	Rated Heater Amps	MCA	Maximum Fuse
208/60/1	197	228	3.2	2.8	20.5	126.0	None, Steam		–	–	32.73	50
			3.2	2.8	20.5	126.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	10.0	48.1	65.50	70
			3.2	2.8	20.5	126.0		High (6 elem.)	20.0	96.2	125.63	150
230/60/1	207	253	3.2	2.8	20.5	126.0	None, Steam		–	–	32.73	50
			3.2	2.8	20.5	126.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	9.2	41.7	57.50	60
			3.2	2.8	20.5	126.0		High (6 elem.)	18.4	83.3	109.50	110
208/60/3	197	228	3.2	2.8	10.2	82.0	None, Steam		–	–	19.85	30
			3.2	2.8	10.2	82.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	10.0	27.8	40.13	45
			3.2	2.8	10.2	82.0		High (6 elem.)	20.0	55.5	74.75	80
230/60/3	207	253	3.2	2.8	10.2	82.0	None, Steam		–	–	19.85	30
			3.2	2.8	10.2	82.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	9.2	24.1	35.50	40
			3.2	2.8	10.2	82.0		High (6 elem.)	18.4	48.1	65.50	70
460/60/3	414	506	3.2	1.5	4.6	56.0	None, Steam		–	–	12.08	15
			3.2	1.5	4.6	56.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	9.2	12.0	21.04	25
			3.2	1.5	4.6	56.0		High (6 elem.)	18.4	24.1	36.16	40

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 47: AZR – Size 036

Volt/Hz/Phase	Voltage Range		Indoor Fan FLA	Outdoor Fan FLA	Compressor		Heating Option				Power Supply	
	Min.	Max.			RLA	LRA	Heat Type		Heater kW	Rated Heater Amps	MCA	Maximum Fuse
208/60/1	197	228	3.2	2.8	20.5	126.0	None, Steam		—	—	32.73	50
			3.2	2.8	20.5	126.0	Elec. Heat[1]	Low (3 elem.)	10.0	48.1	92.85	100
			3.2	2.8	20.5	126.0		High (6 elem.)	20.0	96.2	152.98	175
230/60/1	207	253	3.2	2.8	20.5	126.0	None, Steam		–	–	32.73	50
			3.2	2.8	20.5	126.0	Elec. Heat[1]	Low (3 elem.)	9.2	41.7	84.85	90
			3.2	2.8	20.5	126.0		High (6 elem.)	18.4	83.3	136.85	150
208/60/3	197	228	3.2	2.8	10.2	82.0	None, Steam		–	–	19.85	30
			3.2	2.8	10.2	82.0	Elec. Heat[1]	Low (3 elem.)	10.0	27.8	54.60	60
			3.2	2.8	10.2	82.0		High (6 elem.)	20.0	55.5	89.23	90
230/60/3	207	257	3.2	2.8	10.2	82.0	None, Steam		–	–	19.85	30
			3.2	2.8	10.2	82.0	Elec. Heat[1]	Low (3 elem.)	9.2	24.1	49.98	50
			3.2	2.8	10.2	82.0		High (6 elem.)	18.4	48.1	79.98	80
460/60/3	414	506	3.2	1.5	4.6	56.0	None, Steam		–	–	12.08	15
			3.2	1.5	4.6	56.0	Elec. Heat[1]	Low (3 elem.)	9.2	12.0	27.08	30
			3.2	1.5	4.6	56.0		High (6 elem.)	18.4	24.1	42.21	45

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 48: AZU & AZQ – Size 044

Volt/Hz/Phase	Voltage Range Min.	Voltage Range Max.	Indoor Fan FLA	Outdoor Fan FLA	Compressor RLA	Compressor LRA	Heating Option Heat Type		Heater kW	Rated Heater Amps	Power Supply MCA	Power Supply Maximum Fuse
208/60/1	197	228	3.2	6.8	25.9	128.4	None, Steam		–	–	43.48	60
			3.2	6.8	25.9	128.4	Elec. Heat[1] (AZU Only)	Low (3 elem.)	12.0	57.7	77.50	80
			3.2	6.8	25.9	128.4		High (6 elem.)	24.0	115.4	149.63	150
230/60/1	207	253	3.2	6.8	25.9	128.4	None, Steam		–	–	43.48	60
			3.2	6.8	25.9	128.4	Elec. Heat[1] (AZU Only)	Low (3 elem.)	11.0	50.0	67.88	70
			3.2	6.8	25.9	128.4		High (6 elem.)	22.0	100.0	130.38	150
208/60/3	197	228	3.2	6.8	13.4	105.3	None, Steam		–	–	27.85	40
			3.2	6.8	13.4	105.3	Elec. Heat[1] (AZU Only)	Low (3 elem.)	12.0	33.3	47.00	50
			3.2	6.8	13.4	105.3		High (6 elem.)	24.0	66.6	88.63	90
230/60/3	207	253	3.2	6.8	13.4	105.3	None, Steam		–	–	27.85	40
			3.2	6.8	13.4	105.3	Elec. Heat[1] (AZU Only)	Low (3 elem.)	11.0	28.9	41.50	45
			3.2	6.8	13.4	105.3		High (6 elem.)	22.0	57.7	77.50	80
460/60/3	414	506	3.2	2.2	6.9	61.8	None, Steam		–	–	15.66	20
			3.2	2.2	6.9	61.8	Elec. Heat[1] (AZU Only)	Low (3 elem.)	11.0	14.4	24.04	25
			3.2	2.2	6.9	61.8		High (6 elem.)	22.0	28.9	42.16	45

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 49: AZR – Size 044

Volt/Hz/Phase	Voltage Range Min.	Voltage Range Max.	Indoor Fan FLA	Outdoor Fan FLA	Compressor RLA	Compressor LRA	Heating Option Heat Type		Heater kW	Rated Heater Amps	Power Supply MCA	Power Supply Maximum Fuse
208/60/1	197	228	3.2	6.8	25.9	128.4	None, Steam		–	–	43.48	60
			3.2	6.8	25.9	128.4	Elec. Heat[1]	Low (3 elem.)	12.0	57.7	115.60	125
			3.2	6.8	25.9	128.4		High (6 elem.)	24.0	115.4	187.73	200
230/60/1	207	253	3.2	6.8	25.9	128.4	None, Steam		–	–	43.48	60
			3.2	6.8	25.9	128.4	Elec. Heat[1]	Low (3 elem.)	11.0	50	105.98	110
			3.2	6.8	25.9	128.4		High (6 elem.)	22.0	100	168.48	175
208/60/3	197	228	3.2	6.8	13.4	105.3	None, Steam		–	–	27.85	40
			3.2	6.8	13.4	105.3	Elec. Heat[1]	Low (3 elem.)	12.0	33.3	69.48	70
			3.2	6.8	13.4	105.3		High (6 elem.)	24.0	66.6	111.10	125
230/60/3	207	257	3.2	6.8	13.4	105.3	None, Steam		–	–	27.85	40
			3.2	6.8	13.4	105.3	Elec. Heat[1]	Low (3 elem.)	11.0	28.9	63.98	70
			3.2	6.8	13.4	105.3		High (6 elem.)	22.0	57.7	99.98	100
460/60/3	414	506	3.2	2.2	6.9	61.8	None, Steam		–	–	15.66	20
			3.2	2.2	6.9	61.8	Elec. Heat[1]	Low (3 elem.)	11.0	14.4	33.66	35
			3.2	2.2	6.9	61.8		High (6 elem.)	22.0	28.9	51.78	60

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 50: AZU & AZQ – Size 054

Volt/Hz/Phase	Voltage Range		Indoor Fan FLA	Outdoor Fan FLA	Compressor		Heating Option				Power Supply	
	Min.	Max.			RLA	LRA	Heat Type		Heater kW	Rated Heater Amps	MCA	Maximum Fuse
208/60/1	197	228	3.2	6.8	30.2	178.0	None, Steam		–	–	48.85	70
			3.2	6.8	30.2	178.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	12.0	57.7	77.50	80
			3.2	6.8	30.2	178.0		High (6 elem.)	24.0	115.4	149.63	150
230/60/1	207	253	3.2	6.8	30.2	178.0	None, Steam		–	–	48.85	70
			3.2	6.8	30.2	178.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	11.0	50.0	67.88	70
			3.2	6.8	30.2	178.0		High (6 elem.)	22.0	100.0	130.38	150
208/60/3	197	228	3.2	6.8	16.9	140.0	None, Steam		–	–	32.23	45
			3.2	6.8	16.9	140.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	12.0	33.3	47.00	50
			3.2	6.8	16.9	140.0		High (6 elem.)	24.0	66.6	88.63	90
230/60/3	207	253	3.2	6.8	16.9	140.0	None, Steam		–	–	32.23	45
			3.2	6.8	16.9	140.0	Elec. Heat[1] (AZU Only)	Low (3 elem.)	11.0	28.9	41.50	45
			3.2	6.8	16.9	140.0		High (6 elem.)	22.0	57.7	77.50	80
460/60/3	414	506	3.2	2.2	8.2	54.7	None, Steam		–	–	17.28	25
			3.2	2.2	8.2	54.7	Elec. Heat[1] (AZU Only)	Low (3 elem.)	11.0	14.4	24.04	25
			3.2	2.2	8.2	54.7		High (6 elem.)	22.0	28.9	42.16	45

[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Table 51: AZR – Size 054

Volt/Hz/Phase	Voltage Range		Indoor Fan FLA	Outdoor Fan FLA	Compressor		Heating Option				Power Supply	
	Min.	Max.			RLA	LRA	Heat Type		Heater kW	Rated Heater Amps	MCA	Maximum Fuse
208/60/1	197	228	3.2	6.8	30.2	178.0	None, Steam		–	–	48.85	70
			3.2	6.8	30.2	178.0	Elec. Heat[1]	Low (3 elem.)	12.0	57.7	120.98	125
			3.2	6.8	30.2	178.0		High (6 elem.)	24.0	115.4	193.10	200
230/60/1	207	253	3.2	6.8	30.2	178.0	None, Steam		–	–	48.85	70
			3.2	6.8	30.2	178.0	Elec. Heat[1]	Low (3 elem.)	11.0	50	111.35	125
			3.2	6.8	30.2	178.0		High (6 elem.)	22.0	100	173.85	175
208/60/3	197	228	3.2	6.8	16.9	140.0	None, Steam		–	–	32.23	45
			3.2	6.8	16.9	140.0	Elec. Heat[1]	Low (3 elem.)	12.0	33.3	73.85	80
			3.2	6.8	16.9	140.0		High (6 elem.)	24.0	66.6	115.48	125
230/60/3	207	257	3.2	6.8	16.9	140.0	None, Steam		–	–	32.23	45
			3.2	6.8	16.9	140.0	Elec. Heat[1]	Low (3 elem.)	11.0	28.9	68.35	70
			3.2	6.8	16.9	140.0		High (6 elem.)	22.0	57.7	104.35	110
460/60/3	414	506	3.2	2.2	8.2	54.7	None, Steam		–	–	17.28	25
			3.2	2.2	8.2	54.7	Elec. Heat[1]	Low (3 elem.)	11.0	14.4	35.28	40
			3.2	2.2	8.2	54.7		High (6 elem.)	22.0	28.9	53.41	60

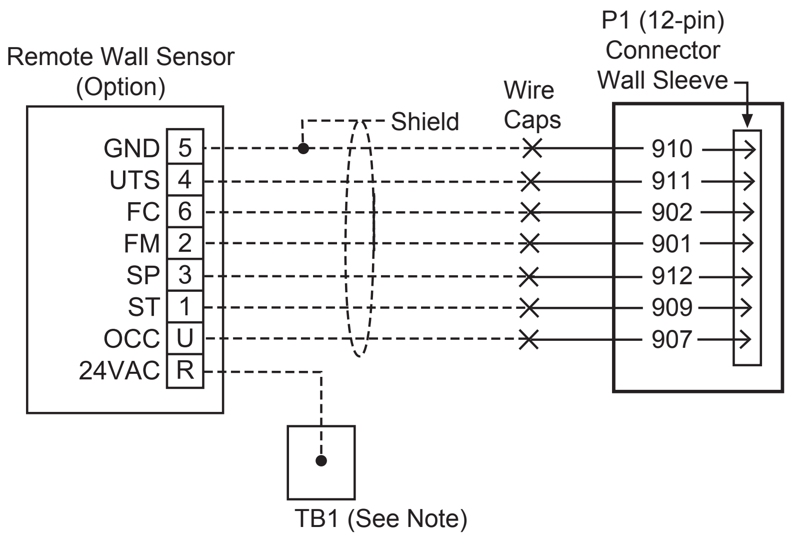
[1] Electric Heat Options are without Compressor and Outdoor Fan.

Legend			
FLA	Full Load Amps	**LRA**	Locked Rotor Amps
RLA	Rated Load Amps	**MCA**	Minimum Circuit Amps

Wiring Diagrams

Typical Wall Sensors Diagram

Figure 52: Wall-Mounted Temperature Sensor Wiring



Power & Control Field Wiring

Figure 53: External Input Wiring Examples with or without Daisy Chaining of Units

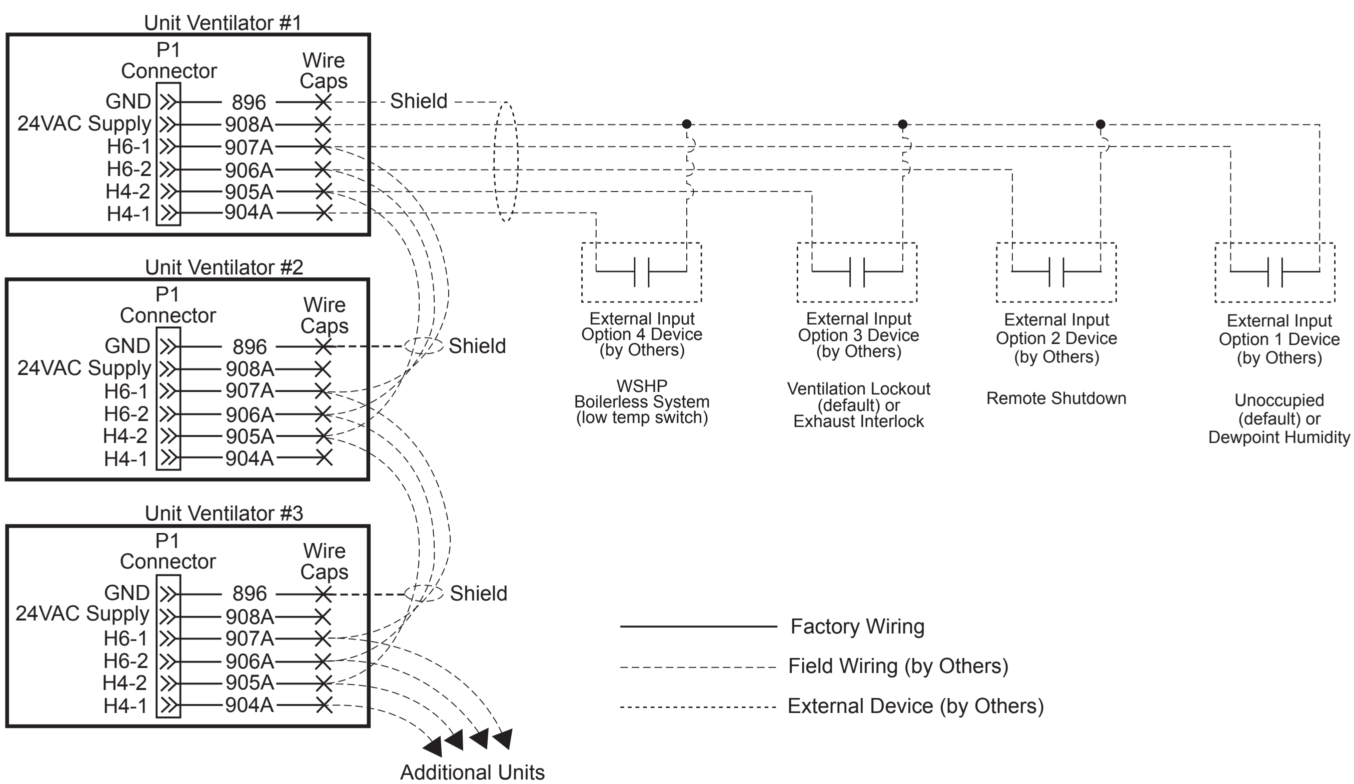


Figure 54: External Output Wiring - Single Unit

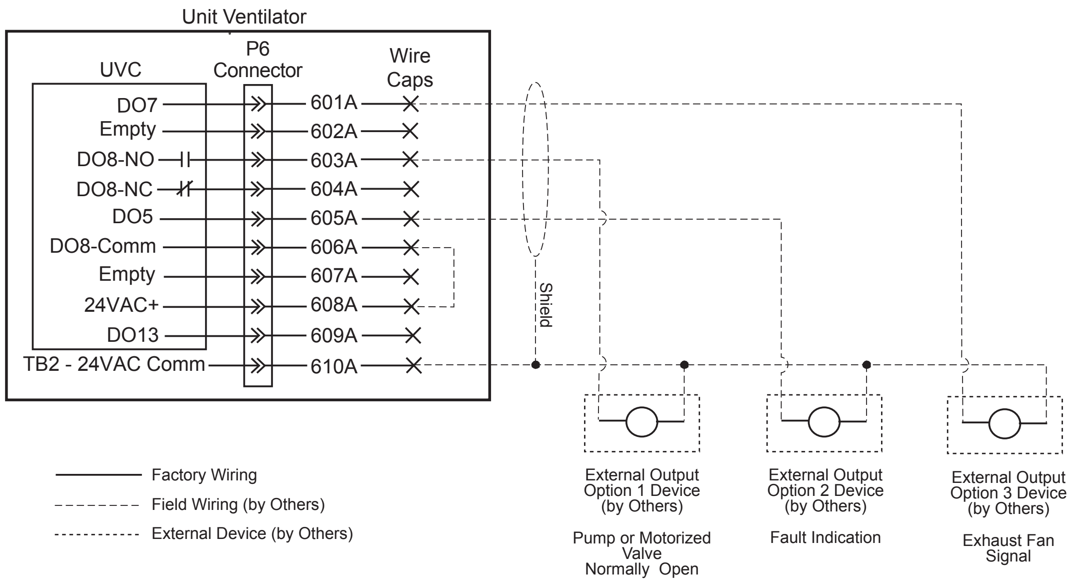
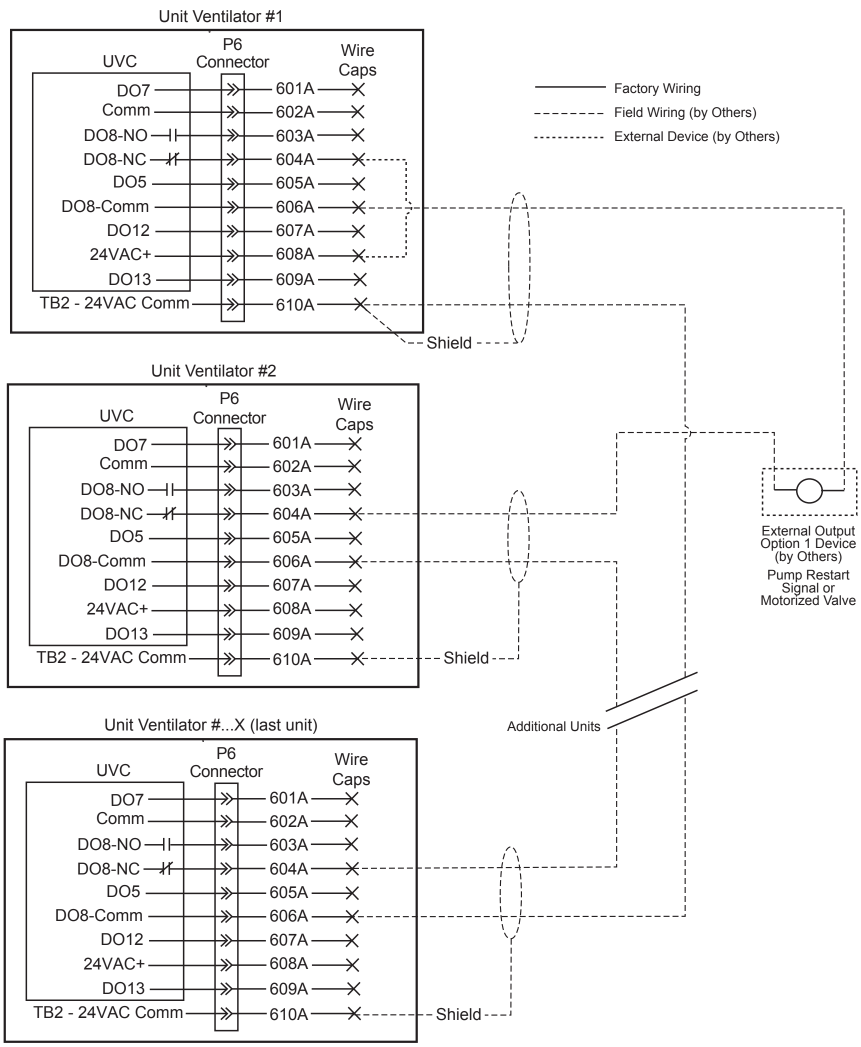


Figure 55: External Output Wiring - Multiple Units Shown



Typical MicroTech Wiring Diagrams

Figure 1: Electromechanical Controls – A2L Leak Mitigation

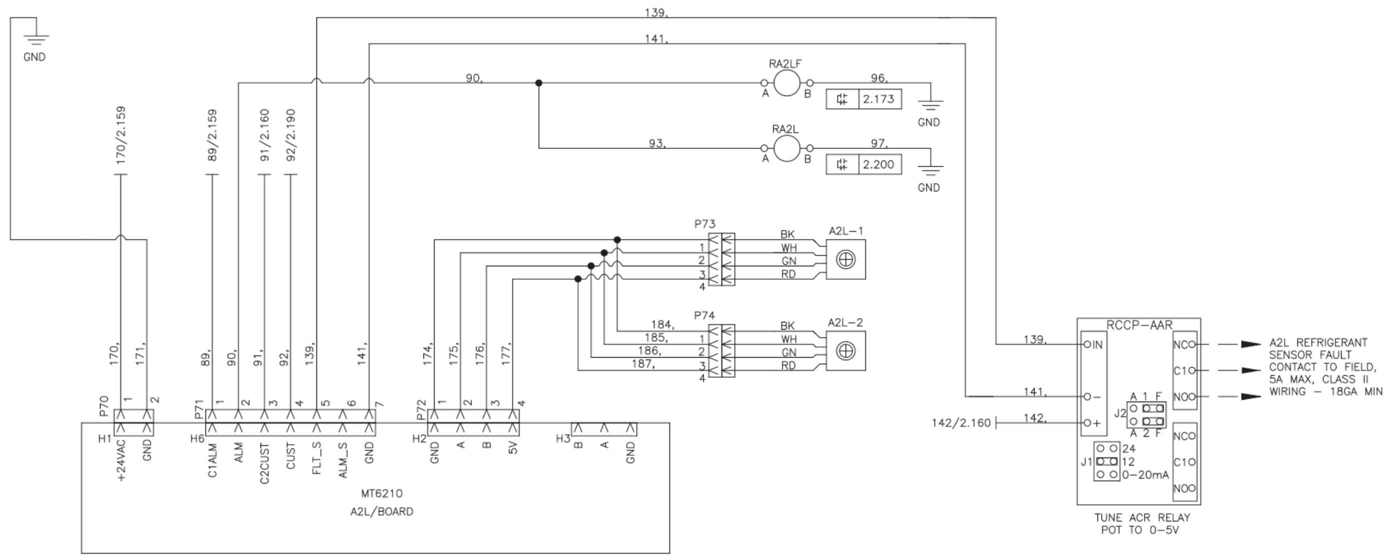


Figure 2: MicroTech Controls – A2L Leak Mitigation

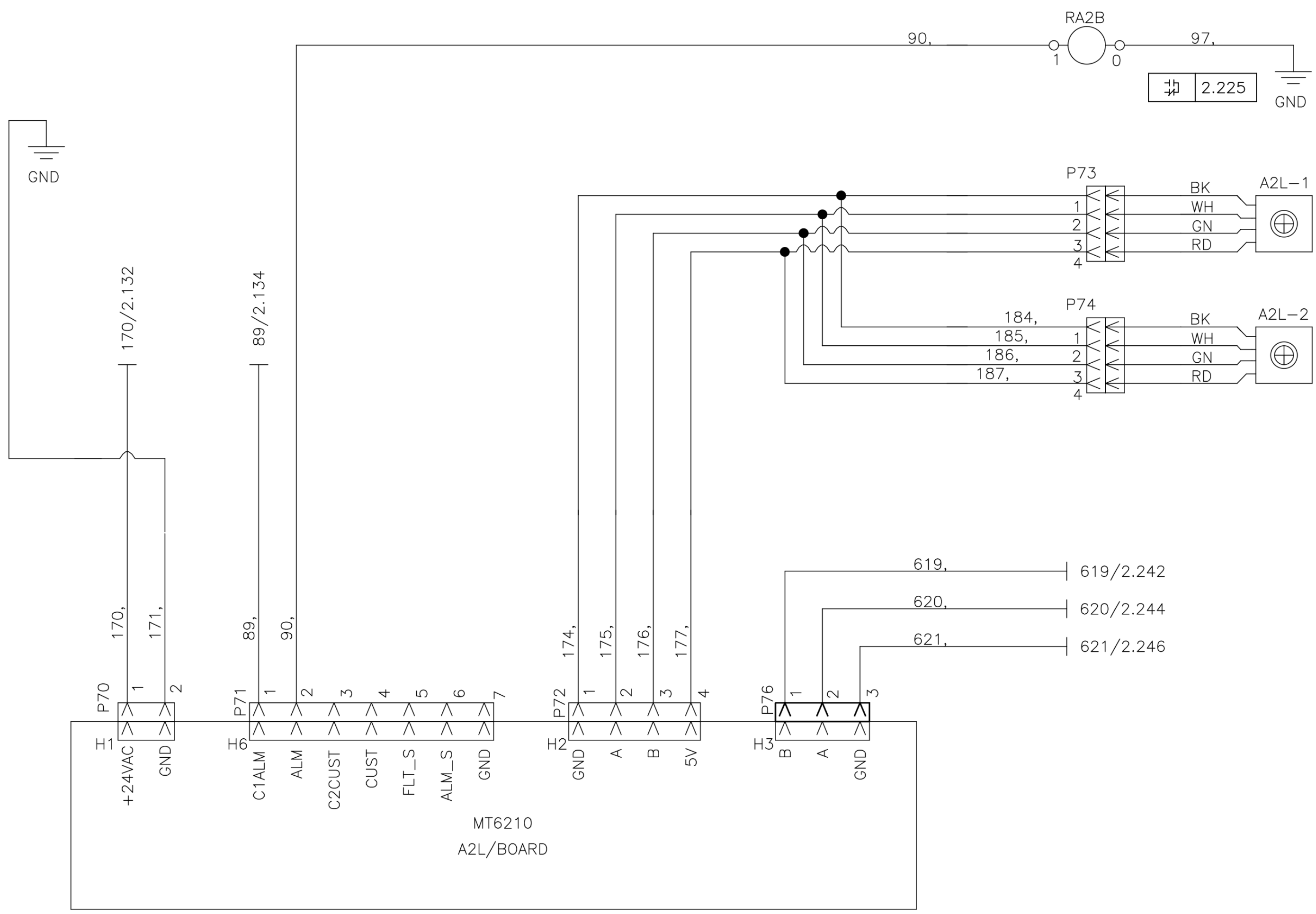


Figure 3: Typical MicroTech Controls Wiring Diagram – 208V / 60Hz / 1Ph

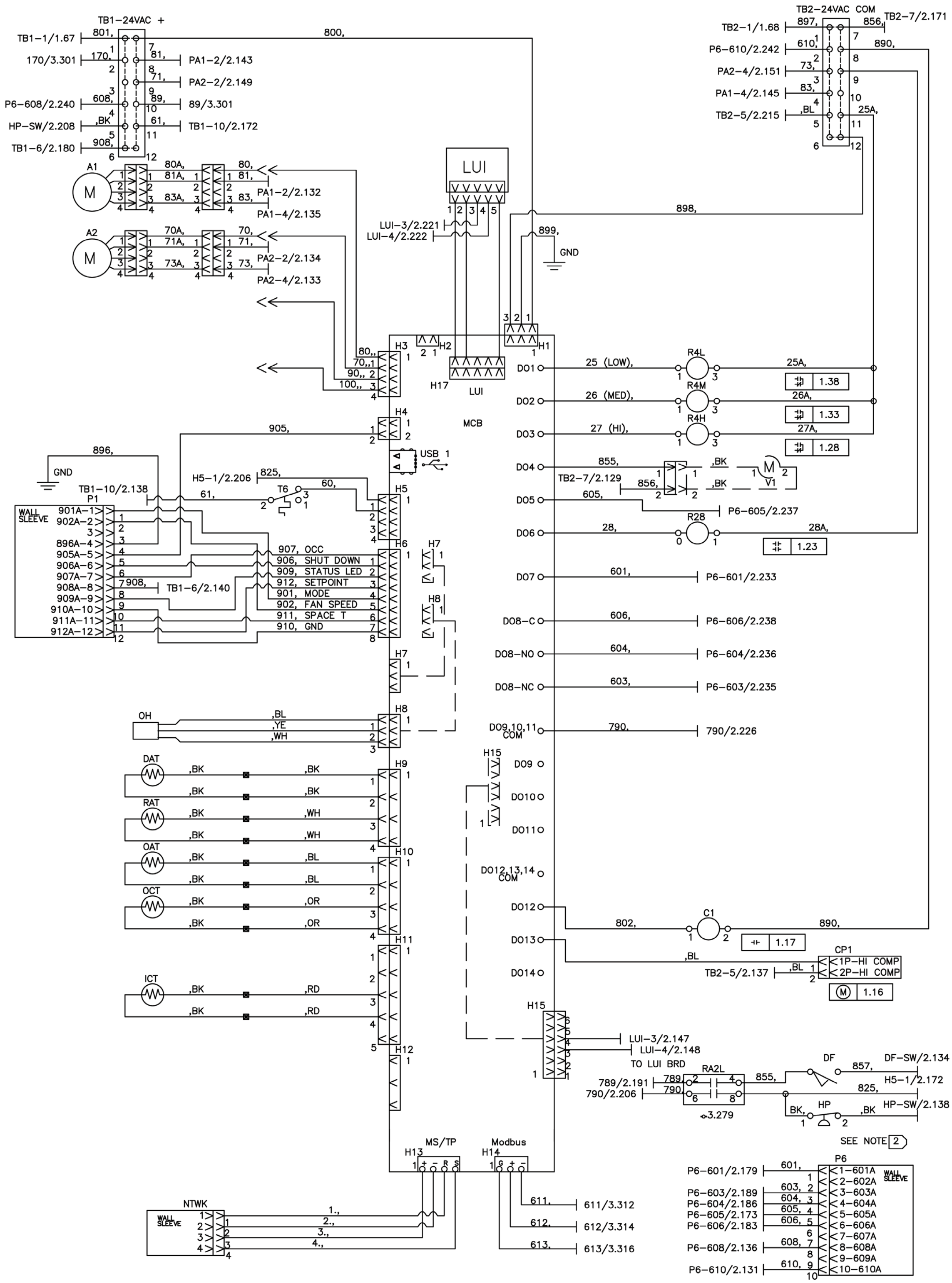
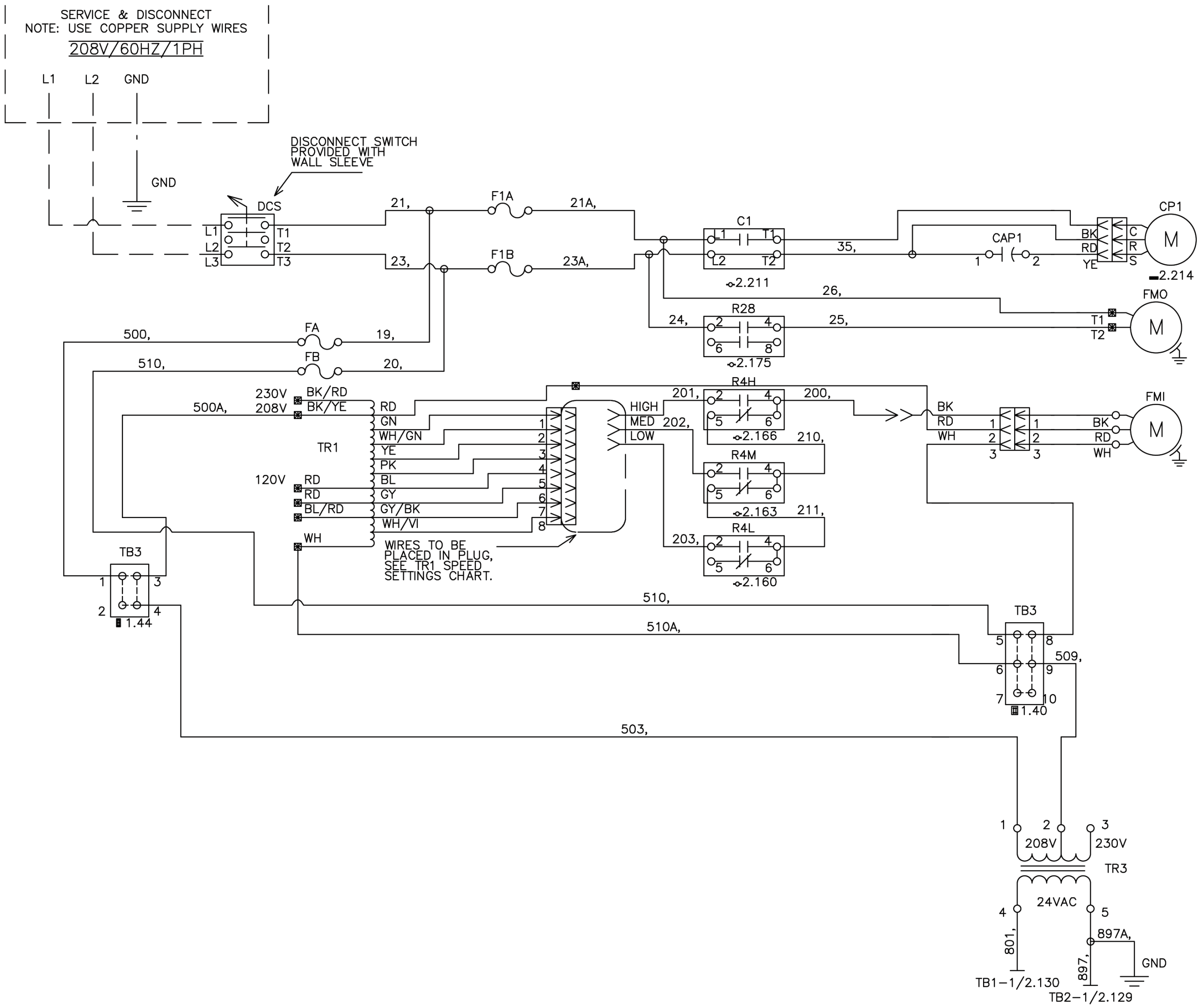


Figure 4: Typical MicroTech Wiring Diagram – Service and Disconnect – 208V / 60Hz / 1Ph



Wiring Schematics Legend for "Typical MicroTech Wiring Diagrams"

Legend			
A1	Actuator- Outdoor Air	**OH1**	Thermostat - Overheat
A2	Actuator- Face & Bypass	**OH2**	Thermostat - Overheat
A2L1-2	A2L Refrigerant Sensor	**OHM**	E.H. Man Reset - Overheat Stat
CP1	Motor Compressor 2-Stage	**PL1**	LED Occupancy / Fault Status
C1	Compressor Contactor	**R1-R3**	Relay Electric Heat (Backup)
CAP1	Capacitor Run	**R10-R12**	Relay – Electric Heat
CEH1-3	Electric Heat Contactor	**R4H**	Relay – Fan High Speed
CO2	Sensor - Indoor Air CO2	**R4M**	Relay– Fan Medium Speed
DAT	Sensor - Discharge Air Temperature	**R4L**	Relay– Fan Low Speed
DCS	Switch - Unit Power	**R32**	Relay - Drain Pan Heater
DF	Dead Front Switch	**R28**	Relay - Outdoor Motor Air
EH1-6	Heater - Electric	**RA2L**	Relay A2L
EH10	Heater - Outdoor Drain Pan	**RAT**	Sensor - Room Air Temperature
EWT	Sensor - Entering Water Temperature	**RCCP**	Transducer AAR
F1A/F1B	Fuse - Compressor	**RV**	Reversing Valve
F2A/F3C	Fuse - Electric Heat	**SRT**	Sensor - Suction Line
FA/FB	Fuse– Control, Load	**T6**	Thermostat - Freeze Stat
FC/FD	Fuse– Control, Transformer	**TB1**	Terminal Block - 24VAC+
FMI	Motor - Room Fan	**TB2**	Terminal Block – 24VAC Gnd
FMO	Motor Outdoor Air	**TB3 (A,B)**	Terminal Block – Main Power
HP	High Pressure Switch	**TBE**	Terminal Block - Electric Heat
ICT	Sensor - Indoor DX Coil Temperature	**TR1**	Transformer - Motor Speed
IH	Sensor - Indoor Humidity	**TR3**	Transformer - 208 / 230V-24V, 75VA
LWT	Sensor - Leaving Water Temperature	**TR4**	Transformer - 460V–230V
MCB	Main Control Board	**TR5**	Transformer - 208 / 230V-24V
MT6210	A2L Control Board	**V1**	Valve - Heat EOC (Accessory)
NTWK	Network Connection	**V2**	Valve - Cool EOC (Accessory)
OAT	Sensor - Outdoor Air Temperature	**VH**	Valve - Heat (Accessory)
OCT	Sensor - Outdoor DX Coil Temperature	**VC**	Valve - Cool (Accessory)
OH	Sensor - Outdoor Humidity		

Legend - Symbols	
– – –	Accessory or field mounted component
⏚	Ground
⊠	Wire nut / splice
●	Overlap point - common potential wires
L1/1.20	Wire link (wire link ID / page # . line #)

TR1 Speed Settings				
	054	**044**	**036**	**024**
High	GN	GN	WH/GN	YE
Med	YE	YE	PK	GY
Low	PK	PK	GY	GY/BK

NOTE 1: All electrical installation must be in accordance with national and local electrical codes and job wiring schematic.

NOTE 2: External wiring options - see IM for the different configured options, wiring to be minimum 18 gauge, 90°C.

NOTE 3: EC motors are factory programmed for specified airflow. Contact Daikin Applied for replacement.

NOTE 4: Cap extra wire. Switch wire 42A to RD wire for 208V operation.

NOTE 5: Devices in legend may or may not be on unit.

Typical Electric Heat Wiring Diagrams

Figure 5: Electric Heat Wiring Diagram – Typical 460 V/60 Hz/3 Ph

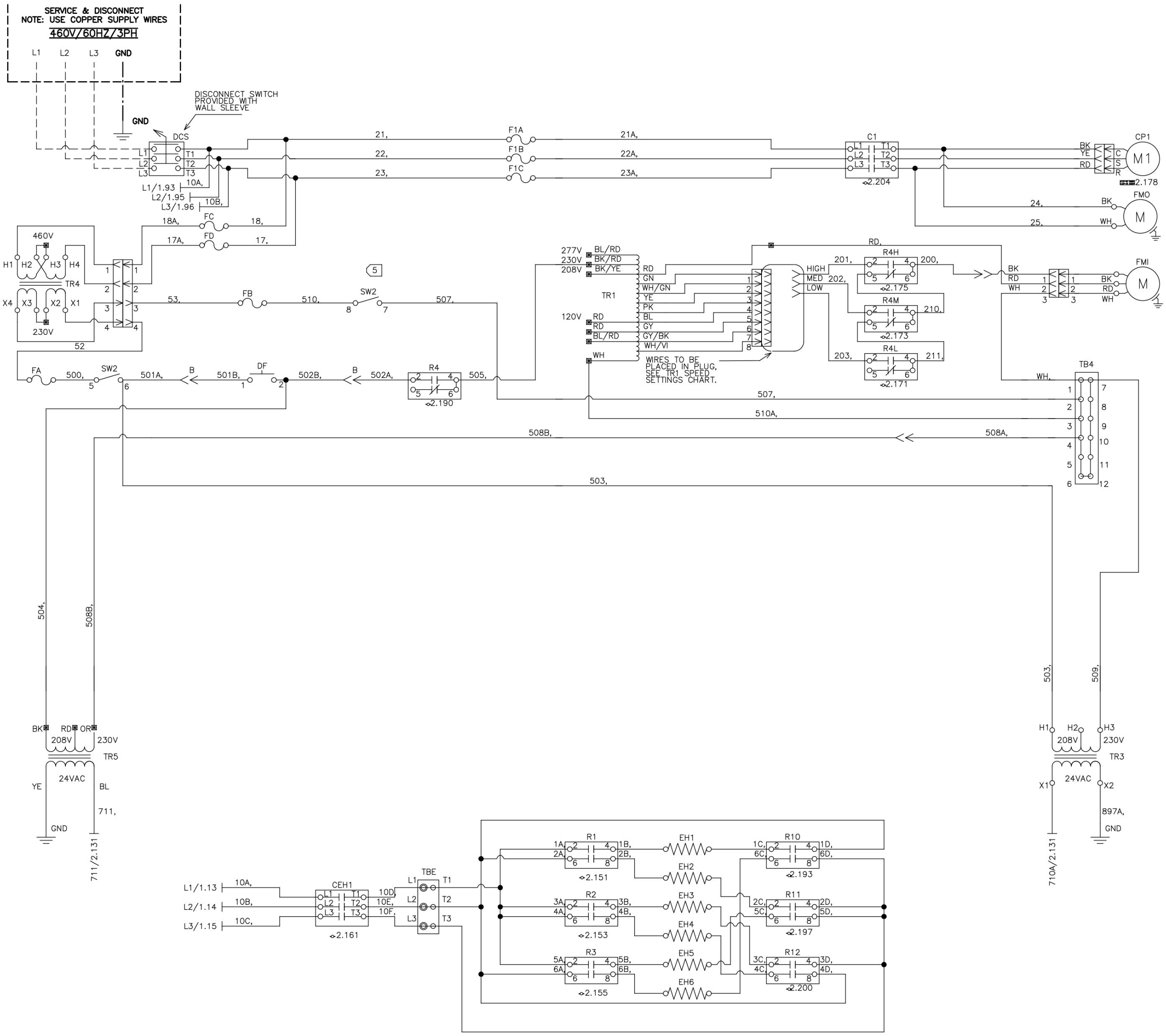
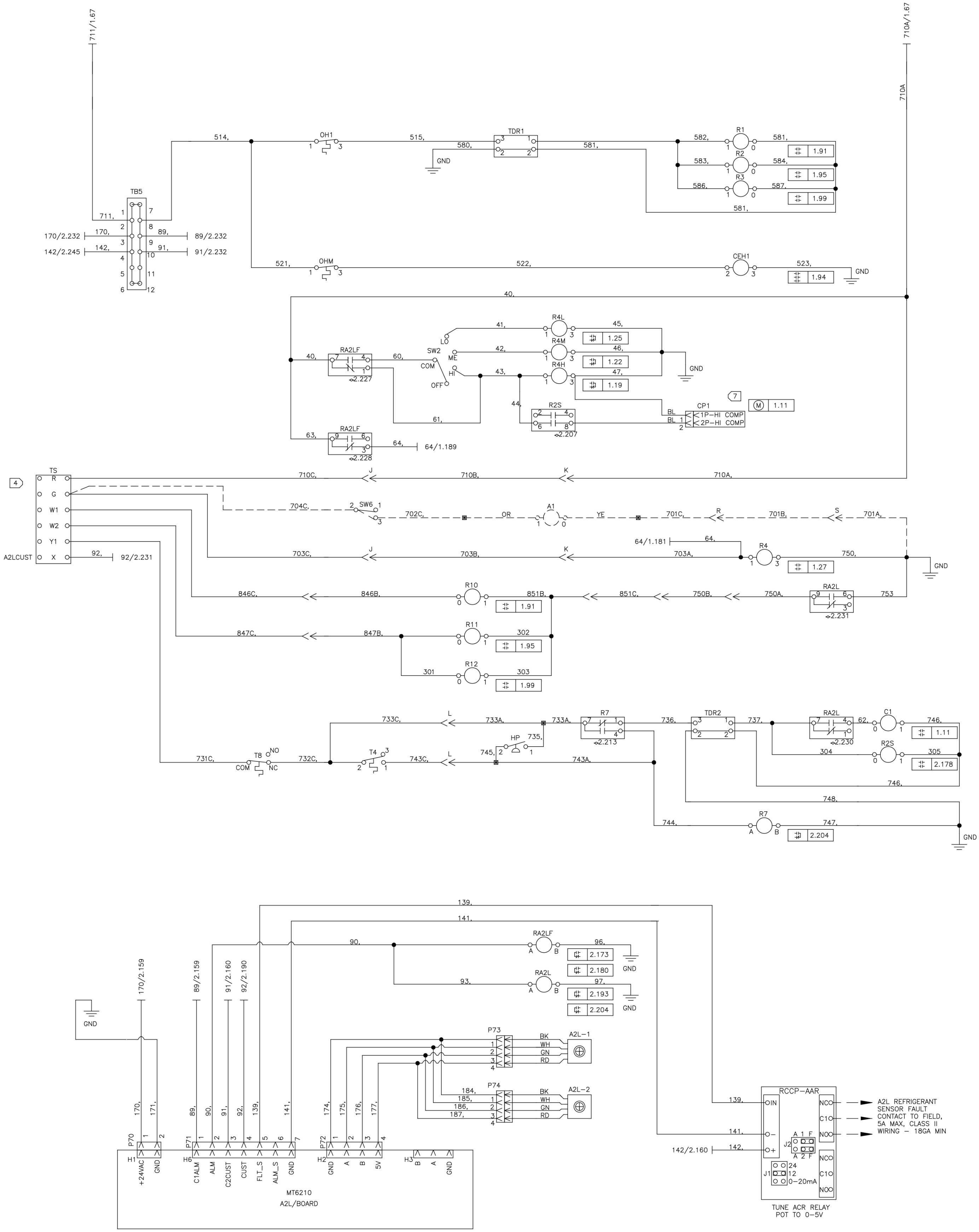


Figure 6: Electric Heat Wiring Diagram – Typical 460 V/60 Hz/3 Ph



Wiring Schematics Legend for "Typical Electric Heat Wiring Diagrams"

Legend					
A1	Actuator (Optional)	**R1-R3**	Relay Electric Heat (Backup)	**T2**	Thermostat EH Relay - 0A Temp>20°
A2LB	A2L Mitigation Board	**R2S**	Relay – High (2nd) Stage Compr	**T4**	Thermostat Low Temp 28°
A2L-1	A2L Sensor	**R3B**	Relay – Defrost/EH Coil (24 VAC)	**T5**	Thermostat Defrost
CP1	Motor Compressor 2-Stage	**R4**	Relay – Fan Coil (24 VAC)	**T6**	Thermostat - Freeze Stat
C1	Compressor Contactor	**R4H**	Relay – Hi Fan Speed Coil (24 VAC)	**T7**	Thermostat Changeover 60°
CAP1	Capacitor Run	**R4L**	Relay – Low Fan Speed Coil (24 VAC)	**T8**	Thermostat - Cooling Lockout 59° F
CEH1-3	Electric Heat Contactor	**R4M**	Relay – Med Fan Speed Coil (24 VAC)	**TDR1**	Time Delay Low Voltage 5 Min
CS	Current Sensor (Hawkeye 800)	**R7**	Relay – Compressor Lockout	**TDR2**	Protector Low Voltage 5 Min
DCS	Switch – Unit Power	**R8-9**	Relay – Emergency Heat	**TB4**	Terminal Board
DF	Dead Front Switch	**R10-R12**	Relay – Electric Heat	**TB5**	Terminal Board
EH1-6	Heater - Electric	**R11A**	Relay – Defrost	**TB-DE**	Terminal Board for DE Contactor
EH10	Heater - Outdoor Drain Pan	**R12A**	Relay – Heating	**TBE**	Terminal Block - Electric Heat
F1A/F1B	Fuse – Compressor	**RA1**	Relay - Actuator/Valve	**TR1**	Transformer - Motor Speed
F2A/F3C	Fuse - Electric Heat	**RA2L**	A2L Actuator	**TR3**	Transformer - 24V, 75VA
FA/FB	Fuse – Control, Load	**RA2LF**	A2L Actuator	**TR4**	Transformer - 460V–230V
FC/FD	Fuse – Control, Transformer	**RCCP**	Transducer AAR	**TR5**	Transformer - 24 V
FMI	Motor – Room Fan	**REH**	Relay – H1 Fan 3rd STG EH	**TS**	Terminal Strip for EH
FMO	Motor Outdoor Air	**RV**	Reversing Valve	**V1**	Valve - Heat EOC (Accessory)
OH1	Thermostat - Overheat	**SW2**	Switch – On - Off and Fan Speed	**V2**	Valve - Cool EOC (Accessory)
OH2	Thermostat - Overheat	**SW5**	Switch – Emergency Heat		
OHM	E.H. Man Reset - Overheat Stat	**SW6**	Switch Rocker SPDT		

Legend - Symbols	
— — —	Accessory or field mounted component
⏚	Ground
⊠	Wire nut / splice
●	Overlap point - common potential wires
L1/1.20	Wire link (wire link ID / page # . line #)

	TR1 Speed Settings			
	054	**044**	**036**	**024**
High	GN	GN	WH/GN	YE
Med	YE	YE	PK	GY
Low	PK	PK	GY	GY/BK

Electric Heat Sequence:

NOTE 1: Backup relays R1, R2, and R3 are energized when power is applied.

NOTE 2: Main relays R10, R11, and R12 are energized when a 24 VAC source is connected to STG1, STG2, and STG3 on terminal strip.

NOTE 3: Electric heat can be staged by applying the 24 VAC to the stages (1, 2, and 3) at different time intervals.

Control Wiring Notes:

NOTE 1: Make electrical installation in accordance with job wiring schematic complying with national and local electrical codes.

NOTE 2: NEC class 1 wiring - Factory mounted night controls connect to BLK and WHT wires. When remote night controls are used, they must be connected to BLK and WHT wires shown capped, and the BLK and WHT wires in the main control box must be disconnected and individually capped.

NOTE 3: Terminal block (TB) furnished when total electric heat load is less than 48 amps.

NOTE 4: See control and thermostat drawing for additional controls.

NOTE 5: R2 furnished with 3, 4 elm; R3 furnished with 5, 6 elm.

NOTE 6: SW2 contacts 5, 6 and 7, 8 open only when SW2 is in OFF position.

NOTE 7: High (2nd stage) compressor rectifier energized when compressor is on and fan speed is on high.

NOTE 8: For 230V operation, switch wire 509, 508B, and 505 to 240V terminal in the transformer.

NOTE 9: Cap all unused transformer leads.

NOTE 10: Devices in legend may or may not be on unit.

Micro Tech Controls

Control Modes and Functions

Daikin Applied unit ventilators equipped with MicroTech unit controllers can be programmed to operate in a variety of modes based on the current situation in the room and the status of the unit ventilator. Changes in mode can be triggered manually, via network signals, by sensor readings, or by date and time. External inputs and outputs can be used to change modes, communicate data to network controls or change the functional operation of the unit.

Occupancy Modes

MicroTech unit controllers can be set up to change modes based on room occupancy. Four different occupancy modes are provided, as described below:

Occupied Mode

This is the normal daytime operation mode. The controller maintains a room set point using the outside air capability and other functions.

Note: *For non-school applications, the unit can also be configured to cycle the fan in response to the room load. In this case, the fan would normally be in the Off Mode until heating or cooling is required. The outside air damper is always closed when the fan is off. When the fan starts, the outside air damper opens to the required position, usually minimum position.*

Unoccupied Mode

This is the night setback operating mode, in which the unit responds to a new room set point and cycles to maintain the condition. The fan comes on when heating or cooling is needed and runs until the load is satisfied. The outdoor air damper is closed during this mode. When a cooling load is satisfied by a refrigerant system, the compressor is de-energized and the unit ventilator indoor fan continues to run for a fixed period of time to remove coldness from the evaporator coil. This reduces the potential for low refrigerant temperatures to exist on the evaporator coil.

Stand By Mode

In this mode, the unit maintains the occupied mode set point temperature with the outdoor air damper closed. The fan runs continuously unless it is configured to cycle in response to the load.

Bypass Mode

This is a tenant override operating mode initiated by using the optional LUI or by depressing the tenant override switch on the optional room sensor. The unit is placed back into occupied mode for a predetermined time (default 120 minutes). This time can be set in 1-minute increments from 1 minute to 240 minutes through the unit ventilator service tool or a network.

Economizer Modes

Economizer operation is facilitated by the outdoor air damper, which automatically adjusts the above-minimum outside air position to provide free cooling when the outdoor air temperature is appropriate. Three levels of economizer control are available:

Basic Economizer Operation: The MicroTech controller compares the inside and outside temperatures. If the temperature comparison is satisfactory, then free-air economizer operation is used to cool the space. Reheat units also come configured with an indoor humidity sensor.

Expanded Economizer Operation: In addition to comparing inside and outside temperatures, outdoor relative humidity is measured to calculate outside air enthalpy. If the enthalpy set point is not exceeded, and the temperature comparison is satisfactory, then free economizer operation is used to cool the space. This helps to minimize the entrance of humid outside air.

Leading-Edge Economizer Operation: The MicroTech controller compares both indoor and outdoor temperatures and indoor and outdoor relative humidities. Then it calculates both inside and outside air enthalpy to determine if free economizer operation can cool the space with non-humid outside air. This is a true enthalpy economizer—a first for unit ventilators.

Night Purge Mode

Under this mode, the unit is configured to purge the room space for one hour for various reasons (odor or fume removal, drying, etc.). During Night Purge the outside air damper is open full and the fan is run on high speed. No "normal" heating or cooling takes place (the emergency heat set point is maintained) and the exhaust fan, if the room is so equipped, is signaled to turn on.

Freeze Prevention Mode

This mode helps protect the unit ventilator from freezing air conditions. Control functions vary depending on the type of temperature control used by the unit, as follows:

Face and Bypass Control Units

Upon sensing a potential freezing air temperature condition leaving the heating coil, the unit will automatically protect itself by shutting the outside air damper and opening the EOC valve. The face and bypass damper is allowed to operate normally to control the space. The fan continues to run to remove the cold air. Once accomplished, the freezestat is reset, the outside air damper opens to the minimum position and the unit commences its normal mode of operation.

Valve Control Units

Upon sensing a potential freezing air temperature condition leaving the heating coil, the unit will automatically protect itself by shutting the outside air damper and opening the hot water valve to a minimum of 50% (more if required to heat the room). The fan speed will be staged down to low speed and then turned off. When the freezestat is reset, the outside air damper opens to the minimum position and the fan runs at low speed for a minimum of 10 minutes. It then will stage up if needed to satisfy the room set point. This reduces the potential to overheat a room recovering from a potential freeze condition.

Note: *Valve selection and coil sizing is critical for proper operation. Face and bypass control is recommended for proper humidity and freeze protection.*

Emergency Heat Mode

If the unit is left in a mode that does not normally allow heating (such as Off, Fan Only, Cool, or Night Purge) and the room temperature falls below 55°F, the unit will heat the space to above 55°F and then return to the previously set mode of operation. This mode of operation can be field configured and/or be disabled.

External Input Functions

The unit ventilator controller is provided with four (4) binary inputs that allow a single set of dry contacts to be used as a signal to it, and two (2) binary inputs that allow a 24 VAC signal. Multiple units can be connected to a single set of dry contacts.

Note: *Not all of the functions listed can be used at the same time. The unit ventilator controller is provided with configuration parameters that can be adjusted to select which function will be used for these inputs where multiple functions are indicated below.*

Unoccupied Input Signal

This input signals the unit ventilator controller to go into unoccupied or occupied mode. When the contacts close, the unit ventilator controller goes into unoccupied mode; when the contacts open, it goes into occupied mode. Additional variables can affect occupancy mode and override this binary input. See "Occupancy Modes" on page 65.

Dewpoint/Humidity Input Signal (Optional)

This input signals the unit ventilator controller to go into active dehumidification mode. When the contacts close (high humidity) the controller will go into active dehumidification; when the contacts open (low humidity) it will stop active dehumidification.

Remote Shutdown Input Signal

This input signals the unit ventilator controller to go into shutdown mode. When the contacts close, the controller goes into shutdown mode; when the contacts open, it returns to normal operation.

Ventilation Lockout Input Signal

This input signals the unit ventilator controller to close the outdoor air damper. When the contacts close (ventilation lockout signal) the controller closes the outdoor damper; when the contacts open, it returns to normal outdoor damper operation.

Exhaust Interlock Input Signal

This input signals the unit ventilator controller that an exhaust fan within the space has been energized. The controller then repositions the outdoor air damper to a user-adjustable minimum position. When the contacts close (exhaust fan on signal) the controller uses the value defined by the Exhaust Interlock OA Damper Min Position Setpoint as the new minimum outdoor air damper position regardless of the indoor air fan speed. When the contacts open, it returns to normal outdoor damper operation.

External Output Functions

The unit ventilator controller is provided with three (3) binary outputs to perform the functions described below. These are relay type outputs that supply 24 VAC.

Note: *Not all of the functions listed can be used at the same time. The unit ventilator controller is provided with configuration parameters that can be adjusted to select which function will be used for these outputs when multiple functions are indicated below.*

Fault Signal

This relay output provides one set of NO (reversible through keypad/software) 24 VAC contacts that can be used to signal a fault condition. When a fault exists, the unit ventilator controller energizes this relay output. When the fault or faults are cleared, it de-energizes this relay output.

Exhaust Fan On/Off Signal

This relay output provides one set of NO (reversible through keypad/software) 24 VAC contacts that can be used to signal the operation of an exhaust fan. When the outdoor air damper opens more than the Energize

Exhaust Fan OA Damper Setpoint, the relay output will signal the exhaust fan on (contacts closed). When the outdoor damper closes below this setpoint, the relay output will signal the exhaust fan off (contacts open).

Auxiliary Heat Signal

This relay output provides one set of NO (reversible through keypad/software) 24 VAC contacts that can be used to operate an auxiliary heat device. The unit ventilator controller by default is configured to operate a NO auxiliary heat device (de-energize when heat is required) such as a wet heat valve actuator with a spring setup to open upon power failure. However, the Auxiliary Heat Configuration variable can be used to set the controller to use an NC auxiliary heat device (energize when heat is required) such as electric heat.

Advanced Control Options

MicroTech controls make possible a number of advanced control options that can quickly pay for themselves in saved energy costs and more comfortable classrooms, as described below.

Part Load Variable Air Control

Part Load Variable Air control can be used in conjunction with face and bypass damper temperature control to automatically adjust the unit ventilator fan speed based upon the room load and the room-temperature PI control loop. This MicroTech control option provides higher latent cooling capabilities and quieter operation during non-peak load periods by basing indoor fan speed upon room load.

During low-load or normal operation (about 60% of the time) the fan will operate on low speed. When the load increases to an intermediate demand, the fan will automatically shift to the medium-speed setting. Under near-design or design-load conditions, the fan will operate on high speed. A built-in, 10-minute delay helps minimize awareness of fan speed changes. Low-speed fan operation under normal operating conditions, in conjunction with our GentleFlo fan technology contributes to a very quiet classroom environment.

Demand-Controlled Ventilation (Optional)

Daikin Applied unit ventilators can be equipped to use input from a CO_2 controller to ventilate the space based on actual occupancy instead of a fixed design occupancy. This Demand Controlled Ventilation (DCV) system monitors the amount of CO_2 produced by students and teachers so that enough fresh outdoor air is introduced to maintain good air quality. The system is designed to achieve a target ventilation rate (e.g., 15 CFM/person) based on actual occupancy.

By using DCV to monitor the actual occupancy pattern in a room, the system can allow code-specific levels of outdoor air to be delivered when needed. Unnecessary over-ventilation is avoided during periods of low or intermittent occupancy.

With DCV you can be confident that your school is meeting ventilation standards for Indoor Air Quality and that your students are receiving adequate air to be attentive to instruction. At the same time, you are saving money in early morning hours, in between classes, or after hours when classrooms are heated and cooled but not always fully occupied.

As Simple As A Thermostat

Demand Controlled Ventilation is easy to apply. When DCV is ordered, a CO_2 sensor is mounted on the unit and configured for operation. The system does the rest. If desired, the ventilation control setpoint can be adjusted through the MicroTech Controller.

Acceptance By Codes And Standards

ASHRAE Standard 62-2004 Ventilation for Indoor Air Quality recognizes CO_2 based DCV as a means of controlling ventilation based on occupancy. The ASHRAE standard has been referenced or adopted by most regional and local building codes. This standard references ventilation on a per-person basis.

Using CO_2 control will sometimes lower the absolute amount of outside air delivered into a room but will maintain the per-person rate. For example, if a classroom is designed for 30 students, the ventilation rate is 450 CFM (30 students x 15 CFM/student). However, when there are only ten students in the classroom, the CO_2 control will adjust ventilation to 150 CFM (10 students x 15 CFM/student). A minimum base ventilation rate (typically 20% of design levels) is provided when in the occupied mode. This provides outdoor air to offset any interior source contamination while allowing for proper space pressurization.

Active Dehumidification Control (Reheat)

In high-humidity applications where valve-controlled, reheat units are used, the Active Dehumidification Control (ADC) sequence should be considered. During excessive humidity conditions, a humidity sensor directs the unit to continue cooling past the room setpoint to remove excess moisture. Hydronic heat or electric heat is then used to reheat the discharge air to maintain acceptable room temperatures.

MicroTech controls minimize the amount of reheat needed to maintain relative humidity below a preset limit. Reheat is used only when required and in the most energy-efficient manner possible.

Active Dehumidification comes standard on units equipped with MicroTech controls, a reheat configuration and valve-control temperature modulation. The MicroTech ADC humidity sensor is unit-mounted. It issues a signal proportional to the classroom's humidity level (unlike humidistats which issue an open-close signal). This enables a control sequence that manages both the temperature and the relative humidity.

When the relative humidity exceeds a preset value, the refrigerant cooling activates to dehumidify the mixture of outdoor and return air entering the cooling coil. The reheat modulating water valve then opens, or electric heat is engaged, to reheat the air leaving the cooling coil, as required to maintain the classroom setpoint.

Active dehumidification starts when the indoor relative humidity exceeds the preset relative humidity upper setpoint and continues until the room humidity falls 5% below the endpoint. During active dehumidification, economizer operation is disabled (and the outdoor air damper is reset to its minimum position) unless the outdoor air temperature is below 55°F. It is maintained until dehumidification is completed. When the indoor humidity level is satisfied, the MicroTech controller reverts to its normal sequences to satisfy the classroom temperature setpoint.

DX System Control

The unit ventilator controller is configured to operate the compressor as secondary (mechanical) cooling when economizer cooling is available, and as primary cooling when economizer cooling is not available. Additional DX control features include:

Compressor Cooling Lockout: The unit ventilator controller is configured to lock out compressor cooling when the outdoor air temperature falls below the compressor cooling lock out setpoint. Below this temperature setpoint only economizer cooling will be available.

Minimum On And Off Time: The unit ventilator controller is provided with minimum-on and minimum-off timers to prevent adverse compressor cycling (3-minutes default).

Compressor Start Delay Variable: This variable is intended to be adjusted as part of the start-up procedure for each unit. It is used to prevent multiple unit compressors from starting at the same time after a power failure or after an unoccupied-to-occupied changeover. Each unit should be configured at start-up with a slightly different (random) delay, or groups of units should be provided with different delays.

System Components

The main components of the MicroTech system are:

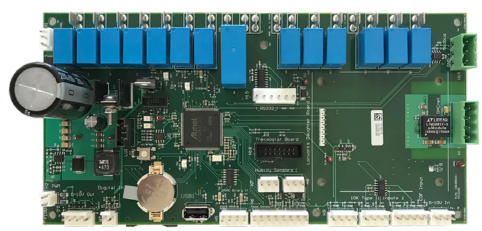
- A Unit Ventilator Controller (UVC) with on-board BACnet MS/TP communications
- Optional Local User Interface (LUI)
- Optional LonWorks plug-in network communication module

In addition, unit ventilators equipped with MicroTech controllers feature factory-mounted sensors and actuators for system control and feedback.

Unit Ventilator Controller

The MicroTech UVC is a DDC, microprocessor-based controller designed to provide sophisticated comfort control of an economizer-equipped Daikin Applied unit ventilator. In addition to normal operating control, it provides alarm monitoring and alarm-specific component shutdown if critical system conditions occur. Each UVC is factory wired, factory programmed and factory run-tested for the specific unit ventilator model and configuration ordered by the customer.

Figure 56: MicroTech Control Board



Local User Interface (Optional)

An optional built-in LUI touch pad with digital LED Display is located in the right hand compartment below the top right access door. The LUI features a 4 x 20 OLED digital display, 4 keys, and 2 individual LED indicators. In addition to the Operating Mode States and Fan Functions, the Touch Pad will digitally display:

- The room set point temperature.
- The current room temperature.
- Any fault code for quick diagnostics at the unit.

Figure 57: User Interface Touch Pad

The User Interface has individual touch-sensitive printed circuit board mounted buttons, and comes with a built-in menu structure (Hidden Key and Password Protected) to change many of the common operating variables.

Four Operating Mode States

Four different user operating mode states can be chosen on the LUI:
Heat: Heating and economizer operation only.
Cool: Cooling and economizer operation only.
Fan Only: Fan only operation.
Auto: The unit automatically switches between heating, cooling and economizer operation to satisfy the room load conditions. The current unit state is also displayed.

Four Fan States

Four fan states are provided on all units: high, medium, low, and Auto speed modulation. The Auto speed function (part load, variable air) varies the fan speed automatically to meet the room load whether the unit is in heating, cooling or economizer mode.

All this is accomplished with a standard, single-speed NEMA frame motor. A built-in 10-minute delay helps minimize awareness of speed changes. During low-load or normal operation (about 60% of the time) the fan will operate at low speed. The low speed operation, along with GentleFlo fan technology, contributes to a very quiet classroom environment.

When the load increases to an intermediate demand, the fan automatically shifts to the medium speed setting. At near-design or design-load conditions the fan will operate on high speed.

With four fan states and GentleFlo fan technology, there is no need to oversize units or worry about uncomfortable conditions.

Communication Types

On-board BACnet communication or the optional LONWORKS communication module provide control and monitoring information to your building automation system without the need for costly gateways. Information on BACnet and the optional LONTALK communication module are described below.

MicroTech Controller with on-board BACnet MS/TP

The MicroTech controller allows the UVC to inter-operate with systems that use the BACnet (MS/TP) protocol with a conformance level of 3. It meets the requirements of the ANSI/ASHRAE 135-2008 standard for BACnet systems.

LONWORKS SCC Communication Module

This module supports the LONWORKS SCC (Space Comfort Communication) profile number 8500-10. Unit controllers are LONMARK certified with this optional LONWORKS communication module.

MicroTech Control Sensor and Component Locations

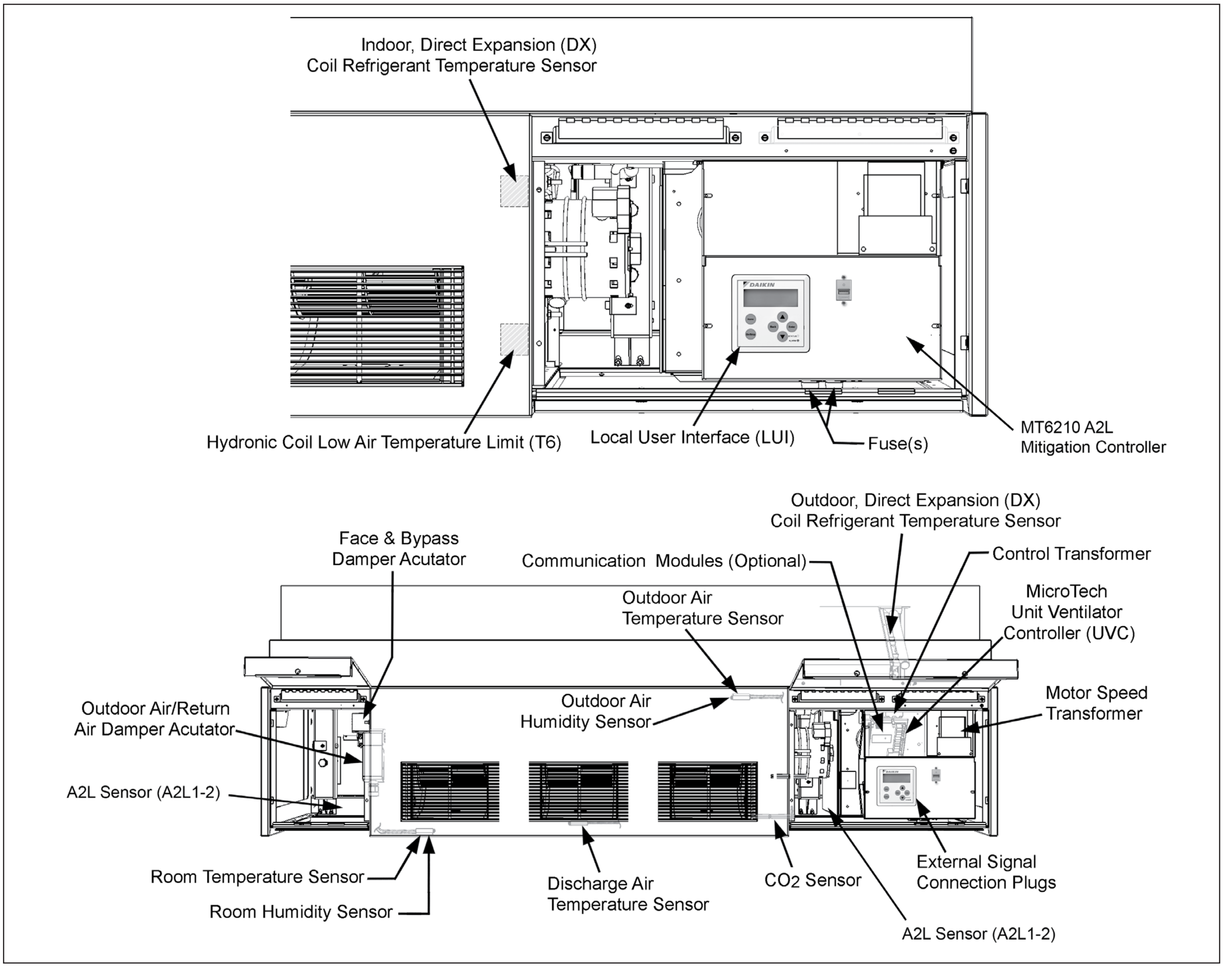
A2L Refrigerant Detection and Mitigation Sensors

Unit mounted A2L refrigerant sensors are installed in the base of each end pocket. They are used to detect a refrigerant leak for initiating leak mitigation control.

The factory mounted MT6210 A2L Mitigation Controller monitors the A2L sensors and indicates a refrigerant leak or refrigerant sensor failure should one occur.

MicroTech Sensor and Component Locations

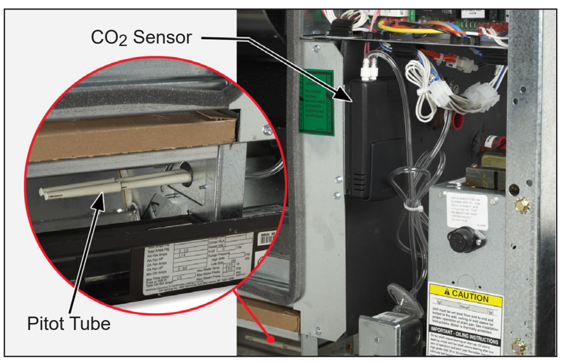
Figure 58: MicroTech Sensor and Component Locations



CO_2 Sensor for Demand Controlled Ventilation

On units equipped for Demand Controlled Ventilation (DCV), the UVC is configured to use a 0-2000 PPM, 0-10 VDC, single beam absorption infrared gas sensor. CO_2 sensors are available as unit mounted only. An air collection probe (pitot tube and filter) is installed in the return air of the unit (Figure 59).

Figure 59: CO_2 Sensor For Demand Control Ventilation



Room Temperature Sensors used with MicroTech Unit Controls

Digitally Adjustable Display Sensor – 910247458

The display sensor is used in conjunction with MicroTech equipped units. This digitally adjustable sensor displays room temperature, fan speed (AUTO/HIGH/MEDIUM/LOW), system mode (HEAT/COOL/AUTO/OFF), ALARM, override and occupancy.

Digitally Adjustable Display Sensor – 910247448

The display sensor is used in conjunction with MicroTech equipped units. The sensor has a digital display for temperature, occupancy, alarm, setpoint and status indication. Controls include four buttons for setpoint, occupied/unoccupied request, and override reset.

Basic Room Sensor With Cool to Warm – 910247453

The basic room sensor with adjustment (cool to warm) is used in conjunction with MicroTech equipped units. The sensor has an output for temperature and LED status indication and includes an override reset button.

Basic Room Sensor – 910247450

The basic room sensor is used in conjunction with MicroTech equipped units. The sensor has an output for temperature and LED status indication and includes an override reset button.

Table 52: Room Temperature Sensors for BAS Operation

Room Temperature Sensors used with Unit Ventilator – Building Automated System (BAS) Operation		**Digitally Adjustable Display Sensor** 	**Digitally Adjustable Display Sensor** 	**Basic Room Sensor With Cool to Warm Adjust** 	**Basic Room Sensor** 
		Part No. 910247458	**Part No.** 910247448	**Part No.** 910247453	**Part No.** 910247450
Feature					
Setpoint Adjustment		Digitally Adjustable	Digitally Adjustable	Cool to Warm	None
Display	Room Temperature & Setpoint	●	●		
Operating Modes	System	Heat-Cool-Auto-Off-			
	Fan	Auto-High-Medium-Low			
	Occupancy	LCD Display of Occupied-Unoccupied Icon	LCD Display of Occupied-Unoccupied Icon		
Annunciation	Status LED	LCD Display of Unit Status	LCD Display of Unit Status	●	●
	LCD Alarm Display	●	●		
Reset	Alarm	●	●	●	●
	Setback Override	●	●	●	●

Actuators

Face and Bypass Damper Actuator

On units equipped with face and bypass damper control, the UVC is configured to operate a proportional, direct-coupled, face and bypass damper actuator. To increase accuracy, the controller has an overdrive feature for the 0% and 100% positions and a periodic (12-hour) auto-zero PI control loop for each modulating actuator.

Figure 60: Face and Bypass Damper Actuator

Outdoor Air/Return Air Damper (OAD) Actuator

The UVC is configured to operate a proportional, direct-coupled actuator for the outdoor air damper. This actuator provides spring-return operation upon loss of power for positive close-off of the outdoor air damper. To increase actuator positioning accuracy, the UVC is provided with an overdrive feature for the 0% and 100% positions and a periodic (12- hour) auto-zero PI control loop for each modulating actuator.

Figure 61:Outdoor Air Damper Actuator

2-Position End-of-Cycle Valve Actuators (Optional)

On units equipped with 2-way or 3-way, end-of-cycle (EOC) valves, the UVC is configured to operate 2-position End-Of-Cycle (EOC) valve actuators (Figure 62). Spring return actuators are used for all End of Cycle (EOC) valves. All wet heat and heat/ cool EOC valves are normally open, and all cooling EOC valves are normally closed.

Figure 62: End of Cycle Valve Actuator

Modulating Valve Actuators (Optional)

On units equipped with modulating valves, the UVC is configured to operate proportional actuators for modulating 2-way and 3-way valves (Figure 63).

Figure 63: Modulating Valve Actuators

2-Way Valve **3-Way Valve**

A Wide Variety of Input, Output & Alarm Data Points Available

A wide variety of data is available from Daikin Applied unit ventilators when equipped with MicroTech unit controllers in a network situation. They provide a clear picture of just what's happening in each classroom and notify your building automation system of alarm conditions regardless of the protocol you select. Table 53 below shows a list of inputs, outputs and alarm functions available.

ServiceTools

ServiceTools for MicroTech Unit Ventilators is software for operation on a personal computer. This software provides representation of the sequence of operation and enables the service technician to:

- Monitor equipment operation
- Configure network communications
- Diagnose unit operating problems
- Download application code and configure the unit

This software is a purchased tool for service technicians and will run on PCs with Microsoft Windows, Windows 7, and newer operating systems.

This tool provides more capabilities than the unit's user interface touch pad and is highly recommended for startup and servicing. (It may be required for startup and/or servicing, depending upon unit integration and other requirements.) It does not replace BAS functions, such as system wide scheduling or sequencing, and it cannot serve as a Work Station Monitoring package. *ServiceTools* interfaces with the MicroTech controller using serial communications through a USB type A connector.

Setpoints and Configuration Parameters

The UVC can save a snapshot of all setpoints and configuration parameters in the controller. Those configurations and setpoints can be saved onto a SD flash memory card (max size of 32GB), ensuring the controller can be reverted to those settings at a later date. Additionally, the settings saved to a SD can be taken to another UVC and loaded into it. Certain parameters, such as BACnet addressing and location, can be optionally restored to prevent duplication.

Data Trending

Data can be written to an optional SD card inserted into the control unit. The parameters that can be trended through MicroTech can be found in OM 732. Six options for trending frequency are available:

- None
- Occupancy Change
- 1 Minute
- 10 Minutes
- Hourly
- Daily

A separate trend file will be created of each day. If a "Daily" trend is selected, the trend file will contain a header and 1 line of data. If an "Hourly" trend is selected, the trend file will contain a header and 24 lines of data. The last 3 alarms in the Alarm History are always recorded.

Table 53: Network Operation -Typical Data Points[1]

Read/Write Attributes	Read Only Attributes	Read/Write Setpoint Attributes	Typical Alarms
• Application Mode • Compressor Enable • Emergency Override • Energy Hold Off • Heat/Cool Mode • Occupancy Override • Outdoor Air Humidity • Outdoor Air Temperature • Reset Alarm • Reset Filter Alarm • Source (Water In) Temperature • Space CO_2 • Space Humidity • Space Temperature • Economizer Enable • Heating Setpoint Shift • Cooling Setpoint Shift	• Binary Input Status • Binary Output Status • UV Software Application Version • Compressor Run Time • Chiller Water Valve Position • Discharge Air Temperature • Discharge Air Temperature Setpoint • Effective Setpoint • Fan Speed • F & BP Damper Position • Outdoor Air Damper Position • Space Fan Runtime • Unit Ventilator Controller State • Water-Out Temperature • WH or CW/HW Valve Position • OA Minimum Position	• Econ. IA/OA Enthalpy Differential Setpoint • Econ. IA/OA Temp. Differential. Setpoint • Econ. Outdoor Air Enthalpy Setpoint • OAD Min. Position Low-Speed Setpoint • OAD Min. Position Med.-Speed Setpoint • Occupied Cooling Setpoint • Occupied Heating Setpoint • Space CO_2 Setpoint • Space Humidity Setpoint • Standby Cooling Setpoint • Unoccupied Cooling Setpoint • Unoccupied Heating Setpoint	• Indoor Air Temperature Sensor Failure • DX Pressure Fault • Indoor Air Coil DX Temperature Sensor Failure • Outdoor Air Temperature Sensor Failure • Discharge Air Temperature Sensor Failure • Outdoor Air Coil DX Temperature Sensor Failure (or) • Water Coil DX Temperature Sensor Failure • Water-Out Temperature Sensor Failure (or) • Water-In Temperature Sensor Failure • Space Humidity Sensor Failure • Outdoor Humidity Sensor Failure • Space CO_2 Sensor Failure • Source Temperature (Water-In) Inadequate Indication • Change Filter Indication

[1] Not all data points or alarms listed will be available in all unit ventilator configurations. Humidity and CO_2 points require the use of optional sensors.

Application Considerations

Why Classrooms Overheat

Overheated classrooms occur every day in schools in every area of the country. The most serious result is their detrimental effect on students' ability to concentrate and learn. Research has determined that the ability to learn and retain knowledge decreases rapidly as the temperature exceeds recommendations. Overheated rooms also represent wasted fuel, resulting in excessive operating costs.

Correcting an overheating problem in an existing building is very difficult and expensive. It calls for redesign and alteration of the heating and ventilating system, necessitating considerable renovation. This potential problem should be recognized, understood and planned for when heating and ventilating systems are designed for new and existing buildings.

Schools Have Special Needs

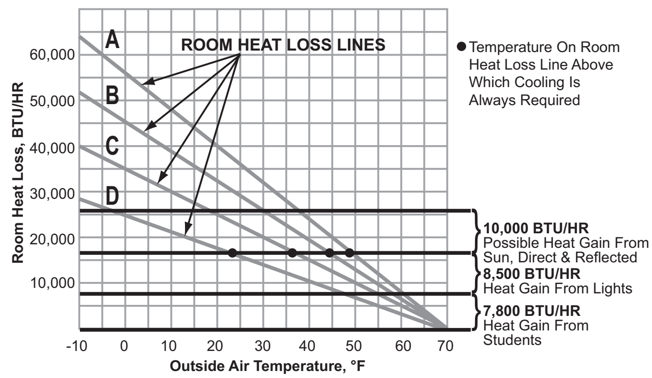
Schools have unique heating and ventilating needs, in large part because of their variable occupancy and usage patterns. Fewer cubic feet of space is provided per student in a school building than in any other type of commercial or public building. School classrooms are typically occupied only six hours a day, five days a week, for only three-fourths of the year, with time out for vacations. All in all, this represents approximately 15% of the hours in a year that a classroom is occupied.

To understand the overheating problem in schools, one must first realize that the excess heat comes from what is commonly termed "uncontrolled heat sources." To gain some perspective on how this affects heating and cooling decisions, let's take a look at a typical classroom in the northern section of the mid western United States.

Suppose we have a classroom that is 24 by 38 feet with 10-foot ceilings and 100 square feet of window area along the outside wall. At an outside temperature of 0°F and a desired room temperature of 72°F, let's assume the normal amount of heat loss from the room to the outside is 55,000 Btu per hour.

As the outside temperature changes, so does the amount of heat that the room loses. This is represented in Figure 64 by Room Heat Loss Line A, which ranges from 55,000 Btu per hour at 0°F outside air temperature to zero Btu at 70°F. Obviously, if the heating system were the only source of heat in the classroom, the solution would be simple: The room thermostat would cause the heating system to supply exactly the amount of heat required to maintain the room at the thermostat temperature setting. In reality, the introduction of excess heat from a variety of uncontrolled sources makes the challenge considerably more complex.

Figure 64: Heat Gain Vs. Heat Loss In Occupied Classrooms



As Figure 64 illustrates, even in very cold weather an occupied classroom is more likely to require cooling than heating.

Heat From Students

Body heat generated by students in a classroom is one of the three primary sources of uncontrolled heat. In a typical classroom of 30 students, the amount of heat given off at all times will vary according to factors such as age, activity, gender, etc. A conservative estimate is 260 Btu per hour per pupil. Multiply this by 30 and you get a total of 7,800 Btu per hour added to the room by the students alone. This excess heat is noted in Figure 64 as "Heat Gain from Students."

Heat Gain From Lights

Heat emitted by the lighting system constitutes a second uncontrolled heat source. Artificial lighting is needed in most classrooms even during daylight hours to prevent unbalanced lighting and eye strain. A typical classroom requires approximately 2,500 watts of supplemental lighting to provide properly balanced lighting. Fluorescent lights add heat to the room at the rate of 3.4 BTU per watt per hour, or a total of 8,500 BTU per hour. This extra heat is represented in Figure 64 as "Heat Gain from Lights."

Add the heat gain from lighting to the 7,800 Btu introduced by student body heat and we now have an extra 16,300 Btu/h being introduced into the classroom by uncontrolled sources. This heat gain remains constant regardless of the outdoor air temperature.

Solar Heat Gain

The sun is a third uncontrolled source of heat. And, because it is neither positive nor constant, calculating its contribution to the overall heat gain is difficult. Solar heat gain can be the worst offender of the three in classrooms with large windows. Indirect or reflected solar radiation is substantial even on cloudy days, even in rooms with north exposure, as a result of what is termed "skyshine." To get an idea of the potential effect of the sun, let's assume that the solar heat gain in our hypothetical classroom will peak at 240 Btu/h per square foot of glass area. If we then assume a glass area of 100 square feet and at least

100 Btu/h per square foot of glass for solar heat gain, we can calculate a very conservative estimate of 10,000 Btu/h heat gain through windows. If we add this to the heat from the lights and body heat, total heat gain adds up to 26,300 Btu/h from sources other than the heating and ventilating system. This is indicated in Figure 64 on page 75 by the top horizontal line, which intersects Room Heat Loss Line A at approximately 37°F. This is a reasonable estimate of the maximum uncontrolled heat gain that can be received in the typical classroom from these common heat sources.

The Analysis

From Figure 64 on page 75 it is evident that, at an outside temperature of 48°F or higher, the heat given off by 30 students and classroom lighting is sufficient to cause overheating. This is true even if the classroom is occupied at night when solar heat gain is not a factor. But, since classrooms are occupied during the day, solar addition provides heat in varying amounts even in classrooms with north exposures. Consequently, the heating and ventilating system in our typical classroom must provide cooling at all times when the outdoor temperature is above 48°F and at any time during colder weather when the solar heat gain exceeds room heat loss.

If we assume an average winter temperature of approximately 33°F in the region where our typical classroom is located, we know that, half of the time, both night and day, the outside temperature will be above 33°F. However, since it is generally warmer during the day, when school is in session, the heating and ventilating system will be required to provide cooling for this classroom during much of the time that the room is occupied.

In this example, we've assumed that our classroom had a room heat loss of 55,000 Btu/h at a design outdoor air temperature of 0°F (Room Heat Loss Line "A"). Bear in mind, however, that the recent trend in "energy-saving" building design often results in rooms with lower room heat loss, as indicated by Room Heat Loss Lines "B", "C" and "D." At 0°F design outdoor air temperature:

- Room "B" has a room heat loss of 45,000 Btu/h,
- Room "C" has a room heat loss of 35,000 Btu/h,
- Room "D" has a room heat loss of 25,000 Btu/h.

Note the lowering of the temperature above which cooling will always be required as the room heat loss decreases.

We've noted that cooling is always required in Classroom "A" when outdoor air temperatures exceed 48°F. In Classroom "B," "C," and "D" cooling is always required when outdoor temperatures exceed 44°, 36°and 23°F, respectively (Figure 64 on page 75).

Now that we understand the reason for classrooms overheating, the solution is simple: The heating and ventilating system must provide cooling to take care of the heat given off in the classroom by uncontrolled heat sources.

Cooling The Classroom

The Daikin Applied unit ventilator has become a standard for heating and ventilating systems in schools because it provides the solution for overheating classrooms. The unit ventilator cools as well as heats. During the heating season the outdoor air temperature is nearly always below the desired room temperature. It stands to reason then that the outside air should be used to provide the cooling necessary to keep classrooms down to thermostat temperature.

The classroom unit ventilator does just that. By incorporating an automatically controlled outdoor air damper, a variable quantity of outdoor air is introduced in the classroom, metered exactly to counteract overheating. Since our problem is more one of cooling than of heating, it is evident that more than just the room heat loss must be determined to design a good heating and ventilating system. The cooling requirements should be assessed as well, and the free-cooling capacity of the equipment specified along with the heating capacity required. If this is done, the optimum learning temperature can be maintained in each classroom.

Meeting IAQ Requirements

Good indoor air quality (IAQ), which is important in the home and at work, is no less important to students and faculty in schools. For the past several years, efforts to reduce energy costs in new school buildings have seen the use of tighter construction, sealed windows and heavier insulation. While these construction techniques have helped reduce energy costs, tightly sealed buildings, or envelopes, when combined with increased use of recirculated air, have led to a condition known as sick building syndrome.

In a poorly ventilated school building, fumes and vapors from plastics and other synthetics are often not properly exhausted, while mold, fungus, and bacteria are able to flourish. These conditions can cause various ailments, including nausea, smarting eyes, and coughing, as well as increased student absenteeism and diminished productivity.

For these reasons, the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) now has recommendations for minimum ventilations rates for various types of classrooms and no longer endorses the practice of little or no usage of outdoor air.

Following ASHRAE Control Cycle II

ASHRAE Cycle II is a very economical sequence of control because only minimum amounts of outdoor air are heated and free outdoor air—natural cooling—is available to offset the large internal heat gain associated with the dense occupancy of classrooms.

Daikin Applied unit ventilators are normally controlled according to ASHRAE Control Cycle II. ASHRAE control cycles apply only to heating, heating-and-ventilating, and free-cooling operation. (For more information on the ASHRAE Control Cycle II sequence, see page 81.)

Under ASHRAE Cycle II, the outdoor air damper is closed during warm-up of the room. As the room temperature approaches the thermostat setting, the outdoor air damper opens to a predetermined minimum percentage of outside air. The heating coil capacity controller then modulates to maintain the thermostat setting.

If the room temperature rises above the thermostat setting, the heating coil is turned off and the outdoor air damper opens beyond the minimum position to maintain the thermostat setting.

EXAMPLE: For a 60°F entering air mixture temperature and 70°F room temperature, with 30°F outdoor air temperature, 25% outdoor air will produce the 60°F mixture air temperature. When the outdoor air temperature drops to 10°F, 12.5% outdoor air will produce the 60°F mixture air temperature.

Night Setback

Substantial fuel savings can be realized by operating the unit ventilator system at a reduced room setting at night and during other unoccupied periods, such as weekends and holidays. Units with steam or hot-water coils will provide convective heat during the setback period. If the space temperature falls below the setting of the unoccupied thermostat, the unit fans will be brought on to provide additional heat. Units with electric heat coils do not provide convective heat. The electric coil and the unit fans will be brought on to maintain the thermostat setting.

Typical Temperature Control Components

In general, unit ventilators require the following basic DDC electrical components in order to operate on any of the standard unit ventilator ASHRAE cycles of control. The control components listed in this section are for familiarization purposes only and should not be construed as a bill of material.

Outdoor Air Damper Actuator

This is a modulating device under the control of the room and discharge sensors. It positions the outdoor air damper to admit the amount of outdoor air required at any given point in the control cycle. The room air damper is mechanically linked to the outdoor air damper, which permits the use of a single actuator. Electric actuators should be of the spring-return type so that the outdoor air damper closes whenever the electric power supply to the unit is interrupted.

Discharge Airstream Sensor

This device overrides the room sensor and modulates the outdoor air damper toward the closed position when the unit discharge air falls to a potentially uncomfortable temperature.

Temperature Modulation Devices

The temperature of the air entering the room is modulated using one or more of the following devices:

Face and Bypass Damper Control: A modulating damper actuator, under control of the room sensor, positions a face and bypass damper to control the amount of air that passes through or around the unit coil.

Valve Control: A modulating valve, under control of the room sensor, regulates the flow of steam or hot water through the unit coil.

Electric Heat Step Control: A modulating step controller, under control of the room sensor, steps individual electric heating elements on and off as required. Staging relays are sometimes used in lieu of a step controller.

Room Sensor

The room sensor is a temperature-sensing device that modulates the intensity of an electric signal to the controlled components within the unit in order to maintain the room sensor's comfort setting. Room sensors can be mounted on the wall or within the unit in a sampling chamber.

Additional Components

Additional components may be required depending on the specific application. They include:

Sampling Chamber: This device is required whenever the room sensor is to be mounted within the unit ventilator rather than on the wall. The sampling chamber is located behind a series of holes in the unit front panel. The sensing element of the room sensor is positioned within the sampling chamber. The unit fans draw a representative sample of room air over the sensing element at a relatively high velocity, which is necessary for rapid control response. Sampling chambers are furnished with MicroTech controls.

Low Temperature Protection: A low temperature limit or freezestat senses the discharge air temperature off the hydronic coil. If the temperature drops below 38°F, the unit ventilator will shut down, closing the outdoor air damper and opening the heating valve.

DX Cooling Control: This sequence switch in the cooling control circuit energizes the condensing unit contactor on a call for mechanical cooling.

DX Cooling Low Ambient Lockout: This lockout must be used on DX split systems to lock out the condensing unit when the outdoor air temperature is below 64°F (17.5°C). This device must be integrated into the control system so that the unit has full ventilation cooling capability during the lockout period.

DX Low Temperature Limit: This limit must be used on DX split system cooling units to de-energize the condensing unit (compressor) when the refrigerant falls below freezing. DX units with MicroTech controls have a factory-installed sensor across the leaving side of the DX coil that provides a representative sample of the coil's temperature.

Face & Bypass Temperature Control

Precise Environment Control

Face and bypass damper control units utilize standard unit ventilator cycles of temperature control and bring in up to 100% fresh outdoor air for ventilation (free) cooling of the classroom. The bypass damper allows all air to pass through the heating coil for fast warm-up. A portion passes through the coil and a portion bypasses the coil when less heat is required. All air bypasses the coil when "free" cooling or no heating is required.

Ease Of System Balancing

With face and bypass damper control, the water in the system is constantly circulating, which maintains a desirable head pressure to the pumps. With fluctuating head pressure eliminated, balancing the system can enable the correct quantity of water in all circuits.

Two Stage Compressors

Our self-contained units with the two-stage compressor will run on lower fan speeds up to 70% of the time, improving comfort through better humidity control and quieter operation, while minimizing issues with over sizing. The unit is designed to operate in low compression mode while in medium and low fan speed. The reduced cooling capacity in the medium and low fan speed will allow the system to run longer at moderate and low load conditions providing better humidity control. When the high capacity is needed the high speed will provide high compression and full capacity cooling.

Reduced Risk Of Coil Freeze

With face and bypass damper control, there is no change in the flow of water through the coil. Coils that have a constant flow of water—especially hot water—cannot freeze. On valve control units, water left in the heating coils after the modulating temperature control valve shuts can freeze and rupture the coil.

Additional freeze protection is afforded by Daikin Applied's double-walled cold weather outdoor damper. It has encapsulated insulation and wool mohair end seals to help prevent unwanted cold air from entering the unit. This construction method further decreases the chance of coil freeze if water flow is inadvertently interrupted.

A low-temperature freezestat, factory installed on all hydronic units, significantly reduces the chance of coil freeze-up. Its wave-like configuration senses multiple locations by blanketing the leaving air side of the coil to react to possible freezing conditions.

Modulating Valve Temperature Control

Modulating Valve Control with Hot Water or Steam

The description of unit operation given for damper controlled units is correct for valve-controlled units except that references to face and bypass dampers and end-of-cycle valves should be disregarded. The capacity of the heating coil will be regulated by a modulating control valve and all air handled by the unit will pass through the heating coil at all times.

Hot Water Reset

Hot water system controls should include a provision for resetting the temperature of the supply hot water in relation to the temperature of the outdoor air. A hot water temperature of 100°-110°F, is suggested when the outdoor air temperature is 60°F. The upper limit of the hot water temperature will be dictated by the winter design conditions.

The need for hot water reset controls is not limited to applications involving unit ventilators with face and bypass control. Valve control performance will be improved as well. When the supply water temperature is far in excess of that required to offset the heat loss of the space, the smooth modulating effect of the control valve is lost. The control valve will cycle between slightly open and fully closed. The effect of heat conduction through a closed valve will also be reduced when hot water reset is used.

Freeze Protection

System freeze protection is an important consideration on units utilizing hydronic coils. On valve-controlled units, water left in the heating coils and exposed to freezing outdoor air after the modulating valve shuts can freeze and rupture the coil. Flowing water will not freeze. In addition, it is very important to correctly size the modulating control valve and control the supply water temperature to provide constant water flow. If this situation cannot be guaranteed, an antifreeze solution must be employed to reduce the possibility of coil freeze.

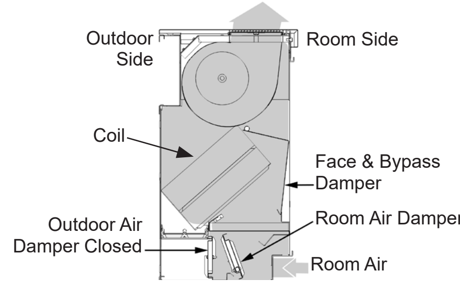
Figure 65: Face & Bypass Temperature Control

Morning Warm-Up/Cool Down

Figure A shows the face and bypass damper, the room air damper, and the outdoor air damper positioned for “morning warm-up/cool-down.” During the summer the unit is cooling; in winter it is heating. When the room air temperature is above (cooling) or below (heating) the sensor setpoint, the face and bypass damper is open to the coil.
At the same time, the outdoor air damper is closed and the room air damper is open. All air handled by the fan passes through the coil for maximum heating or cooling.

A

100% Room Air



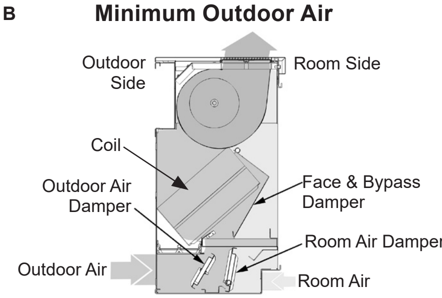
Maximum Heat or Cool, Minimum Outdoor Air

Figure B shows the damper positions as the room temperature approaches the room thermostat setting. The outdoor air damper is open to the minimum setting and the room air damper closes slightly.

Unit ventilators normally admit the same minimum percentage of outdoor air during the mechanical cooling cycle as during the heating cycle.

B

Minimum Outdoor Air

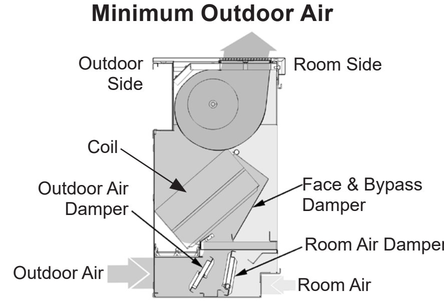


Minimum Outdoor Air, Face & Bypass Damper Modulation

Figure C shows normal operation. Room temperature is maintained within the operating range. Under these conditions, the outdoor air and room air dampers retain their same positions while the face and bypass damper modulates to provide accurate room temperature control.

C

Minimum Outdoor Air



Full Outdoor Air (Free Cooling)

Figure D shows the damper positions for maximum ventilation cooling.

When uncontrolled heat sources tend to overheat a room (such as people, lights or sunlight), the face and bypass damper will bypass 100% of the air around the heat transfer element. The end-of-cycle valve (if furnished) will be closed to the coil. The outdoor air damper will position itself for additional outdoor air, up to 100% of the fan capacity, as required by the room cooling needs. As the outdoor air damper opens, the room air damper closes proportionally.

D

100% Outdoor Air

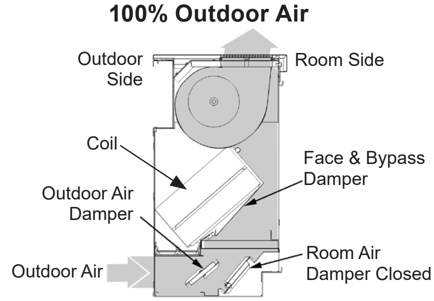
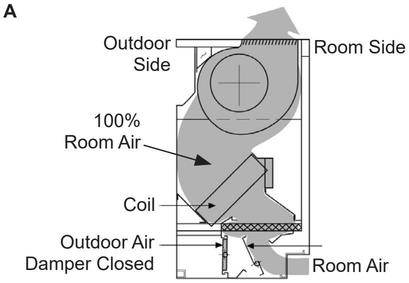


Figure 66: Modulating Valve Temperature Control

Morning Warm-Up/Cool Down

Figure A shows the modulating valve allowing full flow through the coil and the room air damper and outdoor air damper positioned for morning warm-up/cool-down. In the summer, this is full cooling; in the winter, it is full heating. When the room temperature is above the sensor setpoint (cooling), or below the setpoint (heating), the valve opens for full flow through the coil. All air is directed through the coil(s).

A

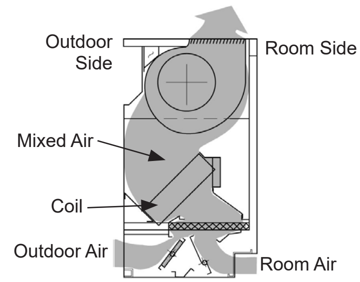


Minimum Heating

Figure B shows the outdoor air damper moved to its minimum position.

The modulating valve is still allowing full flow through the coil. Unit ventilators normally admit the same minimum percentage of outdoor air during the heating cycle as during the mechanical cooling cycle. All the air is directed through the coils.

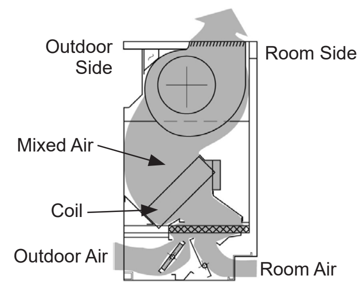
B



Minimum Outdoor Air

Figure C shows normal operation. Room temperature is maintained by modulating the flow through the coil. The outdoor and room air dampers maintain the same positions and all air is directed through the coils.

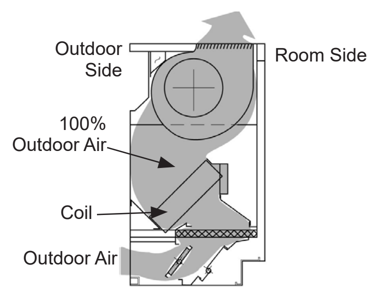
C



Full Outdoor Air (Free Cooling)

Figure D shows the modulating valve closed, allowing no flow through the coil. The outdoor damper is fully open and the room air damper is closed. The sensor setting dictates when the outdoor damper needs to begin closing. When the minimum outdoor damper position is reached, the valve needs to modulate towards the full open position. All the air is directed through the coils. (Care must be taken to ensure coils are not exposed to freezing air conditions when the modulating valve is shut or no water is flowing through coils. See "Freeze Protection" on page 79.)

D



Coil Selection

An extensive choice of coil offerings means that, with Daikin Applied unit ventilators, room conditions can be met using almost any cooling or heating source. All coils are located safely beneath the fans and are designed for draw-thru air flow. All coils have their own unshared fin surfaces (some manufacturers use a continuous fin surface, sacrificing proper heat transfer). The result is maximum efficiency of heat transfer, which promotes comfort and reduces operating costs.

An air break between coils in all Daikin Applied units is used to enhance decoupling of heat transfer surfaces—providing full capacity output, comfort and reduced operating costs.

All water, steam and direct expansion (DX) coils are constructed of aluminum fins with a formed, integral spacing collar. The fins are mechanically bonded to the seamless copper tubes by expansion of the tubes after assembly. Fins are rippled or embossed for strength and increased heat transfer surface.

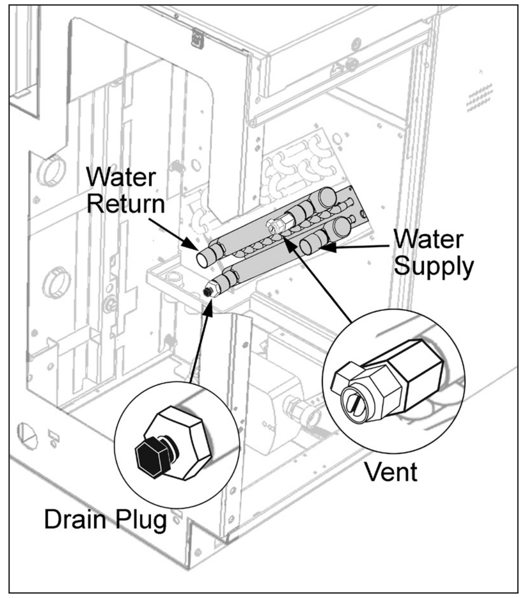
High-Quality Water Coils

Daikin Applied coils rely on advanced heat transfer to provide extra heating capacity for today's increased ventilation requirements. Tuned internal flow and a balanced header design, together with additional surface area in the air stream, increase heat transfer to satisfy the increased need for heat.

A manual air vent is located on the top of the coil header of all floor hydronic coils. (Figure 67). This allows air to be purged from the coil during field start-up or for maintenance.

A manual drain plug (Figure 67) is provided at the bottom of the coil header for coil drainage. Some competitors may not provide for drainage of coils.

Figure 67: Manual Air Vent & Drain Plug



Long Lasting Electric Heating Coils

With our draw-thru design, electric coils are directly exposed to the air stream. They come with a built-in switch to de-energize the coil when the center front panel is removed. A unit-mounted disconnect switch is included. A continuous electric sensory element for high temperature is not required because the air is drawn smoothly and evenly across the coils, prolonging life. (Blow-thru designs use cal rods inserted into the tube of a fin tube coil that results in reduced heat transfer. The constant movement of the electric heating cal rod within the tube shortens life.)

Even Distribution Steam Coils With Vacuum Breakers

Steam distribution coils provide even distribution of steam and even discharge air temperatures. A vacuum breaker relieves the vacuum in the steam coil to allow drainage of condensate. This eliminates water hammer and greatly reduces the possibility of coil freeze-up.

ASHRAE Cycle II

We strongly recommend that ASHRAE Cycle II be implemented with all unit ventilators using controls by others. ASHRAE Cycle II is a very economical sequence since only the minimum amount of outside air is conditioned and free natural cooling is available.

During warm-up (any classroom temperature 3°F or more below heating setpoint), the outdoor air damper is closed and the unit conditions only room air. As room temperature approaches the heating setpoint the outdoor air damper opens to a position that permits a predetermined minimum amount of outside air to be drawn in. Unit capacity is then controlled as needed to maintain room setpoints. If room temperature rises above room cooling setpoint, and the outside air is adequate for economizer cooling, then the outdoor air damper may open above the minimum position to provide economizer cooling.

ASHRAE Cycle II requires that a minimum of three temperature measurements be made:

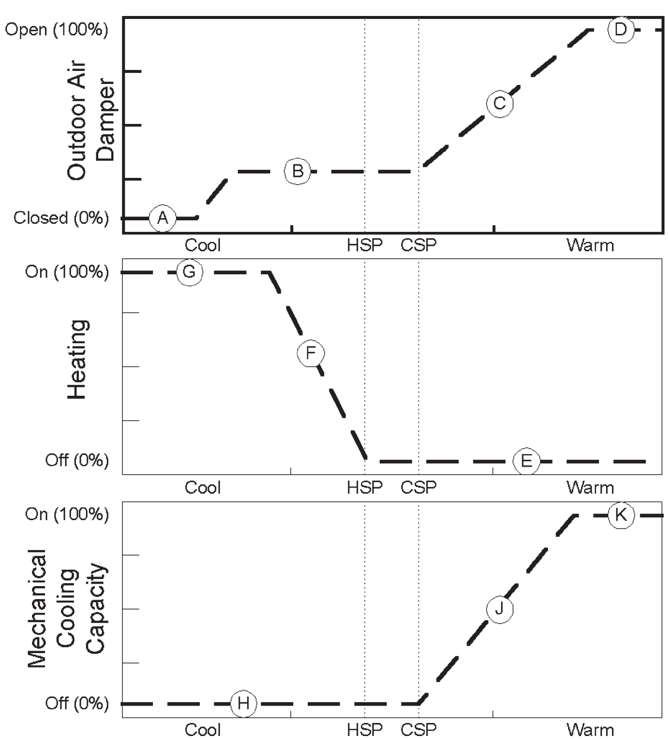
1. Classroom temperature.
2. Unit discharge air temperature.
3. Outdoor air temperature.

Additionally, the control sequence should incorporate a Discharge Air Low Limit function which requires a discharge air temperature sensor and can override classroom temperature control in order to maintain a discharge air temperature setpoint of 55°F.

When the discharge air temperature drops below 55°F, the discharge-air low-limit function will disable cooling (if enabled) and modulate the unit's heating capability as needed to maintain the 55°F discharge-air setpoint regardless of room temperature.

If the unit's heating capability reaches 100%, then the discharge air low-limit function will modulate the outdoor air damper toward closed to maintain the 55°F discharge air setpoint. Outdoor air temperature is used to determine when to use economizer as a first stage of cooling, and when to use mechanical or hydronic cooling as the first stage of cooling.

Figure 68: ASHRAE Cycle II Operation



Typical Outdoor Air Damper Operation

A Outdoor air damper closed.

B Outdoor air damper at minimum position.

C Economizer function is increasing the outdoor air damper position.

Note: *If outdoor air temperature is not adequate for free cooling, secondary mechanical cooling can be used in place of economizer cooling. A low discharge air function is used to help maintain comfort and provide additional equipment protection by preventing the discharge air from falling too low (typically 55°F), and may force the outdoor air damper toward closed to maintain the discharge air temperature regardless of room temperature.*

D Damper is at full open.

Typical Heating Operation

E Heating capability is closed (or off).

F Heating begins to modulate (or on).

G Heating capability has reached 100%.

Typical Mechanical Cooling Operation

H Mechanical cooling (hydronic or DX) is closed (or off).

J Mechanical cooling (hydronic or DX) begins to modulate (or on).

Note: *If economizer cooling is available, then mechanical cooling should be used as a second stage and therefore delayed until the outside air damper reaches near full open.*

K Mechanical cooling (hydronic or DX) has reached 100%.

End-Of-Cycle (EOC) Valve Operation

The intended purpose of an EOC valve is to reduce the chances of conductive radiant overheating which can occur when the face and bypass damper is in the full bypass position (i.e., no heating).

A heating EOC valve must be used on units with DX cooling coupled with steam or hot water heat and face and bypass damper temperature control. It is optional for the remaining models. However, it is strongly recommended that heating or heat/cool EOC valves be used on all face and bypass units with heating capability to prevent overheating.

Heating EOC Valve

For steam or hot water heat only with face and bypass damper control; steam or hot water heat with face and bypass damper control coupled DX cooling:

The heating EOC valve should be a normally open, spring return (open), two position valve. In addition:

1. **Heating Operation:** When the room temperature is 2°F or more below the heating setpoint, the EOC valve should open and remain open until the room temperature becomes equal to the heating setpoint or higher.
2. **Operation Due To Outside Air Temperature:** If the outside air temperature is equal to or less than 35°F, the EOC valve should open, the EOC should then remain open until the outdoor air temperature reaches 37°F or higher.

Water Coil Low Air Temperature Limit (Freezestat) Operation

The Water Coil Low Air Temperature Limit, or freezestat, function is intended to help protect the water coil from extremely low air conditions. All units with hydronic coils ship with a freezestat. The freezestat has a cut-out temperature setting of no less than 38±2°F and a cut-in temperature setting of approximately 45±2°F. The freezestat is intended as a backup in case the normal operating controls fail to protect the equipment. It is used in the following manner:

DX Cooling With Hot Water Heat & Face and Bypass Control:

The freezestat is secured to the leaving air face of the hot water heating coil. When the freezestat cuts out due to low temperatures, the following should occur:

- The compressor is de-energized.
- The outdoor air damper is closed.
- The heating EOC valve is forced to full open.
- The face and bypass damper modulates as needed to maintain space temperature.
- When the freezestat cuts in after cut-out, normal operation may return.

Valve Control Applications

System freeze protection must be considered on valve controlled units utilizing hydronic coils. Non-flowing water in heating coils that are exposed to freezing outdoor air can freeze and rupture the coil (after the modulating valve shuts). The modulating control valve must be correctly sized and the supply water temperature controlled to ensure constant water flow. If this cannot be guaranteed, use an antifreeze solution to eliminate the possibility of coil freeze.

DX Cooling With Hot Water Heat & Valve Control:

The freezestat is secured to the leaving air face of the hot water heating coil. When the freezestat cuts out due to low temperatures, the following should occur:

- The compressor (condensing unit) is de-energized.
- The outdoor air damper is closed.
- The unit fan is de-energized.
- The heating valve is forced to full open.
- When the freezestat cuts in after cut-out, normal operation may return.

Unit Installation

Carefully arrange the location and installation of each model AZ unit to provide convenient service access for maintenance and, if necessary, removal of the unit. The installation consists of four basic elements in the following order:

1 Louver
2 Galvanized wall sleeve
3 Horizontal air splitters by others (if required)
4 AZ self-contained unit ventilator

The louver brings in outdoor air for the condenser fan section and ventilation air to the classroom while providing a path for heated condenser air to exit.

The wall sleeve secures the unit, provides a watertight and air tight seal to the building and brings in electrical and control wiring (if required). It contains the unit main power disconnect switch which is located in the wall sleeve junction box. All field electrical connections are made inside this box.

Horizontal air splitters provide proper air paths and minimize air recirculation.

The AZ self-contained unit ventilator provides comfort cooling and heating for the space. The Model AZ unit is designed to be installed into or up against an exterior wall. The louver, air splitters (if required) and wall sleeve are installed before the AZ unit is installed.

On many jobs, the louver and wall sleeve are shipped ahead of the unit itself. Installation instructions for these components are shipped with the individual components included in this publication.

The following are general instructions for suggested applications. In all cases, good engineering practices and local codes must be followed.

Wall Louvers

The outdoor air wall louver is usually set directly back of the unit ventilator. The position of the wall louver is determined in general by the building construction. The top of the lower channel of the louver frame should be at least 1/2" below the level of the inlet to the unit ventilator.

However, if a high intake opening is necessary, the top of this opening should be not more than 28" above the surface upon which the unit ventilator will set.

Figure 69: Typical Self-Contained Unit Ventilator Installation

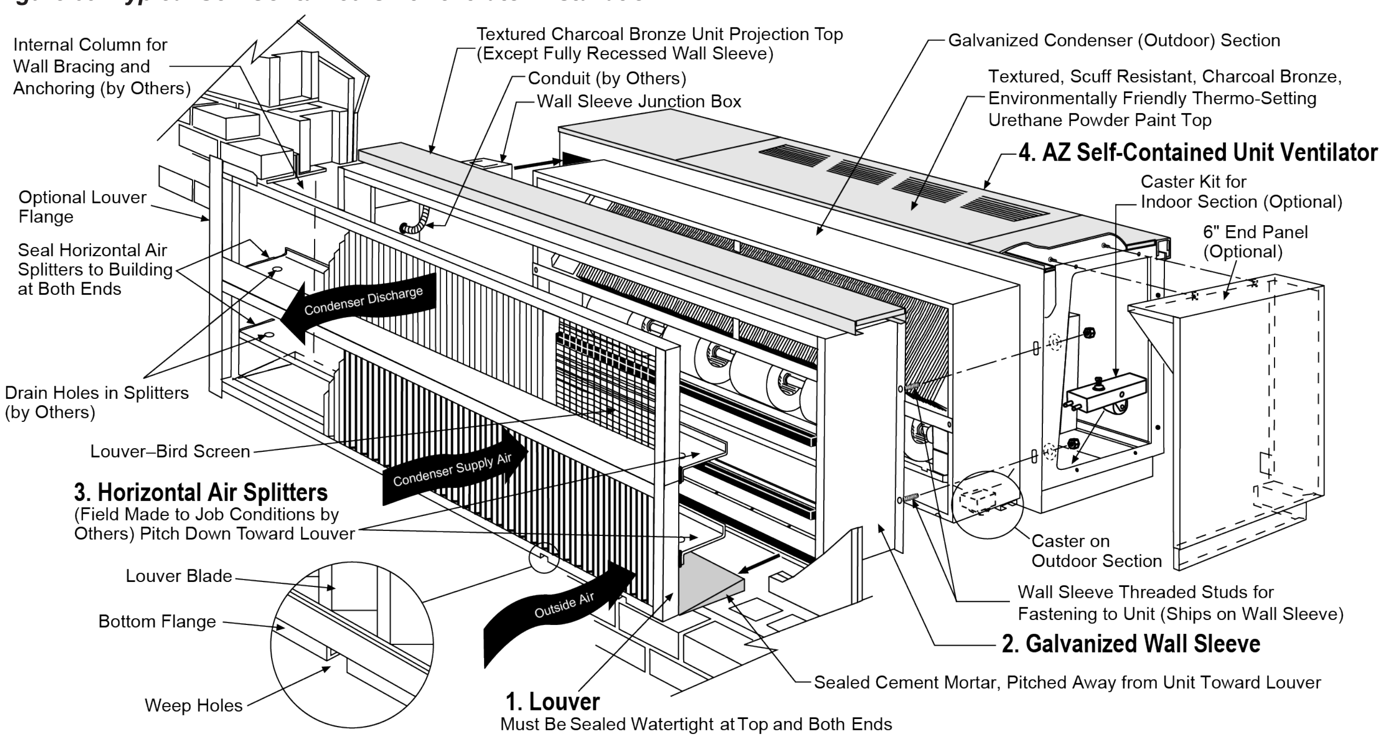


Figure 70: Wall Penetration Detail - Full Recess

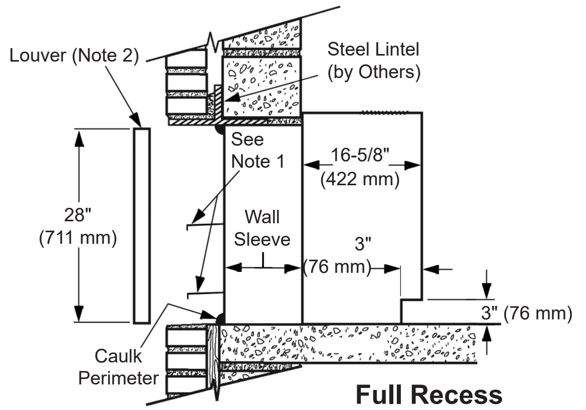


Figure 71: Wall Penetration Detail - Partial Recess

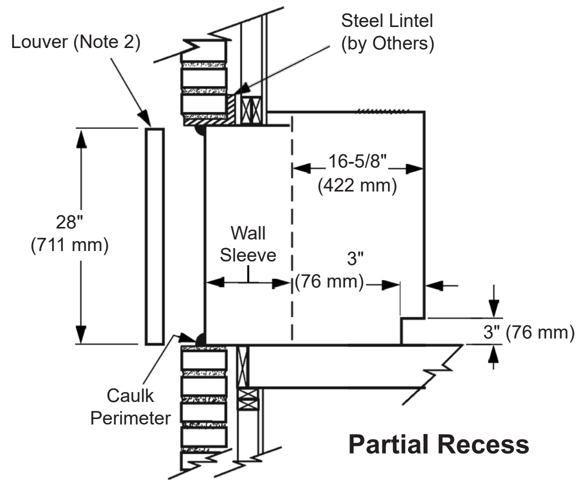
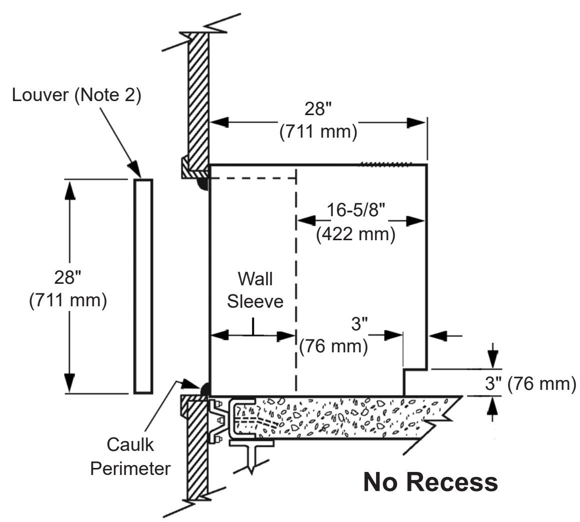


Figure 72: Wall Penetration Detail - No Recess



Notes:

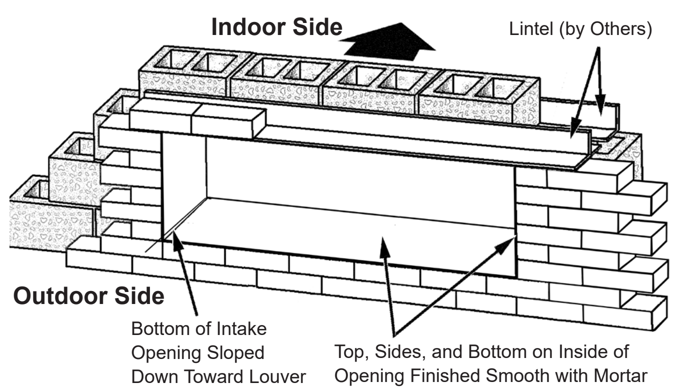
1. *Horizontal splitter (by others) must be installed whenever there is any space between the wall sleeve and the louver. It is necessary to seal the ends of the wall opening.*
2. *The top and two sides of the louver must be caulked water tight. The bottom edge of the louver must not be caulked, to allow for drainage.*
3. *Louvers may be recessed a maximum of 2" (51 mm) from the exterior face of the wall.*
4. *Drain must be flush with floor to allow unit installation and removal. Unit drain tube is 7/8" (22 mm) O.D. copper.*
5. *A field-supplied air seal should be applied to the exterior perimeter of the wall sleeve when unit is installed with no recess.*

Lintels

When brickwork is built up to the top of the intake, lintels must be used above the wall louvers. While the wall is still wet, finish the brick on the top, bottom and both sides of the intake opening with 1/2" cement mortar. With the standard location of the wall louver, the bottom of the intake opening must slope from the louver frame up toward the intake opening to a point 1" above the finished base of the unit.

If a metal sleeve connection is to be used between the unit ventilator and the wall louver, this sleeve must be installed after the unit ventilator is set, making a weather-tight connection to the unit ventilator cabinet. Turn the sleeve over the edge of the louver frame by proper peening before the louver is finally installed.

Figure 73:Figure 45: Typical Wall Opening with Lintels

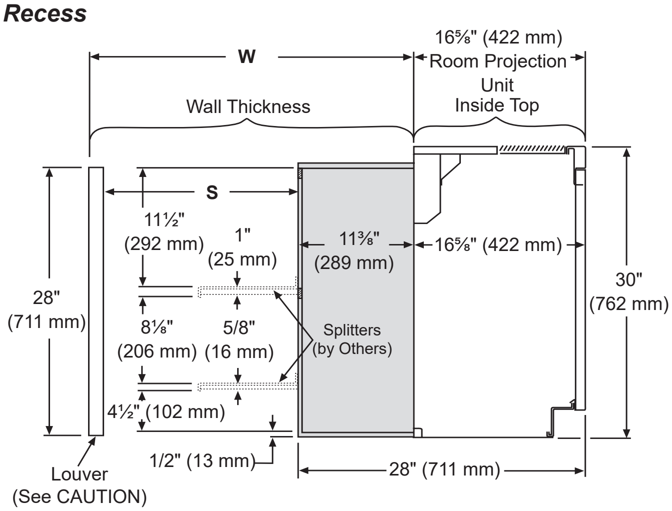


Horizontal Splitters & Unit Recess Details

Horizontal splitter (by others) must be installed whenever there is space between the wall sleeve and the louver. Seal the ends of the wall opening to prevent water penetration and air leakage. Pitch the splitters toward the louver for water drainage.

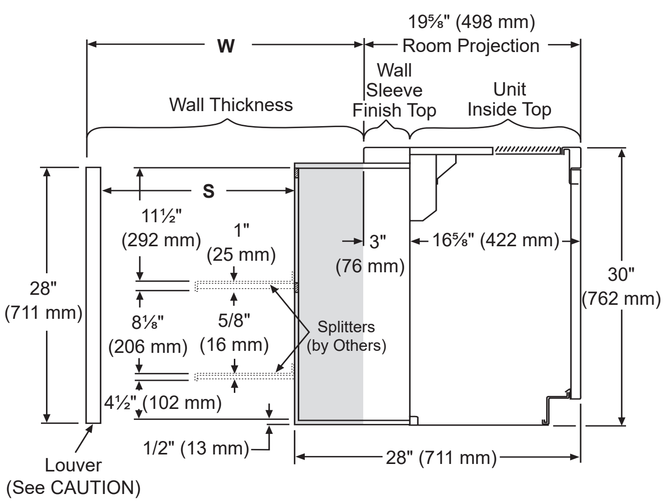
> ⚠ **CAUTION**
>
> Horizontal splitter (by others) must be installed whenever there is space between the wall sleeve and the louver. Seal the ends of the wall opening to prevent water penetration and air leakage. Pitch the splitters toward the louver for water drainage

Figure 74: 16⅝" Room Projection or Full Wall Sleeve Recess



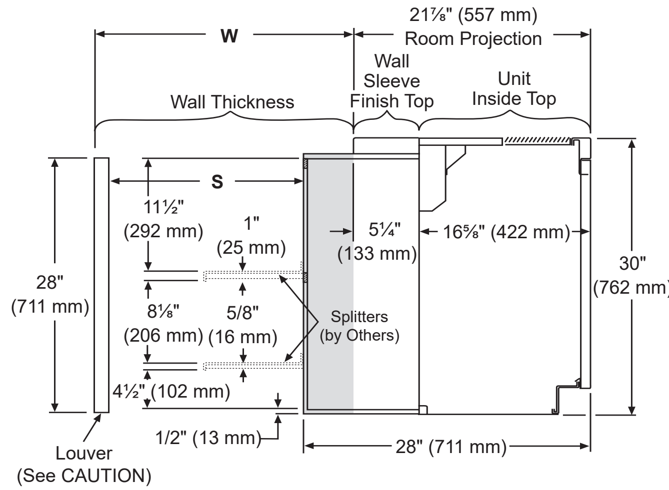
Note: *Shading indicates portion of unit wall sleeve recessed into wall opening.*

Figure 75: 19⅝" Room Projection



Note: *Shading indicates portion of unit wall sleeve recessed into wall opening.*

Figure 76: 21⅞" Room Projection



Note: *Shading indicates portion of unit wall sleeve recessed into wall opening.*

Figure 77: 28" Room Projection

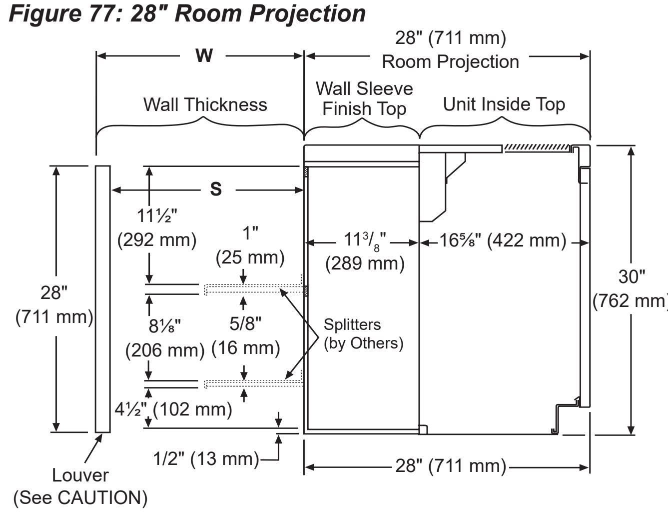


Table 54: Wall Thickness, Unit Projection Into Room

Wall Thickness "W"	Louver	Unit Projection into Room and Wall Sleeve Type			
		28"	21⅞"	19⅝"	16⅝"
		Figure 77	Figure 76	Figure 75	Figure 74
		Splitter Length from Wall Sleeve to Louver "S"			
2½"		0"			
4"		1½"			
6"		3½"			
8"		5½"			
8⅝"		6⅛"	0"		
10"		7½"	1⅜"		
10⅞"	2½"	8⅜"	2¼"	0"	
12"		9½"	3⅜"	1⅛"	
13⅞"				3"	0"
14"				3⅛"	1/8"
16"					2⅛"
18"					4⅛"
24"					10⅛"

Note: All dimensions are approximate and subject to change without notice. Actual building dimensions may vary.

Interior Considerations

The interior wall surface behind the unit ventilator must be smooth and level. A wall that is slightly out of plumb can cause major problems with outside air leakage into the room and unit. This could cause drafts and potentially freeze coils.

Be certain that no gap is left between the unit and the outside air louver opening. Otherwise, outside air can leak into the room.

A rubberized, self-adhering membrane around the outside air opening can be used to seal any air or water leaks that might result from construction. Provide a seal under the unit to prevent air infiltration. In addition, seal the unit top and side perimeters to prevent unnecessary air infiltration due to uneven walls.

Indoor Air Exhaust Considerations

All outdoor air introduced by the unit ventilator must leave the room in some way. In some states, exhaust vents are required by law. In states where vents are not required by law, a decision must be made about how best to handle this problem.

The venting system chosen should have the ability to exhaust varying amounts of air equal to the amount of outside air introduced by the floor unit ventilator. A constant volume system, such as a powered exhaust, is unable to respond to changing conditions. It will either exhaust too much air, resulting in a negative pressure, which draws in more outdoor air than desired. Or, it will exhaust too little air, resulting in increased positive pressure, which restricts the amount of outside air being brought into the room.

The Daikin Applied VentiMatic shutter is a more economical solution to the problem. See "VentiMatic Shutter Room Exhaust Ventilation" on page 23 for information on this system and its proper installation.

Wall Sleeve Arrangements

Figure 78: Recessed Wall Sleeve with Horizontal Air Splitters

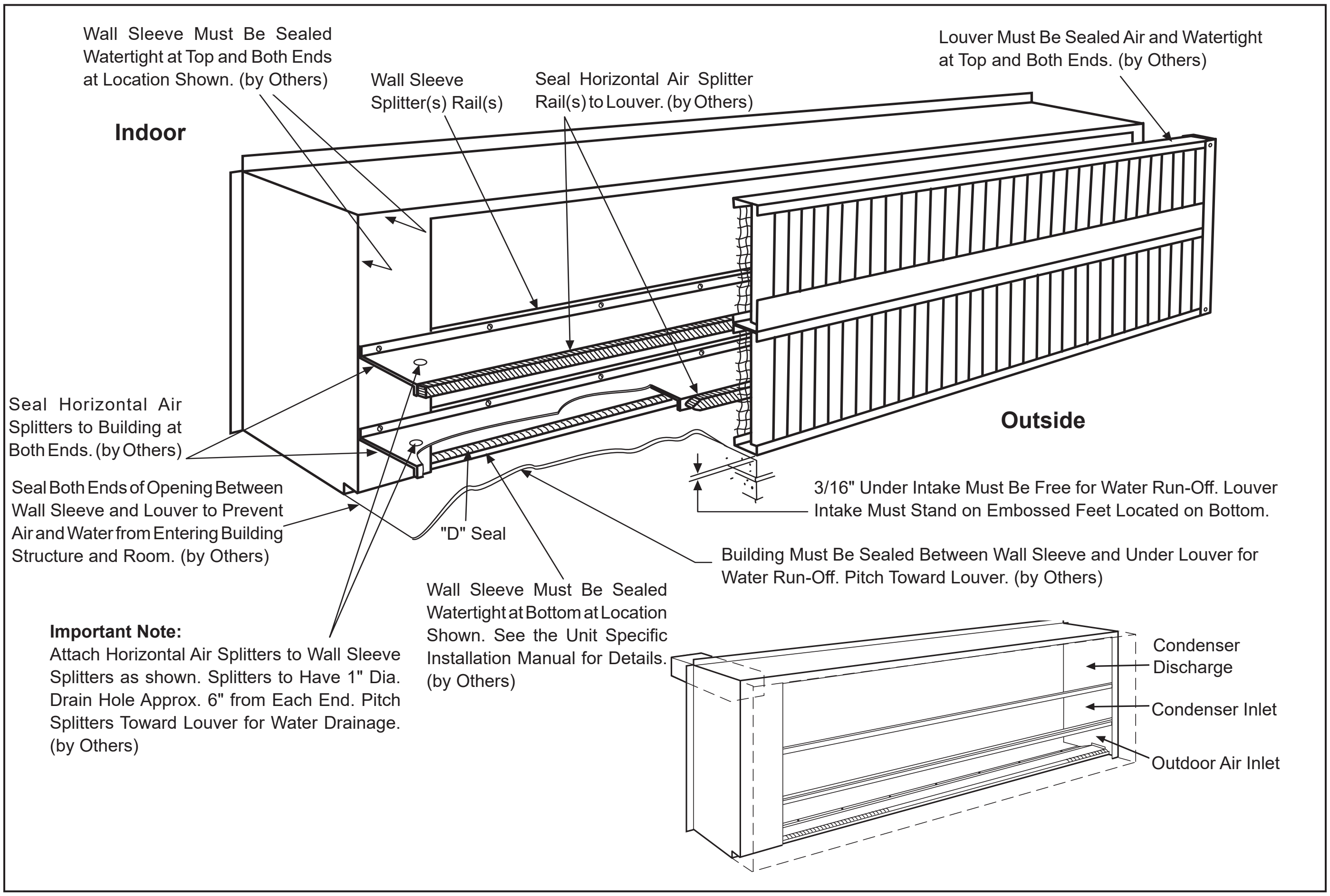


Figure 79: Sealing Full Projection Wall Sleeve and Horizontal Air Splitters

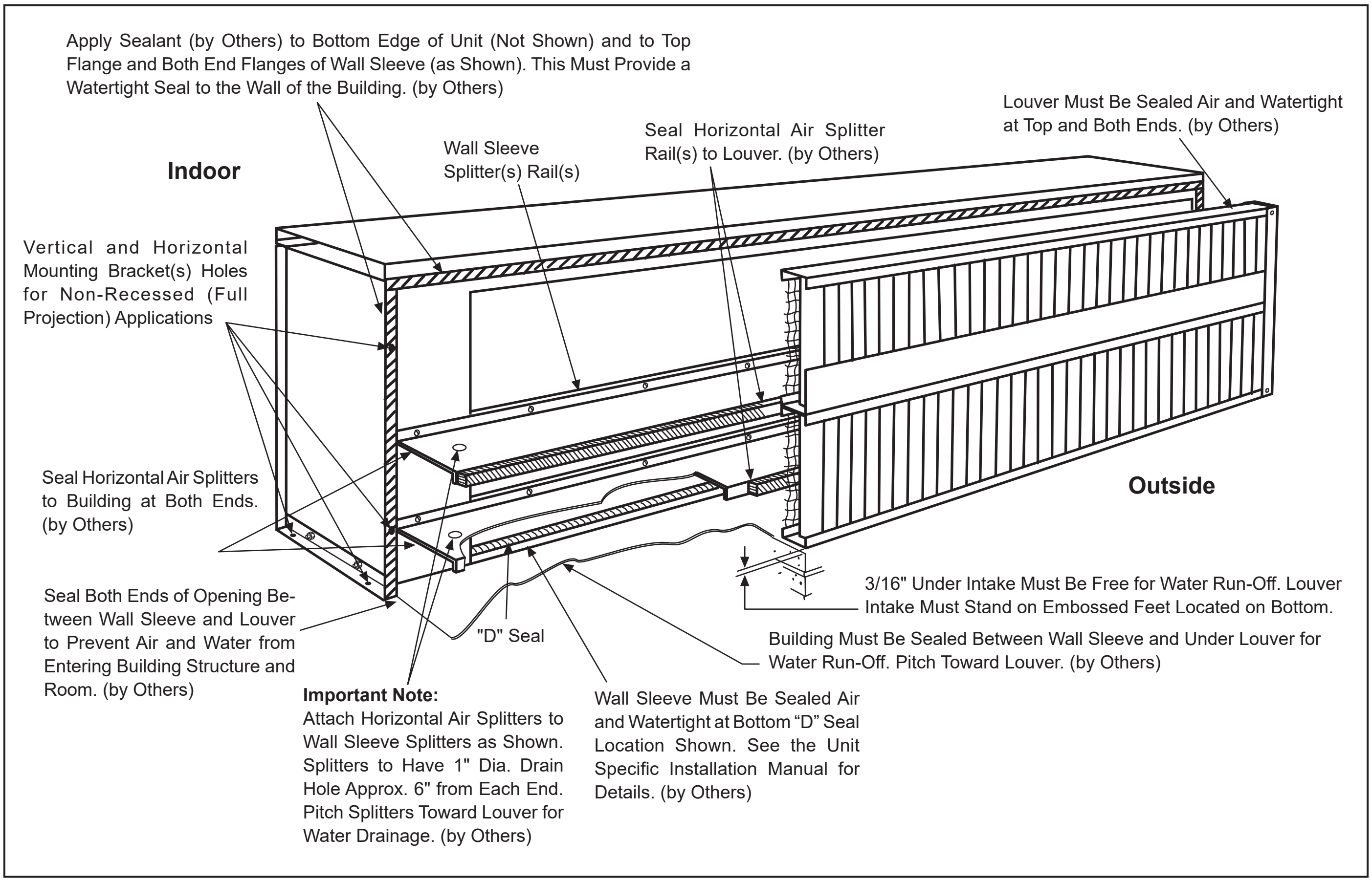


Figure 80: Recessed Wall Sleeve - Direct Sealing Wall Sleeve to Louver

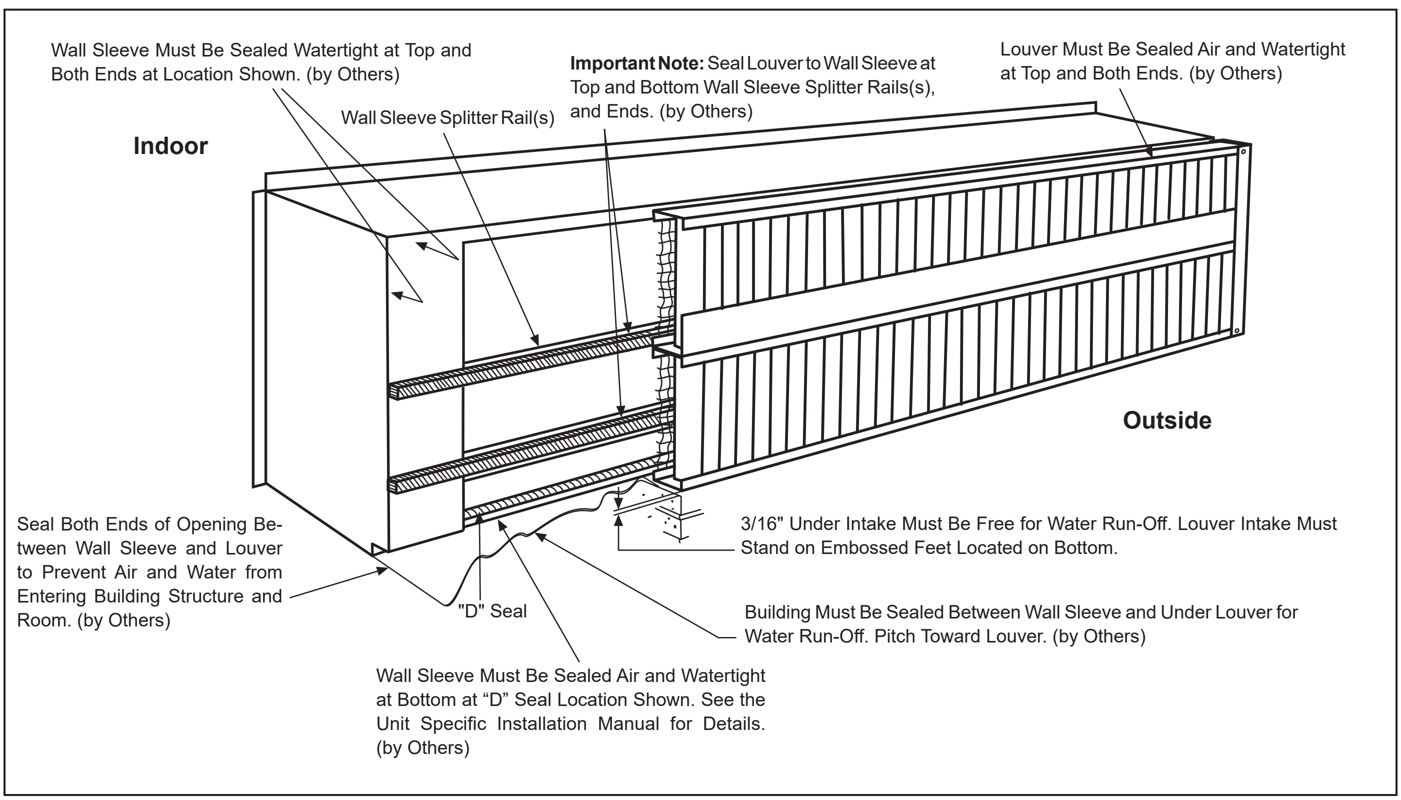


Figure 81: Sealing Full Projection Wall Sleeve to Louver Intake Without Horizontal Air Splitters

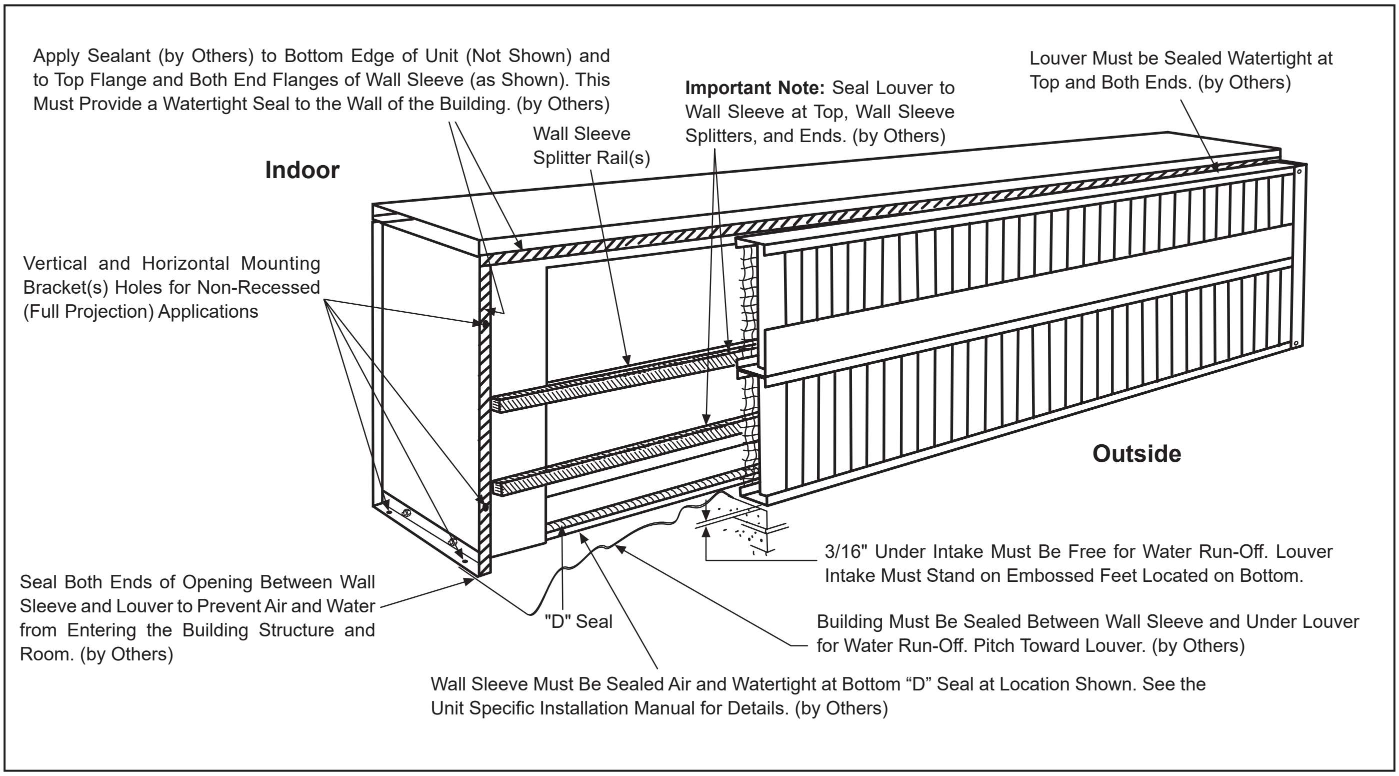
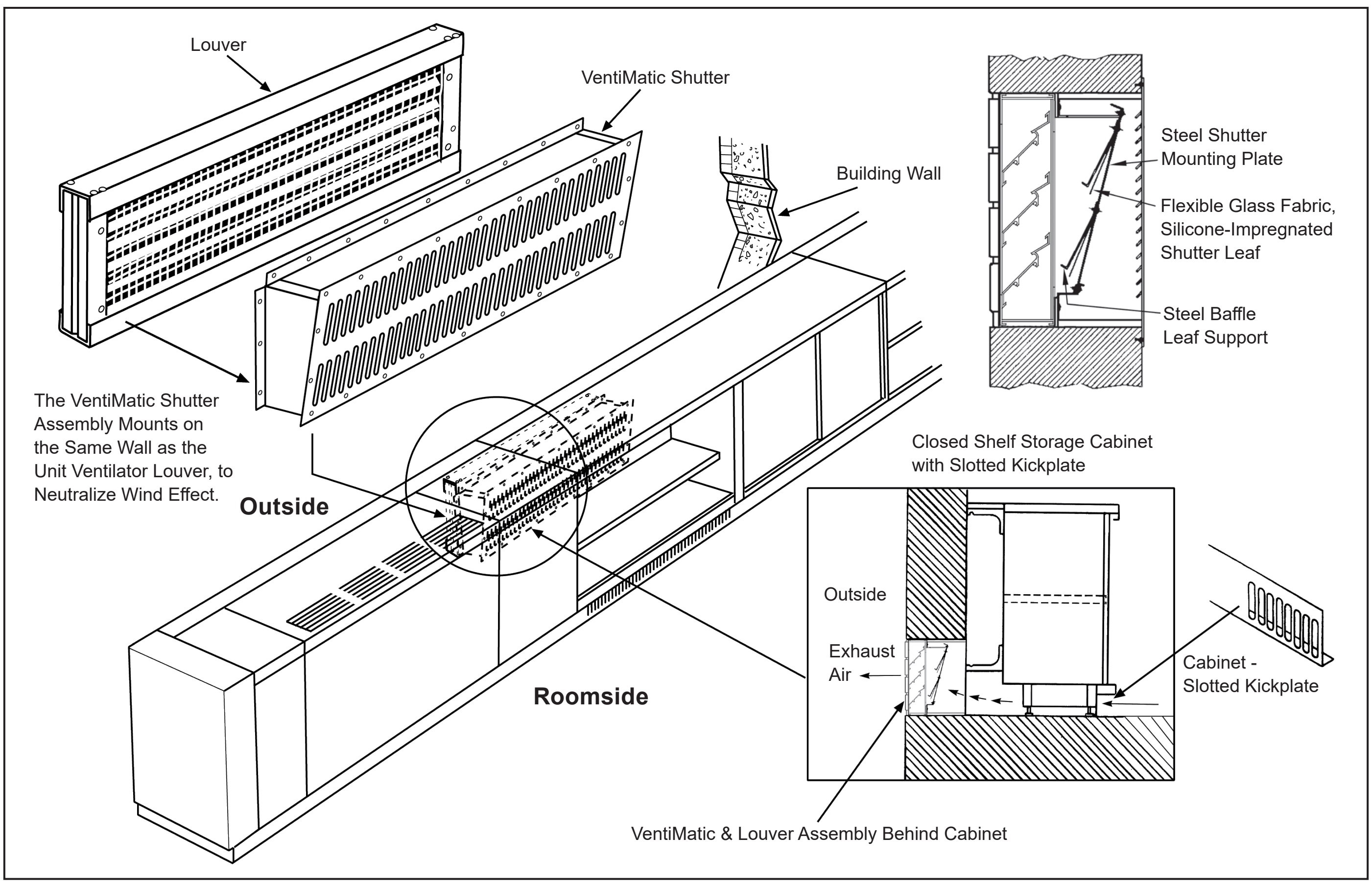


Figure 82: VentiMatic Shutter Installation



Valve Selection

Face and Bypass End-Of-Cycle Valve Sizing & Piping

Note: *Piping packages can be purchased from Daikin Applied or provided by others*

MicroTech face and bypass damper control requires an end-of-cycle (EOC) valve for each hydronic coil. End-of-cycle (or two position) valves are either full-open or full closed. To select an end-of-cycle valve:

1. Determine the flow of water and the corresponding pressure drop through the coil.
2. Obtain the pressure difference between the supply and return mains.
3. Select a valve (Cv) on the basis of taking 10% of the available pressure difference (at design flow) between the supply and return mains at the valve location. The valve should have a pressure drop less than or equal to that of the coil.

Table 55 gives the pressure drops at various water flow rates for the Cv of the valve listed. EOC valves for water applications can be either two-way or three-way.

Refer to the EOC valve label to determine the direction of flow. The EOC valve must be installed on the unit for which it was selected.

Table 55: Hot Water End-Of-Cycle Valve Selection By Pressure Drop

			Valve Pressure Drop at Listed Water Flow Rate															
Cv	Connection Size	GPM	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		L/s	0.32	0.38	0.44	0.50	0.57	0.63	0.69	0.76	0.82	0.88	0.95	1.01	1.07	1.14	1.20	1.26
3-Way Hot Water EOC Valve, FNPT																		
5.0	3/4 inch	ft H2O	2.3	3.3	4.5	5.9	7.5	9.2	11.2	13.3	15.6	18.1	20.8	23.6	26.7	29.9	33.3	36.9
		kPa	6.9	9.9	13.5	17.7	22.3	27.6	33.4	39.7	46.6	54.1	62.1	70.6	79.7	89.4	99.6	110.3
2-Way Hot Water EOC Valve, FNPT, Normally Open																		
7.5	3/4 inch	ft H2O	1.0	1.5	2.0	2.6	3.3	4.1	5.0	5.9	6.9	8.0	9.2	10.5	11.9	13.3	14.8	16.4
		kPa	3.1	4.4	6.0	7.8	9.9	12.3	14.8	17.7	20.7	24.0	27.6	31.4	35.4	39.7	44.2	49.0

Hot Water EOC Valve Piping

Hot water EOC valves are furnished normally open to the coil. When the valve is de-energized (off) there is full flow through the coil. Energizing the valve shuts off the water flow.

Figure 83: 2-Way Hot Water EOC Valve Piping

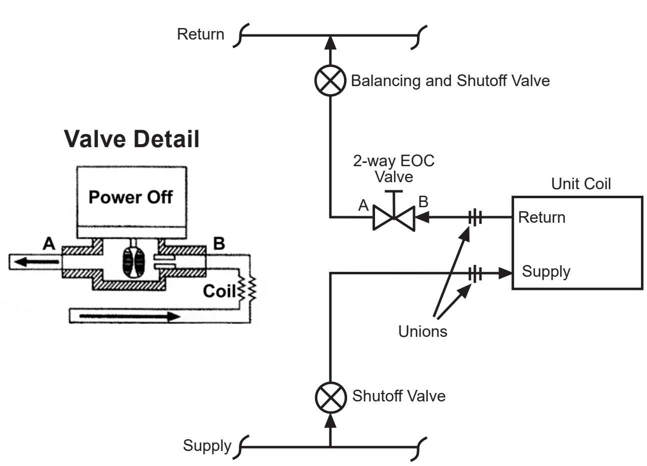
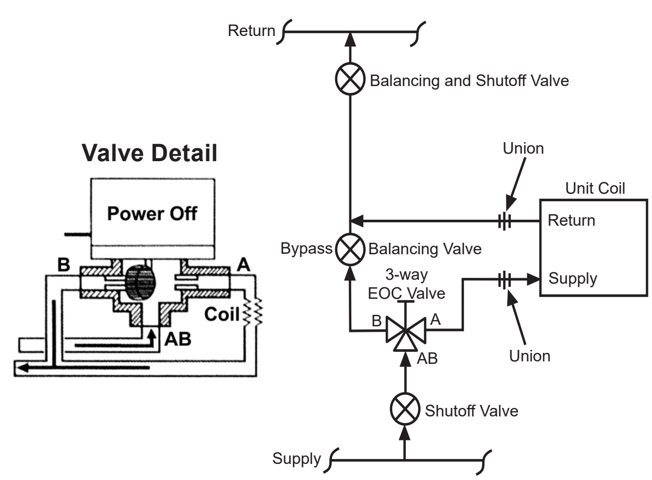


Figure 84: 3-Way Hot Water EOC Valve Piping



Modulating Valve Sizing & Piping

The unit ventilator control valve is expected to vary the quantity of water that flows through the coil in a modulating fashion. Movement of the valve stem should produce a controlled change in the amount of water that flows through the coil. When control valves are oversized (Cv too high) the flow relative to valve position is not linear. For example, assume that, when the control valve is fully open, the pressure drop through the coil is twice as great as the drop through the valve. In this case, the control valve must travel to approximately 50% closed before it can begin to have any influence on the water flow through the coil. The control system, no matter how sophisticated, cannot overcome this. Oversized control valves can also result in hunting which will shorten the life of the valve and actuator and possibly damage the coil. Undersized (Cv too low) control valves will accurately control the flow but will have a very high pressure drop through the valve.

To correctly select the modulating valve:

1. Determine the flow of water and the corresponding pressure drop through the coil.
2. Obtain the pressure difference between the supply and return mains.
3. Select a valve (Cv) from Table 56 or Table 57 on the basis of taking 50% of the available pressure difference (at design flow) between the supply and return mains at the valve location. The valve should have a pressure drop greater than that of the coil. Whenever possible there should be at least 11 feet of water (5 psi) (32.9 kPa) pressure drop across the valve.

Modulating valves for water applications can be either 2-way or 3-way. Refer to the modulating valve label to determine the direction of flow. The modulating valve must be installed on the unit for which it was selected.

The modulating valve furnished for steam applications is a 2-way, normally open to the coil configuration (see "Steam Valve Sizing & Piping" on page 92 for application).

Table 56: 2-Way Modulating Valve - Pressure Drop

			Pressure Drop Across the Valve									
2-Way CCV Part No.	Cv Maximum Rating	Connection Size	1 PSI	2 PSI	3 PSI	4 PSI	5 PSI	6 PSI	7 PSI	8 PSI	9 PSI	10 PSI
B209	0.8	1/2 inch	0.8	1.1	1.4	1.6	1.8	2.0	2.1	2.3	2.4	2.5
B210	1.2		1.2	1.7	2.1	2.4	2.8	2.9	3.2	3.4	3.6	3.8
B211	1.9		1.9	2.7	3.3	3.8	4.2	4.7	5.0	5.4	5.7	6.0
B212	3.0		3.0	4.2	5.2	6.0	6.8	7.3	7.9	8.5	9.0	9.5
B213	4.7		4.7	6.6	8.1	9.4	11	12	12	13	14	15
B214	7.4		7.4	10	13	15	17	18	20	21	22	23

Table 57: 3-Way Modulating Hot Water Valve - Pressure Drop

			Pressure Drop Across the Valve									
2-Way CCV Part No.	Cv Maximum Rating	Connection Size	1 PSI	2 PSI	3 PSI	4 PSI	5 PSI	6 PSI	7 PSI	8 PSI	9 PSI	10 PSI
B309(B)	0.8	1/2 inch	0.8	1.	1.4	1.6	1.8	2.0	2.	2.3	2.4	2.5
B310(B)	1.2		1.2	1.7	2.	2.4	2.8	2.9	3.2	3.4	3.6	3.8
B311(B)	1.9		1.9	2.7	3.3	3.8	4.2	4.7	5.0	5.4	5.7	6.0
B312(B)	3.0		3.0	4.2	5.2	6.0	6.8	7.3	7.9	8.5	9.0	9.5
B313(B)	4.7		4.7	6.6	8.1	9.4	11	12	12	13	14	15
B318(B)	7.4		7.4	10	13	15	17	18	20	21	22	23

Hot Water Modulating Valve Piping

The optional 2-way modulating hot water valve is furnished to fail open to the coil. 24 VAC is required to power the valve actuator. When the actuator is powered, a controller will provide a 2-10 VDC signal to the actuator. A signal of 2 VDC or less will drive the valve closed; the valve will drive open as the signal increases to a maximum of 10 VDC.

If 24 VAC is lost to the actuator, valve will spring-return to its fail position (open to the coil for hot water valves).

Figure 85: 2-Way Hot Water Modulating Valve Piping

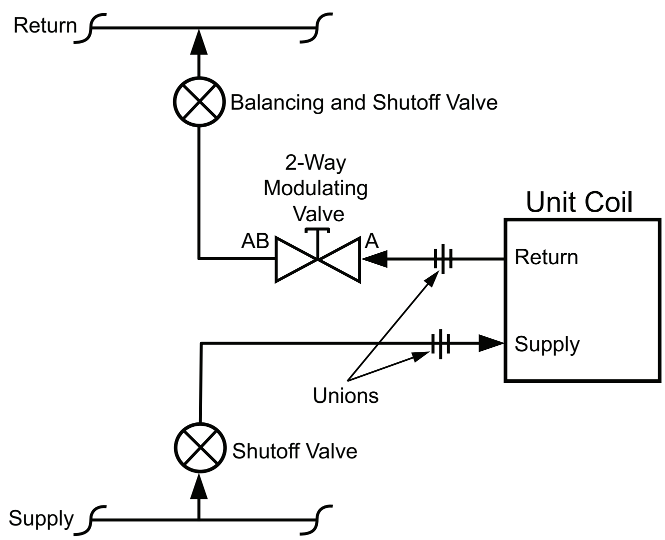
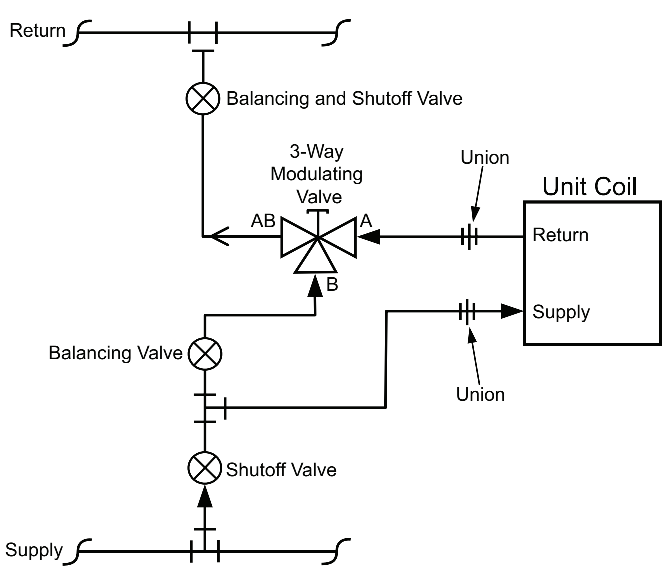


Figure 86: 3-Way Hot Water Modulating Valve Piping



Note: *The **A** port must be piped to the coil to maintain proper control.*

Steam Valve Sizing & Piping

End-Of-Cycle Steam Valve Selection

End-of-cycle steam valves are either full-open or full-closed. To select an end-of-cycle steam valve:

1. Obtain the supply steam inlet pressure.
2. Determine the actual heat requirement of the space to be heated.
3. Select a steam valve (Cv) based on taking 10% of the inlet steam pressure. For example, for a system with an inlet pressure of 2 psig, the valve should be sized based on a 0.2 psig pressure drop. The valve must have a capacity greater than or equal to that of the space to be heated.

Table 58 gives the steam capacity based on a pressure drop equal to 10% of the inlet pressure.

Table 58: EOC Steam Valve Selection

Cv	Connection Size	psig	1	2	3	4	5	6
		kPa	6.9	13.8	20.7	27.6	34.5	41.4
EOC Steam Valve Selection								
8.00	1 inch	MBH	34.3	50.0	63.0	74.7	85.6	96.0
		Watts	10065	14660	18461	21886	25090	28148

[1] Based on 1150 Btu/lb of steam

Modulating Steam Valve Selection

The steam modulating control valve is expected to vary the quantity of steam through the coil. Any movement of the valve stem should produce some change in the steam flow rate. To select a modulating steam valve:

1. Obtain the supply steam inlet pressure.
2. Determine the actual heat requirement of the space to be heated.
3. Select a valve (Cv) from Table 59 on page 93, which gives the capacity range based on a 60% pressure drop at the low end of the range and 100% pressure drop at the high end of the range.

For example: with 2 psig (13.8 kPa) inlet pressure, the valve with port code 4, in the full open position, would have a 1.2 psig (8.3 kPa) pressure drop (60% of 2 psig) at 65 MBH (19,189 watts) and a 2 psig pressure drop at 82 MBH (24,125 watts). The valve should have a capacity less than or equal to the space to be heated.

Table 59: 2-Way Modulating Steam Valve 1/2" – Pressure Drop

2-Way CCV Part No.	Cv Maximum Rating	Connection Size	Pressure Drop Across the Valve					
			2 PSI	3 PSI	4 PSI	5 PSI	10 PSI	15 PSI
B215HT073	0.73	1/2"	10.99	13.71	16.11	18.33	28.03	36.74
B215HT186	1.86		22.34	34.93	41.06	46.70	71.42	93.60

Steam Valve Piping

End-Of-Cycle (EOC) and modulating valves for steam applications are 2-way, fail-open (on loss of 24 V power), angle pattern valves. Energizing the EOC valve shuts off the flow of steam to the coil. For modulating valves, a signal of 2 VDC or less will drive the valve closed; the valve will drive open as the signal increases to a maximum of 10 VDC.

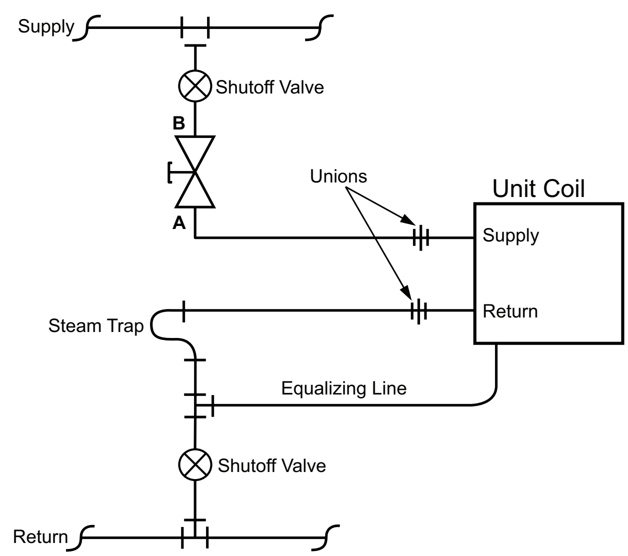
If 24 VAC is lost to the actuator, valve will spring-return to its fail position (open to the coil for steam valves). Refer to the steam valve label to determine the direction of flow. The steam valve must be installed on the unit for which it was selected.

All valves are shipped loose to help prevent shipping damage and to provide the installing contractor with maximum flexibility in making the field piping connection. The valves are field piped by others. They are factory wired for field hook-up.

Notes:

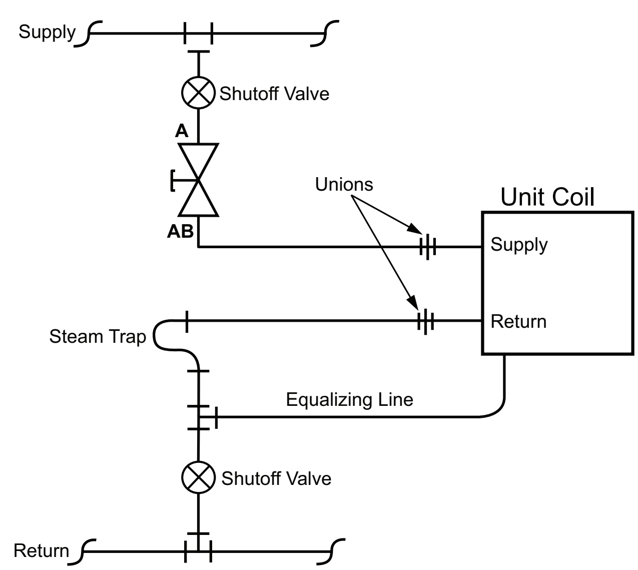
> ***1*** *Refer to the label furnished on 2-way valves to determine direction of flow through the valve.*
>
> ***2*** *The control valve must be installed on the unit in which it was shipped. Indiscriminate mixing of valves among units can result in valves not properly sized for the desired flow rate.*
>
> ***3*** *The control valve should be installed so that there is 2" (51 mm) minimum clearance to remove the actuator from the valve body. Provide unions for the removal of the unit coil and/or control valve. This is a future service consideration.*

Figure 87: 2-Way Steam End of Cycle Valve Piping



Note: *For Erie EOC steam valves, always have the direction of steam flow piped to the* ***B*** *port of the valve. Actuator to be configured for* ***B*** *port to be normally open.*

Figure 88: 2-Way Steam Modulating Valve Piping



Note: *For Belimo steam valves, always have the direction of steam flow piped to the* ***A*** *port of the valve. Actuator to be configured for* ***A*** *port to be normally open.*

Engineering Specifications

DAIKIN APPLIED UNIT VENTILATOR – MODELS AZQ, AZR, AZU

PART 1--GENERAL

1.01 WORK INCLUDED

A. The contractor shall furnish and install packaged unit ventilator systems, of the capacities, performance, and configuration, as indicated in the unit schedule. Each unit shall be complete with factory furnished components and accessories as shown in the plans and as specified herein.

B. Electrical work required as an integral part of the temperature control work is indicated on the mechanical drawings, and is the responsibility of the HVAC contractor to hire the services of a temperature control contractor and/or system integrator contractor to provide a complete system to perform the sequence of operation shown, or as described in this specification. The full sequence of operation must be provided and installed by this contractor for all trades.

1.02 SUBMITTALS

A. Submit schedule for all types, sizes and accessories. Schedule shall include certified performance data, room locations and all operating data.

B. Submit shop drawings for all units including all dimensional information, construction details, installation details, required opening sizes, roughing locations for piping and electrical work and accessory equipment. Equipment must meet specifications. Where deviations from the specifications exist, they must be identified.

C. Provide field wiring diagrams for all electrical power and temperature control field-wiring connections.

D. Submittals shall also include complete operating and maintenance instruction manuals and unit specific replacement parts lists.

1.03 QUALITY ASSURANCE

A. Unit ventilators shall be listed by Underwriters Laboratories Inc. (U.L.) for the United States and Canada.

B. Motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards.

C. Unit ventilation rate to be certified and tested per Air Conditioning and Refrigeration Institute (ARI) standard 840.

D. Unit to be certified and labeled compliant with the seismic design provisions of the International Building Code (IBC) Chapter 16 and independent test agency requirements of Chapter 17.

PART 2--PRODUCTS

2.01 CABINET AND CHASSIS

A. Unit frames shall be of unitized, welded construction, with structural elements aligned in an assembly jig prior to welding, to insure proper dimensions, rigidity, and squareness.

B. Internal sheet metal parts shall be constructed of galvanized steel to inhibit corrosion.

C. Exterior cabinet panels shall be fabricated from furniture grade steel of not less than 16 gauge steel with no sharp edges and no unsightly screw heads and shall receive an electro-statically applied powder paint, and be oven baked with environmentally friendly thermosetting urethane powder finish to provide a high quality appearance. Finish color shall be as selected by Architect from manufacturer's standard colors.

D. The interior areas of the unit ventilator shall be insulated for sound attenuation and to provide protection against condensation of moisture on or within the unit. The unit shall be provided with an ultra-quiet sound package consisting of acoustically matched low speed fans to fan housing, sound barrier insulation material (non-fiberglass) adhered to the bottom underside of the unit top panel, sides of the fan section and sound absorbing insulation (non-fiberglass) material applied to the unit front panel.

E. Units shall be constructed so that testing and troubleshooting can be accomplished in the end pockets of operating units, without affecting the normal air flow patterns through the unit.

F. Each unit shall be provided with a non-fused power interrupt switch that disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time. The fan motor and controls shall have the hot line(s) protected by factory installed cartridge type fuse(s).

2.02 COILS

A. All coils shall be installed in a draw through position to assure uniform air distribution over the full-face area of the coil, and an even unit discharge temperature.

B. All heating and cooling coils shall be constructed with copper tubes and mechanically bonded aluminum corrugated plate type fins. All coils shall have aluminum individual unshared fin surfaces. An air break shall exist between coils.

C. [AZQ] Water heating coils shall be furnished with a threaded drain plug at the lowest point, and a manual air vent at the high point of the coil. A factory installed low temperature freezestat shall be provided on the leaving edge of the water heating coil in a wave-like configuration to sense multiple locations and shall react to possible freezing conditions. The unit-mounted controls shall incorporate this device.

[AZR] Steam heating exchanger elements shall be double tube (DT) steam distributing, freeze resistant type with same end, (or for floor units, either same end or opposite end connections), as indicated on the plans. A pressure equalizing device (vacuum breaker) shall be factory installed to prevent the retention of condensate in the coil. The installing contractor shall connect the equalizing device to the return line beyond the trap using the tubing provided.

D. Refrigerant coils shall be supplied with factory-installed thermal expansion valves in lieu of capillary tubes to achieve evaporator performance and to protect the compressor from floodback of liquid refrigerant, venturi type refrigerant distributor and a refrigerant low temperature limit.

2.03 FANS AND MOTOR

A. The fan and motor assembly shall be of a low speed design to assure maximum quietness and efficiency.

B. Fans shall be double-inlet, forward-curved, centrifugal type with offset aerodynamic blades. Fans and shaft shall be statically and dynamically balanced as an assembly in the unit before shipment.

C. Fan housings shall be constructed of galvanized steel incorporating logarithmic expansion for quiet operation. Fan and motor assembly shall be of the direct drive type. Belt drive fans shall not be allowed.

D. Supply motors shall be 115 volt, single phase, 60 Hz, NEMA permanent split capacitor (PSC), plug-in type with auto reset internal thermal overload device designed specifically for unit ventilator operation. Motors shall be located out of the conditioned air stream.

E. Units shall have sleeve type motor and fan shaft bearings, and shall not require oiling more than annually. All bearings shall be located out of the airstream. Bearings in the air stream are not acceptable.

F. Motor speed shall be controlled by factory mounted multi-tap transformer for three (3) speeds, HIGH-MEDIUM-LOW-OFF (not accessible from the exterior of the unit). Fan motor and controls shall each have hot leg protected by a factory installed cartridge fuse.

2.04 [AZQ] FACE AND BYPASS DAMPER

A. Each unit shall be provided with a factory-installed face and by-pass damper, constructed of aluminum. The long sealing edges of the damper shall have silicone rubber impregnated clothe seals for long life and positive sealing. Face and bypass dampers without sealing edges to prevent air bypass shall not be acceptable. The damper ends shall have blended mohair seals along the ends glued to the damper end for a positive seal. Plastic clip-on brushes end seals shall not be acceptable as an end seal. The unit design shall incorporate the face and bypass damper to prevent coil surface wiping and be before the fan in a draw-thru configuration. Face and bypass damper positioned in the direct discharge of the room fan is not acceptable.

The face and by-pass damper shall be arranged to have a dead air space to minimize heat pick-up in the by-pass position.

2.05 OUTDOOR & ROOM DAMPERS

A. Each unit shall be provided with separate room air and outdoor air dampers.

B. The room air damper shall be fabricated from aluminum, and be counterbalanced against backpressure to close by gusts of wind pressure, thereby preventing outdoor air from blowing directly into the room.

C. The outdoor air damper shall be two piece, double wall construction fabricated from galvanized steel, with ½" thick, 1½ lb. density glassfiber insulation encapsulated between the welded blade halves for rigidity and to inhibit corrosion. The outdoor air damper shall have additional foam insulation on the exterior surface damper blade and on the ends of the outdoor air chamber. A single blade damper, which can be twisted and will leak air, will not be considered.

D. Dampers shall be fitted with blended mohair seals along all sealing edges. Pressure adhesive sponge neoprene or plastic clip-on brush type sealers for damper seals are not acceptable. Rubber type gasket using pressure adhesive for fastening to metal and exposed to the outside air is not acceptable.

E. Dampers shall use the turned-metal principle on long closing ends with no metal-to-metal contact for proper sealing.

F. The damper shaft shall be mechanically fastened to the blade, and shall operate in bearings made of nylon or other material, which does not require lubrication.

2.06 FILTER

A. Each unit ventilator shall be equipped with a one-piece filter located to provide filtration of the return air/outdoor air mixture. The entire filter surface must be useable for filtration of 100% room air or 100% of outdoor air. The filter shall be easily accessible from the front, and removable in one piece without removal of the unit return air damper stop. The unit shall ship with a factory installed 1″ thick fiberglass, single-use type.

B. Spare filters shall be:

1. 1" thick fiberglass, single-use type; OR
2. 1" thick permanent wire mesh washable; OR
3. 1" thick permanent metal frames with replaceable media.

2.07 REFRIGERATION SYSTEM

A. The refrigeration section shall be constructed of galvanized steel and shall include a factory sealed, factory piped assembly consisting of a hermetically sealed compressor, an outdoor section consisting of one condenser coil, multiple condenser fans with one motor, and an indoor evaporator coil with indoor fan section. No condensate drain piping system shall be required as the cooling condensate is to be disposed of by directing it into the outdoor condenser fan scrolls for re-evaporation on the hot condenser coil. The entire refrigeration system shall ship as an integral completed assembly, which shall be evacuated, charged and run tested prior to shipment.

B. The condenser fan board and fan housings shall be constructed of galvanized steel. Condenser fan wheels shall be double inlet, forward curved centrifugal type. Condenser fan housings shall be constructed of galvanized steel and have pick up slots for slinging indoor condensate upon the condenser coil for evaporation. One long condenser fan wheel without a fan housing is not acceptable. Fan and motor assembly shall be of the direct drive type. Belt drive fans shall not be allowed.

C. The indoor refrigerant cooling heat transfer coil shall include a thermostatic expansion valve with external equalizer and venturi type refrigerant distributor. A low refrigerant temperature sensor shall be factory installed in a u-bend of the refrigerant indoor coil to protect the system during low refrigerant suction conditions.

D. Refrigerant shall be metered by a thermostatic expansion valve in lieu of capillary tubing to achieve evaporator performance and to protect the compressor from floodback of liquid refrigerant.

E. Unit shall have scroll compressors for maximum quietness. Compressors will operate with two stages for efficiency and improved sound. Compressor shall operate at low stage for slow and medium fan speed to improve dehumidification and reduced sound level. Compressor and fan will operate at high speed for sensible enhancement.

F. The unit shall be furnished and wired with compressor thermal/current overload and high-pressure cutout. Gauge ports shall be provided to allow reading of refrigerant pressures at the suction and discharge of the compressor. Compressor shall be equipped with internal pressure relief valve to protect against excessive pressure buildup.

G. The outdoor condenser coils shall be constructed of copper tubes mechanically expanded to raised lanced aluminum plate fins mechanically bonded thereto and shall be positioned above a galvanized steel drain pan.

H. Single-phase units shall have permanent split capacitor (PSC) compressor motor with start assist consisting of a compressor start capacitor and compressor start relay.

I. Acoustic Treatment

1. The refrigeration system shall come with an Ultra Quiet configuration using the following: The compressor shall be mounted on neoprene compressor isolators for external vibration isolation. The compressor shall be connected by attenuation loops in both the suction and discharge lines to prevent transmission of vibration to other components within the section. In addition the refrigerant piping shall include braided copper tubing in the suction and discharge lines to further reduce the transmission of compressor pulsations. Straight compressor discharge lines without attenuation loops and/ or braided copper flex-tubing are not acceptable. Compressor enclosure panels shall be 16-gauge minimum and crossbroken for additional rigidity to dampen vibration. Compressor jackets or compressors without their own enclosure cabinets shall not be acceptable. The complete interior of the compressor compartment shall be lined with a multi-functional material that serves as a sound barrier, an absorber of sound and also must act as a decoupler to the compressor enclosure. This multi-functional material shall have a mylar coating on the face to act as a sound reflector and to increase the strength of the material. Damping material shall be textured foam type. The exterior of the compressor compartment shall be coated with a high density damping material to eliminate impact noise and vibration. The right end panel, right hand front panel, 36″ (914 mm) of the right hand end of the center front panel, and the hinged top access door shall be coated with a high density material to eliminate noise and vibration.

2.08 CONTROL COMPONENTS

A. Each unit ventilator shall be furnished with a factory installed and wired, microprocessor based DDC Unit Ventilator Controller (UVC), by the manufacturer of the unit ventilator, which is pre-programmed, factory pre-tested prior to shipment and capable of complete, stand-alone unit control or incorporation into a building-wide network using an optional plug-in communication module. The UVC shall be preprogrammed with the application code required to operate the unit using ASHRAE Cycle II. The unit control system shall include all required temperature sensors, input/output boards, main microprocessor modules, Local User Interface (referred to as LUI) Touch Pad with Digital LED Display, wiring, 24 volt power and direct coupled damper actuators. The UVC shall support up to 6 analog inputs, 12 binary inputs, and 9 binary outputs plus additional I/O points of 4 analog inputs and 8 binary outputs.

B. [AZQ] All units shall be Face & By-pass Damper Control. The Face and Bypass Damper Actuator shall be direct coupled, floating point actuator that is non-spring returned.

C. The Outdoor Air/Return Air Damper Actuator shall be direct coupled, floating point actuator that spring returns the outdoor air damper shut upon a loss of power.

D. [AZQ] The hot water heating coil shall use a factory furnished, field installed, two position End Of Cycle (EOC) control valve to shut off the heating medium at the end of the heating cycle. Upon a power failure, the heating EOC valve shall spring return to the normally open position for flow of water. End of cycle valves without spring return to the normal position upon a power failure shall not be acceptable. The EOC shall be of the 2-way or 3-way configuration as specified in the valve specifications.

[AZR] The steam heating coil shall use a factory furnished, field installed, two position End Of Cycle (EOC) control valve to shut off the heating medium at the end of the heating cycle. Upon a power failure, the heating EOC valve shall spring return to the normally open position for flow of water. End of cycle valves without spring return to the normal position upon a power failure shall not be acceptable. The EOC shall be of the 2-way or 3-way configuration as specified in the valve specifications.

E. A low refrigerant temperature sensor shall be factory installed on a U-bend of the coil to protect the refrigerant system during low refrigerant suction conditions.

F. [AZR and AZU] All units shall be Valve Control. The Modulating Valve Actuator shall be direct coupled, floating point actuator that is non-spring returned.

G. [AZR] The steam heating coil shall use a factory furnished, field installed, modulating control valve to modulate the heating medium during the heating cycle. Upon a power failure, the modulating heating valve shall spring return to the normally open position for flow of water. Modulating valves without spring return to the normal position upon a power failure shall not be acceptable. The modulating valves shall be of the 2-way or 3-way configuration as specified in the valve specifications.

H. The LUI shall provide a unit mounted interface which indicates the current unit operating state, room temperature set point, and can be used to adjust the unit ventilator operating parameters (operating mode, fan speed and occupancy mode). The LUI shall have a digit display, 7 keys (1 key hidden for parameter menu access), 9 individual LED indicators and 3-level password protected security feature.

I. The unit controller shall monitor room conditions, and automatically adjust unit operations (fan speed, temperatures, etc.) to maintain pre-programmed temperature setting selection ranges and ventilation requirements. The control sequence shall be on the basis of ASHRAE Cycle II for normal classroom locations, but shall have exhaust fan interlock for override to bring in full outside air for laboratory/ science room applications. The fan speeds shall be high constant, medium constant, low constant and auto, which shall vary the air flow in direct relation to the room load. The fan shall not change speeds in less than ten minutes in any one mode. Two constant fan speed operation shall not be acceptable.

J. Each Local User Interface (LUI) Touch Pad shall have a Digital LED Display status/fault indication.

K. Controls shall allow monitoring and adjustment from a portable IBM compatible PC using the applicable software. When using this PC and software, the unit shall be capable of reacting to commands for changes in control sequence and set points.

L. All units shall come equipped with a factory mounted room temperature sensor located in a sampling chamber (front, center panel) where room air is continuously drawn through for fast response to temperature changes in the room. When using a remote wall-mounted temperature sensor the ability shall exist to simply disconnect the unit-mounted temperature sensor using the provided quick disconnect plug.

M. A discharge air temperature sensor shall be factory located on the second fan from the right to constantly sense unit discharge air temperatures. The unit's discharge air temperature sensor shall work in conjunction with the room temperature sensor to provide for stable discharge air temperatures, even in the event of rapid changes in outdoor air quantities.

N. An outdoor air temperature sensor shall be factory located in the outside air prior to the outside air damper to continually sense outdoor air temperature.

O. A tenant override switch shall be factory mounted next to the Local User Interface (LUI) Touch Pad to provide a momentary contact closure that causes the unit to enter the "tenant override" operating mode for a set time period (adjustable) of 120 minutes. The tenant override switch shall cause a unit operating in the unoccupied mode (temperature set-back/set-up, and no outdoor ventilation) to return to the occupied mode for two hours (adjustable) and then the system shall automatically return to un-occupied mode. The room temperature sensor and override switch shall:

1. Both be unit mounted; OR
2. [OPTIONAL] Be an optional wall mounted temperature sensor, with integral tenant override capability.

P. Tenant Override/set-up control shall be provided by:

1. A factory mounted and wired digital time clock (optional for standalone operation) which shall cycle the unit ventilator through occupied and unoccupied modes in accordance with one of twenty (20) user programmed time schedules; OR
2. A remote mounted time clock as described in the temperature control specification and provided by the automatic temperature controls contractor; OR
3. The network DDC control system.

Q. The unit shall have three (3) multi-pin External Signal Connection Plugs factory provided and pre-wired with short wire whips that are capped for field wiring of:

1. A Remote Wall Mounted Temperature Sensor.
2. External Input Signals (by others): unoccupied, remote shutdown, ventilation lockout, dewpoint/ humidity, or exhaust interlock signals. (Available inputs may vary by unit model. Not all functions can be used at the same time.)

3. External Output Options (by others): lights on/off, motorized water valve open/close, fault indication signal, pump restart, exhaust fan on/off or auxiliary heat signal. (Available outputs may vary by unit model. Not all functions can be used at the same time.)

2.09 CONTROL FUNCTIONS

A. The Unit Ventilator Digital Controller (here after referred to as UVC) shall support ASHRAE Cycle II operation.

B. A discharge air temperature sensor shall be installed in all unit ventilators. The ASHRAE II control algorithm shall override room control and modify the heating, ventilating, and cooling functions (as available) to prevent the discharge air temperature from falling below the Ventilation Cooling Low Limit (here after referred to as VCLL) setpoint.

C. Description of Operation

1. The Unit Ventilator UVC shall use State Machine programming concepts to define and control unit ventilator operation. This shall eliminate the possibility of simultaneous heating and cooling, rapid cycling, etc. and simplify sequence verification during unit commissioning or troubleshooting.
2. Super States shall group two or more related states into a single control function such as cooling, or heating, etc. States shall be where all the actual work takes place. Thus within each state the UVC shall enable PI loops and other logic sequences required to control unit ventilator operation within that particular state, while other functions and PI-loops not needed during that state may be disabled. Transitions shall be the logic paths used to determine which State should be made active. These shall be the "questions" the UVC will continually consider/determine for which path is followed and which state is active.
3. The UVC States and Super States shall be used to define the "normal" unit modes, such as Off, Fan Only, Heat, Emergency Heat, Cool, Auto, Night Purge, and Dehumidification. The UVC shall support several "non-normal" unit modes such as Purge, Pressurize, De-pressurize, and Shutdown, which can be forced via a network connection and override typical UVC operation.

D. Modes of Operation

1. The UVC shall provide several "normal" Modes of unit operation, these shall include Off, Fan Only, Heat, Emergency Heat, Cool, Heat and Cool, Auto, and Night Purge.
2. Non-normal unit modes (i.e. Purge, Pressurize, and De-pressurize modes) accessed via a network connection shall be able to force the UVC to perform "special" functions during which the UVC shall appear to be in the Off mode.

E. Off Mode

1. An Off Mode shall be provided so that the UVC can be forced into a powered off condition. The Off mode shall be a "stop" state for the unit ventilator; it shall not be a power off state. The Local User Interface module (here after referred to as LUI) or a network connection shall be able to force the unit into the Off mode.

F. Fan Only Mode

1. A Fan Only Mode shall be provided so that the UVC can be forced into a Fan Only operation. The LUI or a network connection shall be able to force the unit into the Fan Only Mode.

G. Heat Mode

1. A Heat Mode shall be provided to force the UVC shall use primary heat (wet heat) as needed to maintain the effective heating setpoint. The LUI or a network connection shall be able to force the unit into the Heat mode.
2. When the Heat mode super state becomes active, the UVC shall automatically determine which UVC State to make active; Heat, Low Limit, or Cant Heat based upon the transitions for each of those states. The UVC shall remain in this super state until one of the transition out conditions become true.
3. The Heat State shall be the "normal" state that the UVC will go into when Heat mode is active. When the Heat State becomes active, the UVC shall continually calculate the Discharge Air Temperature Setpoint (here after referred to as DATS) required to maintain the effective heat setpoint (Space Temperature Setpoint). The calculated DATS shall not be allowed to go above Discharge Air High Limit (here after referred to as DAHL).

   a. [AZQ] The face and bypass damper shall be positioned to maintain the classroom temperature setpoint. The UVC shall use primary heat (wet heat) as needed to maintain the current DATS. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions (see Wet Heat Coil Leaving Air Temperature Thermostat).

   [AZR and AZU] The modulating valve shall be positioned to maintain the classroom temperature setpoint. The UVC shall use primary heat (wet heat) as needed to maintain the current DATS. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions (see Wet Heat Coil Leaving Air Temperature Thermostat).
4. A Low Limit Heat State shall be a "non-normal" state that shall become active if during Heat mode the unit reaches 100% heating and is unable to meet the current Discharge Air Temperature Setpoint required to maintain the effective heating setpoint.
5. The Cant Heat State shall be a "non-normal" state that the UVC can go into when Heat mode is active. Sensor faults, etc. during the Heat mode shall cause the UVC to make the Cant Heat State active. When the Cant Heat State becomes active, no heating or ventilation shall

take place. The OA damper shall be closed. The UVC shall monitor the wet heat coil leaving air temperature thermostat, when provided, in order to prevent coil freezing conditions.

H. Cool Mode

1. A Cool mode shall be provided to force the UVC into Cool Only operation. The Cool mode shall use primary cooling (economizer) and secondary cooling (mechanical compressor type) as needed to maintain the effective cooling setpoint. The LUI or a network connection shall be able to compel the unit into the Cool mode. Additionally, the UVC when set to Auto mode shall automatically compel the unit into the Cool mode as needed.

   a. [AZQ] The face and bypass damper shall be positioned to the full face position during compressor cooling (mechanical cooling) to maintain the classroom temperature setpoint.

2. When the Cool mode becomes active, the UVC shall automatically determine which UVC state to make active, Econ, Econ Mech, Mech, DA Heat, Low Limit, Cant Cool, or Dehumidify based upon the transitions for each of those states.

3. An Econ State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Econ State shall be typically active in the Cool mode when primary cooling (economizer) is available and adequate to meet the cooling requirements. When the Econ State becomes active, the UVC shall use economizer cooling as needed to maintain the effective cooling setpoint. The UVC shall monitor the DAT to ensure it does not fall below Ventilation Cooling Low Limit (here after referred to as VCLL) setpoint. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

4. An Econ Mech State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Econ Mech state shall typically be active in the Cool mode when primary cooling (economizer) alone is not adequate to meet the cooling requirements and both primary cooling and secondary cooling are available. When the Econ Mech State becomes active, the OA damper shall be set to 100% open, and the UVC shall use the units mechanical cooling capabilities as needed to maintain the effective cooling setpoint. The UVC shall monitor the DAT to ensure it does not fall below the Mechanical Cooling Low Limit (here after referred to as MCLL) setpoint. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

5. A Mech State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Mech State shall be typically active in the Cool mode when primary cooling (economizer) is not available and secondary cooling is available. When the Mech State becomes active, the UVC shall use the units mechanical cooling capabilities as needed to maintain the effective cooling setpoint. The UVC shall monitor the DAT to ensure it does not fall below the Mechanical Cooling Low Limit (here after referred to as MCLL) setpoint. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions. The UVC shall be configured to operate the compressor as secondary (mechanical) cooling when the economizer is available, when the economizer is not available and the compressor is available then the UVC shall use the compressor when cooling is required. A compressor envelope shall be established using a sensor on the indoor and outdoor coils to monitor refrigeration temperature conditions. This envelope shall protect the compressor from adverse operating conditions, which can damage or shorten compressor life by ending compressor operation if coil temperatures exceed the defined operating envelope.

6. A Mech State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The Mech State shall be typically active in the Cool mode when primary cooling (economizer) is not available and secondary cooling (compressor) is available. When the Mech State becomes active, the UVC shall use the unit's mechanical cooling capabilities as needed to maintain the effective cooling setpoint. The UVC shall be configured to operate the compressor as secondary (mechanical) cooling when the economizer is available, when the economizer is not available and the compressor is available then the UVC shall use the compressor when cooling is required. A compressor envelope shall be established using a sensor on the indoor and outdoor coils to monitor refrigeration temperature conditions. This envelope shall protect the compressor from adverse operating conditions, which can damage or shorten compressor life by ending compressor operation if coil temperatures exceed the defined operating envelope.

7. A DA Heat State shall be provided as a “normal” state that the UVC can go into when Cool mode is active. The DA Heat State shall be typically active when reheat is required to maintain VCLL while maintaining the required OA damper position. When DA Heat State is active, then the UVC shall use the units heating capability as needed to maintain the VCLL setpoint. The Heat Timer (3-minutes fixed) shall begin counting. The UVC shall monitor the wet heat coil leaving air temperature thermostat in order to prevent coil freezing conditions. The UVC shall remain in this state until one of the transition out conditions become true, or until one of the super state transition out conditions becomes true.

8. A Low Limit State shall be provided as a “non-normal” state that the UVC can go into while Cool mode is active. The Low Limit state shall typically follows the DA Heat state when the UVC

has reached 100% heat and still cannot maintain VCLL. When the Low Limit State becomes active, the Low Limit PI-loop shall override the OAD minimum position and adjust the OAD toward closed as necessary to maintain the DAT setpoint.

I. Auto Mode

1. An Auto mode shall be provided so that the UVC can be set to automatically determine if heating, cooling or dehumidification is required. The Auto mode shall be the default start-up UVC mode. Auto mode shall be made up of the Heat, Cool and Dehumidify modes. With the UVC set to auto mode, the UVC shall determine which mode (Heat, Cool and Dehumidify) to use.

J. Emergency Heat Mode

1. An Emergency Heat mode shall be provided for situations where the UVC is in a mode that does not normally allow heating, such as Off, Cool, Fan Only, Night Purge, etc. If Emergency Heat mode is enabled and the space temperature falls below the EHS, the UVC shall automatically force itself into the Emergency Heat mode from Off, Cool, Night Purge, Fan Only, Purge, Pressurize, De-pressurize, and Shutdown. Additionally, the LUI or a network connection shall be used to force the unit into the Emergency Heat mode. Emergency Heat mode shall consists of two UVC states: Full Heat and Cant Heat.
2. A Full Heat State shall be provided as the “normal” state that the UVC will go into when Emergency Heat mode is active. When Emergency Heat (EHS) mode becomes active, the UVC shall go into 100% heating until the space temperature raises to the EHS plus a fixed differential (9°F / 5°C). In the Emergency Heat mode the space fan shall be set to high speed, and the OA damper will operate normally.
3. The Cant Heat State shall be a “non-normal” state that the UVC can go into when Emergency Heat mode is active. Sensor faults, etc., during the Heat mode shall cause the UVC to make the Cant Heat State active. When the Cant Heat State becomes active, no heating or ventilation shall take place. The OA damper shall be closed. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

K. Night Purge Mode

1. A Night Purge mode shall be provided to quickly ventilate a space. Night purge shall be used to remove odor build up at the end of each day, or after cleaning, painting, or other odor generating operations occur within the space. Night Purge shall be full ventilation with exhaust mode, during which room comfort will be compromised. The LUI or a network connection shall be able to force the unit into the Night Purge mode.
2. When Night Purge mode becomes active, the UVC shall stop all normal heating and cooling as any new energy used to treat the incoming air would be wasted in the purging process. In the Night Purge mode the unit classroom air fan shall be set to high speed, the OA damper will be set to 100% open, and the Exhaust Fan binary output shall be set to On. If not set to another mode within 1-hour, the UVC shall force itself into the Fan Only mode. If the space temperature drops below the EHS, and the Emergency Heat function is enabled, the UVC shall be forced into the Emergency Heat mode. The UVC shall continue to monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions.

L. Non-Normal Unit Modes

1. Additional UVC modes shall be provided that are considered non-normal unit modes. These shall include Pressurize, Depressurize, Purge, Shutdown and Energy Hold Off. These modes shall force the UVC to perform very specific and limited functions and shall be used with caution and only for short periods as needed. These modes shall be accessed only via a network connection.
2. In each of these non-normal UVC modes, if the space temperature drops below EHS, and the Emergency Heat function enables, the UVC shall be forced into the Emergency Heat Super State mode and then return once the Emergency Heat function is satisfied.
3. A Shutdown mode shall be provided that is the equivalent of the Off mode, but shall be an Off mode forced by a network connection. When in Shutdown mode the UVC shall stop all normal heating, cooling, ventilation (OA damper shall be closed), and fan operation. By default emergency heat shall not be used during the shutdown mode, however, the UVC can be configured (Emergency Heat Shutdown Configuration) to allow emergency heat operation during shutdown mode. The Shutdown mode shall be accessed via a network connection and a binary input to the UVC.
4. The UVC shall support an Energy Hold Off state, which when active forces the UVC to stop all normal heating, cooling and ventilation. This shall typically be used by a network connection to force the UVC to cease heating, cooling and ventilation when conditions exist where heating, cooling and ventilation are not required or desired. Energy Hold Off mode shall be similar to Shutdown mode except that Energy Hold Off always allows Emergency Heat if required. The Energy Hold Off mode shall be only accessed via a network connection.
5. The UVC shall in the Purge mode use the unit Classroom or Indoor Air Fan (here after referred to as IAF), OAD, and exhaust output as needed to purge the space. The UVC shall stop all normal heating and cooling but allow Emergency Heat if required. The purge mode shall be only accessed via a network connection.
6. The UVC shall in the Pressurize mode use

the IAF, OAD, and exhaust output as needed to pressurize the space. The UVC shall stop all normal heating and cooling but shall allow Emergency Heat if required. The Pressurize Mode shall be accessed only via a network connection.

7. The UVC shall in the Depressurize mode use the IAF, OAD, and exhaust output as needed to depressurize the space. The UVC shall stop all normal heating and cooling but does allow Emergency Heat if required. The Depressurize Mode shall only be accessed via a network connection.

M. Occupancy Modes

1. 1. The UVC shall be provided with four occupancy modes: Occupied, Standby, Unoccupied, and Bypass. The Occupancy mode shall effect which heating and cooling temperature setpoints shall be used, IAF operation, and OAD operation. The Manual Adjust Occupancy and Networked Occupancy Sensor network variables, along with the Unoccupied and Tenant Override binary inputs, shall be used to determine the Effective Occupancy.

2. The Occupied mode shall be the normal daytime mode of UVC operation. During Occupied mode the UVC shall use the occupied heating and cooling setpoints, the OAD shall operate normally, and by default the IAF shall remain on. A Networked Occupancy Sensor shall be able to interfaced with the Occupancy Sensor Input variable to select occupancy modes. When the Occupancy Sensor Input variable is used, it shall automatically override any hard-wired unoccupied binary input signal.

3. The Unoccupied Occupancy mode shall be the normal nighttime mode of UVC operation. During Unoccupied mode the UVC shall use the Unoccupied heating and cooling setpoints, the OAD shall remain closed, and the IAF shall cycle as needed for heating or cooling. The IAF shall remain off when there is no need for heating or cooling. A Unit-mounted factory-installed electronic 24-hour/7-day Time Clock shall be provided when the unit operates in Stand-alone or no Network is available. This time clock shall be factory wired to the UVC Unoccupied binary input and shall be settable to automatically place the unit into Occupied and Unoccupied modes based upon its user-configured schedule.

4. The Standby mode shall be a non-normal daytime mode of UVC operation. During Standby mode the UVC shall use the standby heating and cooling setpoints, the OAD shall remain closed, and by default the IAF shall remain on.

5. The Bypass mode (also called Tenant Override) shall be the equivalent of a temporary occupied mode. Once the Bypass mode is initiated it shall remain in effect for a set period of time (120-minutes default). During the Bypass mode the UVC shall use the occupied heating and cooling setpoints, the OAD shall operate normally, and by default the IAF shall remain on. A Tenant Override Switch shall be factory installed in all floor-mounted units. This Tenant Override Switch shall be located near the LUI on the unit. The Tenant Override Switch shall provide a momentary contact closure that can be used by room occupants to temporarily force the UVC into the Bypass Occupancy mode from Unoccupied mode. The optional Remote Wall-mounted Sensors shall include a Tenant Override Switch. This Tenant Override Switch shall provide a momentary contact closure that can be used by room occupants to temporarily force the UVC into the Bypass Occupancy mode from Unoccupied mode. The optional Remote Wall-mounted Sensors shall each indicate a UVC status LED. This status LED shall aid in diagnostics by indicating the UVC Occupancy mode and Fault condition.

N. Space Temperature Setpoints

1. The UVC shall use the six occupancy-based temperature setpoints for heating and cooling, Occupancy mode, and the value of the Network variables Space Temp Setpoint Input, Setpoint Offset Input and Setpoint Shift Input as the basis to determine the Effective Setpoint Output. The UVC shall calculate the effective setpoint based upon the unit mode, the occupancy mode, and the values of several network variables. The effective setpoint shall then be used as the temperature setpoint that the UVC will maintain.

O. LUI Setpoint Offset Adjustment

1. The LUI shall be used to make adjustments to the value of the Setpoint Offset Input variable.

P. [OPTIONAL] Expanded Remote Wall-Mounted Sensor with +/- 3°F Adjustment

1. When the optional Remote Wall-mounted Sensor with +/- 3°F adjustment dial is used, the UVC shall effectively write the value of the setpoint adjustment dial to the Setpoint Offset Input variable.

Q. [OPTIONAL] Deluxe Remote Wall-Mounted Sensor with 55°F to 85°F Adjustment

1. When the optional Remote Wall-mounted Sensor with 55°F to 85°F adjustment dial is used, the UVC shall effectively write the value of the setpoint dial to the Space Temp Setpoint Input variable.

R. Indoor Air Fan Operation

1. The UVC shall support a three-speed IAF with Low, Medium, and High speed. The UVC will calculate the effective fan speed and operation based upon the unit mode, the occupancy mode, and the values of several network variables.

2. The UVC shall be provided with a user selectable Auto Fan Mode feature. When in auto fan mode, the UVC shall use the space temperature PI loop to automatically adjust the fan speed as needed to maintain space temperature. This shall

ensure that the UVC will maintain the lowest and quietest fan speeds whenever possible. When in Auto Fan Mode, a maximum of 6 fan speed changes per hour shall be allowed (by default), this shall prevent frequent automatic fan speed changes from disturbing room occupants. During occupied, standby and bypass modes the IAF shall, by default, remain On. During unoccupied mode the IAF shall typically remain off and shall cycle with calls for heating and cooling. The UVC shall be provided with a Fan Cycling Configuration variable that can be used to force the IAF to cycle with calls for heating and cooling during the Occupied, Standby and Bypass Occupancy modes. When the fan is off, the OA damper shall be closed. This feature shall only be used when it is acceptable that normal ventilation is not required. When the IAF is set to cycle, or during the Unoccupied mode, or when the UVC is placed into Off mode, the UVC shall be configured to continue fan operation for a time period (30-seconds default) after heating or cooling is complete.

S. Outdoor Air Damper Operation

1. The UVC shall be configured for an Outdoor Air Damper operated by a floating-point actuator. The OA damper actuator shall contains a spring to ensure that the OA damper is closed upon lose of power. The OA damper shall be typically open to the current minimum position during the Occupied and Bypass occupancy modes, and closed during the Unoccupied and Standby Occupancy modes.
2. The UVC shall be configured to maintain three Outdoor Air Damper minimum positions based upon the operation of the IAF. This shall allow the ability for each unit to be job site configured to provide the amount of fresh air required to the space at each of the three IAF speeds.
3. The Economizer function shall be used by the UVC to determine if the OA is adequate for economizer (primary) cooling. When both the economizer and mechanical cooling are available, the economizer shall be used as primary cooling and the UVC shall add mechanical cooling only if the economizer is not adequate to meet the current cooling load (i.e. the OA damper reaches 100% and cooling is still required). The UVC shall be configured to support the economizer type of (default) for which the UVC shall use two configuration variables for the Temperature Comparison Economizer: Economizer OA Temp Setpoint and Economizer Temp Differential. The Economizer Temperature Differential shall compare the classroom air temperature to the OA temperature. If the difference is greater than the economizer temperature differential and the Economizer OAT is below the temperature setpoint then the Economizer function shall be energized.

T. [AZQ] Face & Bypass Damper Control

1. The UVC shall be configured for a Face and Bypass damper operated by a floating-point actuator.
2. The UVC shall be configured for a 2-position wet heat EOC valve. The 2-position valve actuator shall contain a spring which will ensure that the wet heat valve is driven open upon a lose of power.

[AZR and AZU] Modulating Valve Control

1. The UVC shall be configured for a modulating valve operated by a floating-point actuator.
2. The UVC shall be configured for a wet heat modulating valve. The modulating valve actuator shall contain a spring which will ensure that the wet heat valve is driven open upon a lose of power.

U. Actuator Auto-Zero, Overdrive and Sync

1. The UVC at power-up shall auto-zero actuators OA damper, F&BP damper and Valve before going into normal operation to ensure proper positioning, this may take as long as 150-seconds after power-up.
2. The UVC shall be configured such that whenever the floating-point actuator is commanded to go to 0% or 100%, the UVC shall overdrive the actuator one full stroke period past the 0% or 100% position to ensure proper positioning.
3. Additionally, the UVC shall be configured to sync all actuators once every 12-hours of operation.

V. [AZQ and AZR] Water Coil Leaving Air Temperature Thermostat (Freezestat)

1. A normally-closed Low Temperature Thermostat (Freezestat) shall be factory provided to detect low leaving air temperature conditions on the unit indoor air hot water coil. This thermostat shall be mounted on the discharge airside of the units hot water coil. The low temperature thermostat cutout shall be 38°F (3°C) +/-2 and the cut-in shall be 45°F (7°C) +/-2.
2. [AZQ] When the low temperature thermostat detects low leaving air temperatures (contacts open) the following shall occur during Face and Bypass Heating operation: when the freezestat cuts-out the OAD shall close immediately, the heating EOC valve shall fully open immediately, any mechanical cooling shall be de-energized immediately. If heating is required, the Face and Bypass damper shall modulate, as needed, otherwise the Face and Bypass damper shall go to 100% bypass, auxiliary heat may be used as needed. When the Freezestat resets or cuts-in the UVC shall return to normal operation.

   [AZR] When the low temperature thermostat detects low leaving air temperatures (contacts open) the following shall occur during Valve Control Heating operation: when the freezestat cuts-out the OAD shall close immediately, the heating modulating valve shall fully open immediately, any mechanical cooling shall be de-energized immediately. If heating is required, the modulating valve shall modulate, as needed, auxiliary heat may be used as needed. When the Freezestat resets or cuts-in the UVC shall return to normal operation.

W. External Binary Inputs (Inputs vary by model type. Not all functions can be used at the same time)

1. The UVC shall be provided with three (3) binary inputs that can provide the following functions. These inputs each shall allow a single set of dry-contacts (no voltage source) to be used as a signal to the UVC, multiple units can be connected to a single set of dry-contacts.
2. External Binary Input 1 shall be able to be configured as an Unoccupied (default) or dewpoint/humidity signal. The Unoccupied Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to go into Unoccupied or Occupied mode. When the contacts close (Unoccupied) the UVC shall go into Unoccupied mode, when the contacts open (Occupied) the UVC shall go into Occupied mode. The (optional) Dewpoint/Humidity Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to go into Active or Passive Dehumidification. When the contacts close (High Humidity) the UVC shall go into Dehumidification, when the contacts open (Low Humidity) the UVC shall stop dehumidification. The device used must incorporate its own differential dewpoint or differential humidity.
3. External Binary Input 2 shall only be used for remote shutdown. The Remote Shutdown Input Signal shall allow a single set of dry-contacts to be used to signal the UVC to go into Shutdown mode. When the contacts close (Shutdown) the UVC shall go into Shutdown mode, when the contacts open the UVC shall return to Normal operation. See Non-Normal Unit Modes.
4. External Binary Input 3 shall be able to be configured as a Ventilation Lockout (default) or Exhaust Interlock Signal. The Ventilation Lockout Input Signal input shall allow a single set of dry-contacts to be used to signal the UVC to close the OA damper. When the contacts close (Ventilation Lockout Signal) the UVC shall close the OA damper, when the contacts open the UVC shall return to normal OA damper operation. The Exhaust Interlock Input Signal input shall allow a single set of dry-contacts to be used to signal the UVC that an Exhaust Fan within the space has been energized, the UVC shall reposition the OA damper to a user adjustable minimum position (Exhaust Interlock OA Damper Min Position Setpoint). When the contacts close (Exhaust fan on signal) the UVC shall use the value defined by the Exhaust Interlock OA Damper Min Position Setpoint as the minimum OA damper position regardless of IAF speed, when the contacts open the UVC shall return to normal OA damper operation.
5. The UVC shall be provided with three (3) binary outputs that can provide the following functions (outputs vary by model type. Not all functions can be used at the same time). These outputs shall be relay type outputs that shall to be used with signal level voltages (24vac max) only. External Binary Output 1 output shall only be able to be used as a signal for Space Lights. The Lights On/Off Signal relay output shall provide one set of NO dry-contacts that shall be used to signal the operation of the Space Lights. When the UVC is in Occupied, Standby or Bypass Occupancy modes the relay output shall signal the lights on (contacts closed), when the UVC is in Unoccupied occupancy mode the relay output shall signal the lights off (contacts open). External Binary Output 2 shall only be able to be used as a fault signal. A Fault Signal relay output shall provide a NO, NC, and Common connections that can be used to signal a fault condition. When a fault exists, the UVC shall energize this relay output, when the fault or faults are cleared the UVC shall de-energize this relay output. External Binary Output 3 shall only be able to be used to operate an Auxiliary Heat device (default) or signal Exhaust Fan operation. The Auxiliary Heat Signal relay output shall provide one set of NO dry-contacts that can be used to operate an Auxiliary Heat device. The UVC shall be by default configured to operate a NO Auxiliary Heat device (de-energize when heat is required) such as a wet heat valve actuator with a spring setup to open upon power failure. However, the Auxiliary Heat Configuration variable shall be able to be used to set the UVC to use a NC Auxiliary Heat device (energize when heat is required) such as electric heat. The Exhaust Fan On/Off Signal relay output shall provide one set of NO dry-contacts that can be used to signal the operation of an Exhaust Fan. When the OA damper opens more than the Energize Exhaust Fan OA Damper Setpoint then the relay output shall signal the Exhaust Fan on (contacts closed), when the OA damper closes below this setpoint the relay output shall signal the Exhaust Fan off (contacts open).

2.010 UNIT VENTILATOR OPTIONS/ACCESSORIES

A. Wall Sleeve

1. Unit manufacturer shall provide a galvanized steel, one-piece wall sleeve that is to be set into the wall opening and butted up directly against the intake louver. The Wall Sleeve shall be provided for the following types of unit ventilator installation:
    a. 16 5/8″ unit ventilator exposure into the classroom; OR
    b. 19 5/8″ unit ventilator exposure into the classroom; OR
    c. 21 7/8″ unit ventilator exposure into the classroom; OR
    d. 28″ unit ventilator exposure into the classroom.
2. Where it is not possible to butt the wall sleeve against the wall intake louver, the contractor shall fabricate and install two (2) horizontal sheet metal baffles between louver and wall sleeve to provide an airtight separation between condenser

discharge and condenser outside air, and condenser outside air and room outside air. The wall sleeve is to be permanently fastened in place and shall be suitably sealed, caulked, or grouted by the contractor around the entire perimeter to prevent air leakage.

3. The wall sleeve shall be fitted with an electrical junction box containing a main "on-off" switch. All field-wiring connections shall be made in this wall sleeve junction box.
4. It shall be the installing contractor's responsibility to make the final load side power wiring connections between the wall sleeve junction box and the unit terminal block.
5. The wall sleeve with electrical junction box shall be cartoned separately and shipped to the jobsite preceding the unit ventilator.

B. Outdoor Air Intake Louver (Select One):

1. Outdoor air intake louver shall be provided by unit ventilator manufacturer except as otherwise noted on the drawings:

a. Masonry wall intake louver shall be constructed with vertical double brake type blades with weep holes in the louver frame and diamond pattern expanded aluminum bird screen on the interior side. Louver shall be fabricated of extruded aluminum 6063-T5. The louver shall be divided in half horizontally across the louver to prevent condenser air recirculation. All louvers shall be 28″ (711 mm) high by 2.14″ (51 mm) thick. The louver length shall be the entire length of the unit outside section. The intake assembly and frame shall be 16 Ga. vertical chevron type aluminum blades in a 12 Ga. frame, with:

i. Unfinished capable of field painting; OR

ii. Manufacturer's oven baked powder paint finish and color for selection by the Architect; OR

iii. Clear anodized finish.

b. Panel wall or masonry wall intake louver shall be constructed with vertical blade double brake type blades. Provide weep holes along face of bottom frame and diamond pattern expanded aluminum bird screen on the interior side. Louver shall be fabricated of extruded aluminum 6063-T5. The louver shall be divided in half horizontally across the louver to prevent condenser air recirculation. All louvers shall be 28″ (711 mm) high by 2.14″ (51 mm) thick. The louver length shall be the entire length of the unit outside section. Each intake louver assembly shall be furnished with a matching four sided flange around the perimeter of the opening of same material and finish as louver. The intake assembly and frame shall be: 16 Ga. vertical blade double brake type aluminum blades in a 14 Ga. frame, with:

i. Unfinished capable of field painting; OR

ii. Manufacturer's oven baked powder paint finish and color for selection by the Architect; OR

iii. Clear anodized finish.

2. [OPTIONAL] Intake Grille - Where indicated, each intake louver assembly shall be furnished with a decorative aluminum intake grille with square holes to match the louver opening, maximizing the air opening. The grille shall come with holes for mounting to building exteriors. The grille shall be of same material and finish as the louver.

C. VentiMatic Shutter (Room Exhaust)

1. Where indicated, the unit manufacturer shall provide a passive (non powered) "in-room" air pressure relief Ventimatic shutter, mounted on a separate wall louver to prevent excessive static pressure. The VentiMatic shutter shall be constructed of galvannealed steel with shutter dampers of woven glass fabric impregnated with silicone rubber.

D. Classroom Matching Accessories

1. Furnish and install in accordance with manufacturer's printed instructions, matching accessories; shelf cabinets, sink and bubbler cabinets, and filler sections, where indicated on the plans. Colors to match the unit ventilator. Cabinet and filler section top shall be finished with textured paint coating to match the unit ventilator top.

a. [OPTIONAL] Top of shelving to be made of Formica.

2. Shelving lengths to be scaled from drawings. Sinks to be stainless steel.
3. All cabinet sections to have adjustable kick plates, and leveling legs and slots for spline attachment to the unit ventilator matching edges.

2.011 BASIS OF DESIGN

A. By Daikin Applied.

B. Acceptable Alternates

1. With prior approval only, submit detailed listing of all variations in form, fit, or function, in addition to specified submittal data. Provide required information as specified.

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin Applied equipment, its care should be a high priority. For training information on all Daikin Applied HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin Applied equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. Refer to Form 933-430285Y. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

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Products manufactured in an ISO Certified Facility.