Catalog 1661-2

Classroom Unit Ventilators

Models AHF, AHB, AHV, and AHR Ceiling Units

MicroTech® Control (“K” Vintage)

Table of Contents

Introduction

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 decades 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 face and bypass air control and our MicroTech active and passive dehumidification control strategies, 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. Multiple control options—including: MicroTech controls or Digital Ready™ features—provide easy, low cost integration into the building automation system of your choice.

Low Operating Costs

When running, Daikin Applied unit ventilators can use as little electricity as two 100-watt light bulbs. 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. MicroTech controls have on-board BACnet® communications, with optional LonTalk® to communicate control and monitoring information to your BAS, without the need for costly gateways. Unit controllers are LonMark® certified with the optional LonWorks® communication module.

AHRI Performance Data

Table 1: AHRI Performance Data

Model	Unit Size	Nominal Airflow		Cooling Coil Rows	Total Capacity		Sensible Capacity		Temperature Rise		Power Input	Ventilation Rate
		CFM	L/s		Btuh	Watt	Btuh	Watt	F	C	Watts	%
AHV AHF	H07, V07	750	354	2-Row	15700	4601	11400	3341	10	12.2	216	80
				3-Row	19000	5568	12900	3781			212	
				4-Row	24500	7180	15300	4484			207	
				5-Row	30800	9027	20300	5949			203	
	H10, V10	1000	472	2-Row	23600	6916	17800	5217	10	12.2	277	80
				3-Row	33200	9730	22600	6623			277	
				4-Row	35600	10433	23300	6829			279	
				5-Row	35900	10521	23600	6916			280	
	H13, V13	1250	590	2-Row	31500	9232	23600	6916	10	12.2	335	80
				3-Row	41000	12016	28600	8382			331	
				4-Row	43300	12690	28700	8411			327	
				5-Row	47200	13833	31100	9115			323	
	H15, V15	1500	708	2-Row	38700	11342	28400	8323	10	12.2	445	80
				3-Row	51200	15005	34900	10228			431	
				4-Row	56700	16617	37100	10873			418	
				5-Row	57600	16881	36800	10785			380	

Notes: ***1.*** *Rated in accordance with AHRI Standard 840-98 for Unit Ventilators.*

2. *Capacity is based on 80°F db, 67°F wb entering air temperature, 45°F enter water temperature and high-speed fan.*

3. *Data for 2000 CFM unit not available at time of publication. See Figure 76 through Figure 79 for 2000 CFM performance*

.

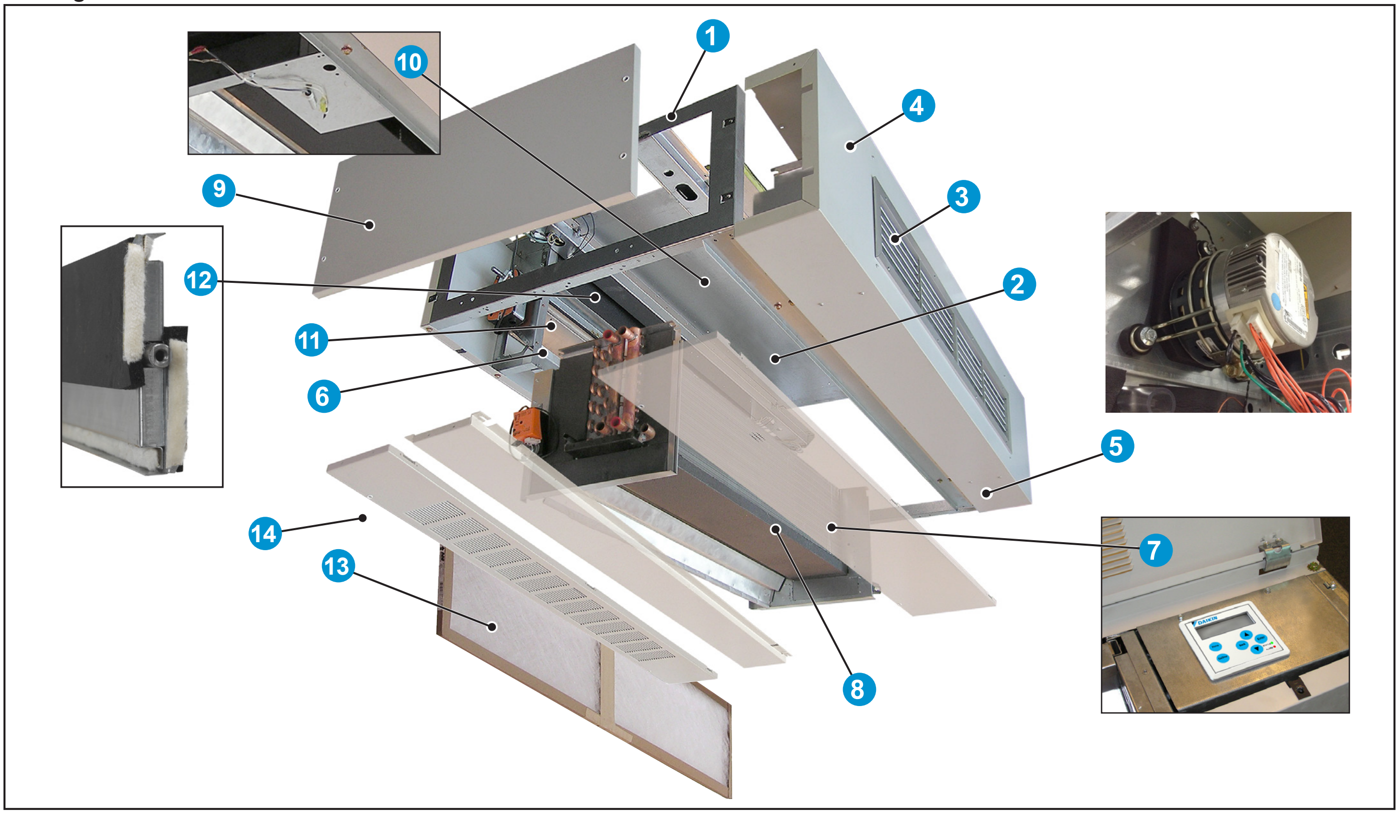
Features and Benefits

Model AH Ceiling Unit Features

Our Model AH is a horizontal, ceiling-mounted unit that is designed for rooms where floor space is at a premium. It utilizes remotely-supplied chilled water or refrigerant for cooling, and hot water, steam or electric heat for heating. It also can be supplied as a cooling/ventilating unit only or as a heating/ventilating unit only with the option of adding cooling at a later date.

The Model AH is just right for new construction and for retrofit applications. It can be installed with a variety of exposures, including completely exposed, partially or fully recessed, or completely concealed. Older buildings with baseboard radiant heat or other hydronic heating systems can be easily adapted to work efficiently with Model AH units. Chilled-water or refrigerant cooling can be added to provide year-round comfort.

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. **EC fan motor**
   - located out of air stream and away from heating coil, reduces heat exposure to prolong life.
   - self-adjusts to low or high static installations.
6. **Face and bypass damper design**
   - provides superior dehumidification and reduces chance of coil freeze-up.
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. **Easy access for service**
   - Easy bottom and side panel removal for access to piping, drain pan and controls.
10. **Sampling chamber**
    - unit-mounted sensor provides accurate sensing of room temperature.
11. **Indoor room air damper**
    - blocks unwanted gusts of outdoor air on windy days. Its nylon bearings are quiet and maintenance free.
12. **Insulated double-wall outdoor air damper**
    - seals tightly without twisting.
13. **Single full-length air filter**
    - is efficient and easy to replace. All air delivered to classroom is filtered.
14. **Single door access to air filter**
    - makes replacement easy.

Quiet Operation With 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.
- A large, expanded discharge opening minimizes air resistance, further lowering sound levels.
- Fan housings incorporate the latest logarithmic expansion technology for smoother, quieter air flow (Figure 1).
- 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

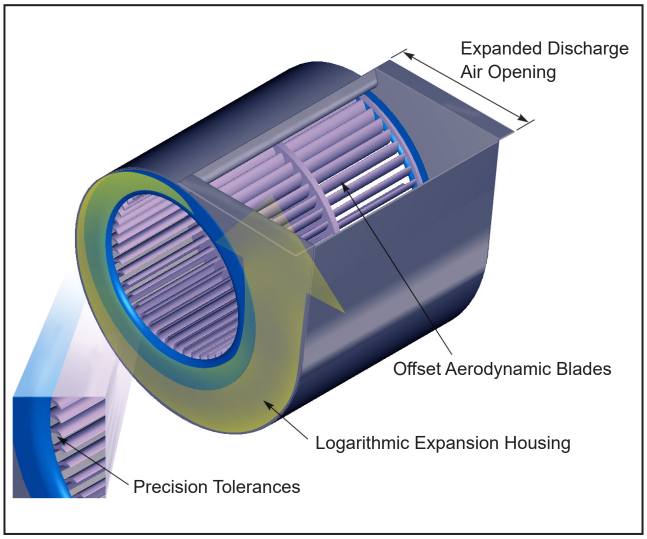
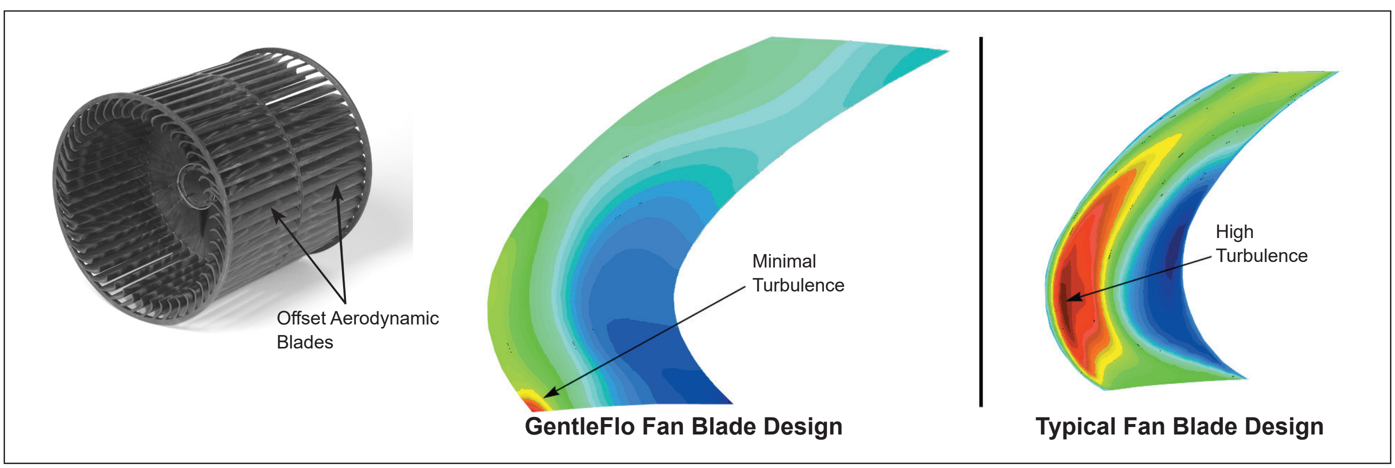


Figure 2: GentleFlo Reduces Turbulence



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.

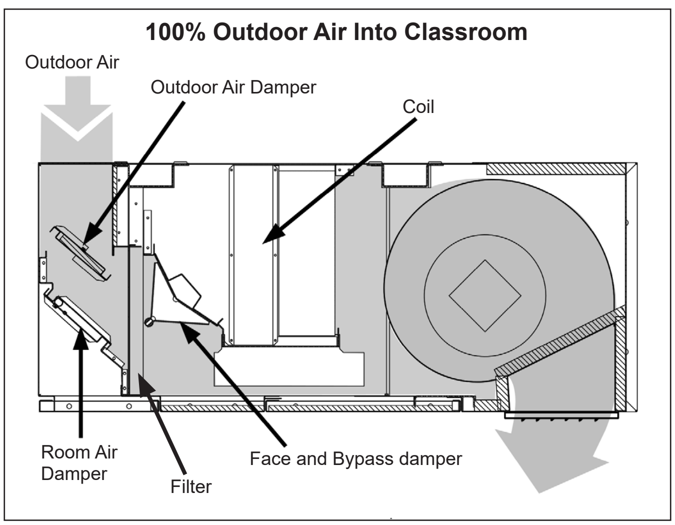
This means that you can be confident that your school is meeting ventilation standards for Indoor Air Quality and that your students are receiving adequate air to be attentive to instruction. At the same time, you are saving money in early morning hours, between classes or after hours when classrooms 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 (see page 88).

Figure 3: Full Economizer Mode



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. The 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 (see page 6) 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.

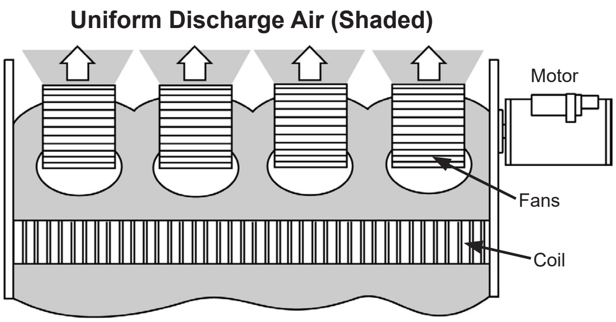
Precise Temperature and Dehumidification Control

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. Coupled with face and bypass damper air control and/or our MicroTech active and passive dehumidification control strategies, they provide precise control of temperature and humidity levels under both part-load and full-load conditions.

Draw-Thru Design For Even Discharge Temperatures

The 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



Face and Bypass Design For Better Temperature and Humidity Control

When coupled with our draw-thru design, face and bypass damper air control offers maximum dehumidification and optimal temperature control. That's because indoor and outdoor air streams can be separated until it is optimal to mix them.

During most part-load conditions, humid outdoor air is directed through the cold coil (coil surface below the dew point) where moisture is removed. Room air is bypassed around the coil, since it has already been dehumidified. This arrangement allows for maximum condensate removal. Humid outdoor air is not bypassed around the coil until the total amount of cooling air required is less than the total amount of fresh outdoor air required in the room. Figure 5 and Figure 6 below compare the composition of the air streams through the coil and air streams bypassing the coil at various bypass air percentages for draw-thru and blow-thru unit ventilators using 450 cfm of outdoor air. At both 0% bypass air and 100% bypass air, no difference exists in the composition of the air streams. However, at all other bypass air percentages (part load), significant differences are evident. For instance, compare the 1500 cfm draw-thru (Figure 5) and blow-thru (Figure 6) units at 70% bypass air. At this point, the draw-thru unit still has all of the outdoor air going through the coil. Meanwhile, the blow-thru unit is bypassing 70% (315 cfm) of the humid outdoor air directly into the classroom.

Figure 5: Daikin Applied 1500 CFM Draw-Thru Unit

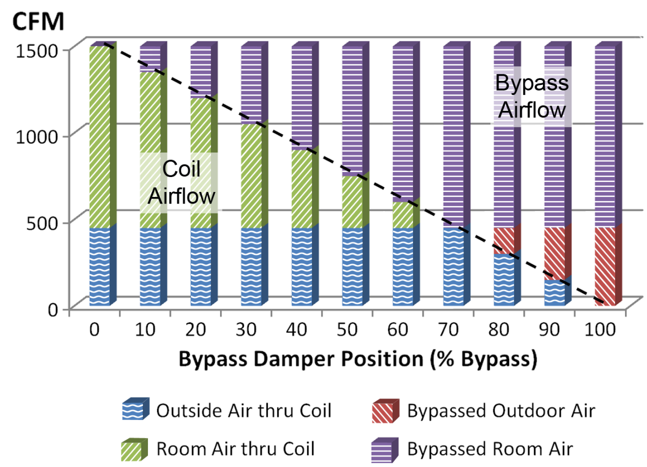
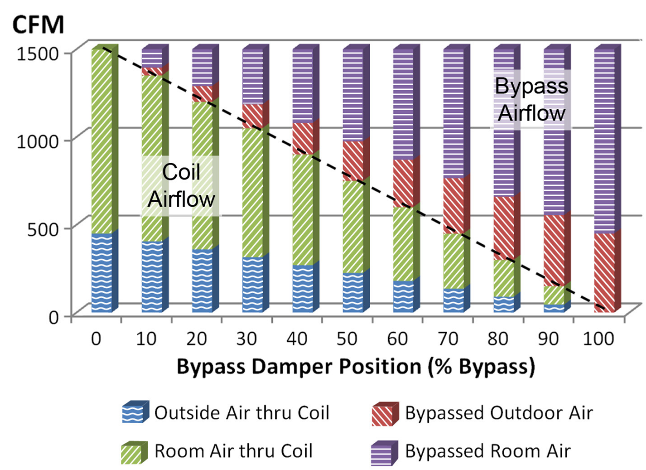


Figure 6: 1500 CFM Typical Blow-Thru Design

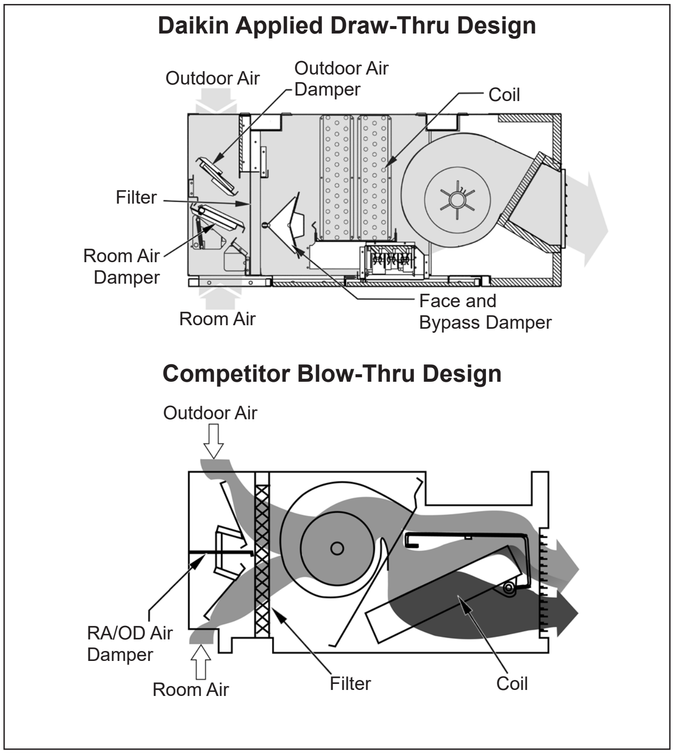


This illustrates that the most effective way to maintain an acceptable humidity level with a chilled-water unit ventilator system is to use a face and bypass damper, draw-thru unit.

Why Blow-Thru Designs Don't Measure Up

Blow-thru designs cannot provide comfort like this. With blow-thru designs, the humid outside air is pre-mixed with the room air before it can go through the coil (Figure 7). Dehumidification occurs only to the portion of the air that is directed unevenly through the cooling coil. The air that bypasses the coil is largely humid outdoor air, resulting in unconditioned air being bypassed and creating poor comfort conditions.

Figure 7: Blow-Thru Vs. Draw-Thru Design



With a blow-thru design the positive pressure of the fan discharge can create areas across the coil of varying temperatures and airflow. In addition, blow-thru face and bypass damper construction picks up heat by wiping the coil, creating overheating conditions. The sound level in a blow-thru design also varies based upon the position of the face and bypass damper.

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 90 for more information.

Passive Dehumidification (Optional)

On units with face and bypass damper air control and MicroTech part-load variable air control, passive dehumidification can be used under high humidity conditions to keep classrooms comfortable. A unit mounted humidity sensor and fan speed changes are utilized to improve latent cooling by keeping the air in closer contact with the cold coil for passive dehumidification.

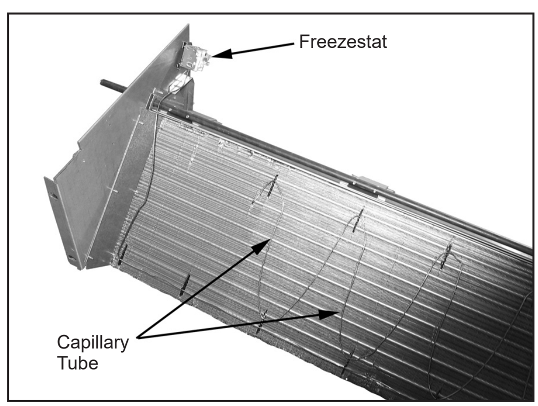
This occurs in the unoccupied mode as the unit operates to satisfy the unoccupied temperature and humidity set points with the outside damper closed. The face and bypass damper is placed in a minimum face position to promote high latent cooling. The unit fan continues to operate on low speed until the load is satisfied. This is very helpful in high humidity areas where high night time humidity can be absorbed in the building during off hours.

Increased Coil Freeze Protection

Daikin Applied units equipped with face and bypass damper control provide extra protection from coil freeze-up. That's 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 8: 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 and 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 also economical because new units fit the same space occupied by existing ones. Using Daikin Applied unit ventilators, central equipment, such as chillers, can be sized smaller using building diversity. This results in a low capital-cost system.

Built In Flexibility

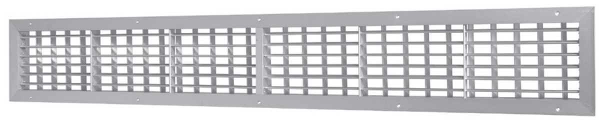
Daikin Applied unit ventilators include features that make them easy to set up and reconfigure as needed to meet special requirements. These features include:

- **Reversible Drain Connections:** All units come with a galvanized steel drain pan that has drain connections on either end (Figure 9). A secondary, overflow drain connection is also provided. The drain-side connection can be selected in the field. The direction in which the drain pan slants can also be field-modified.

Figure 9: Drain Pan, Reversible Connections

- **Add Cooling At A Later Date:** Because we recognize that some schools may wish to add cooling at a later date, even heating-only units are shipped standard with a composite drain pan.
- **Built-In Wire Race:** A built-in metal wire race runs from one end of the unit to the other to provide extra protection for wires and protect them from unit air.
- **Adjustable, Double-Deflection Discharge Grille:** Units with front and bottom discharge come standard with four-way, double-deflection discharge grilles (Figure 10). This allows air distribution patterns to be adjusted both vertically and horizontally on the job, to meet room requirements.

Figure 10: Double-Deflection Discharge Grille



- **Finished Appearance:** Units can be mounted in an exposed position, in a soffit, partially recessed, fully recessed or concealed (Figure 11). For fully and partially recessed units, recess flanges are a standard accessory (Figure 12). These provide a finished appearance and a break to isolate the unit from the ceiling.

Figure 11: Exposures

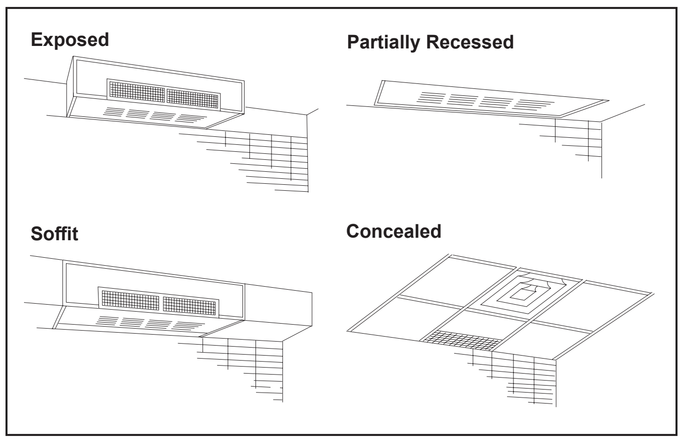
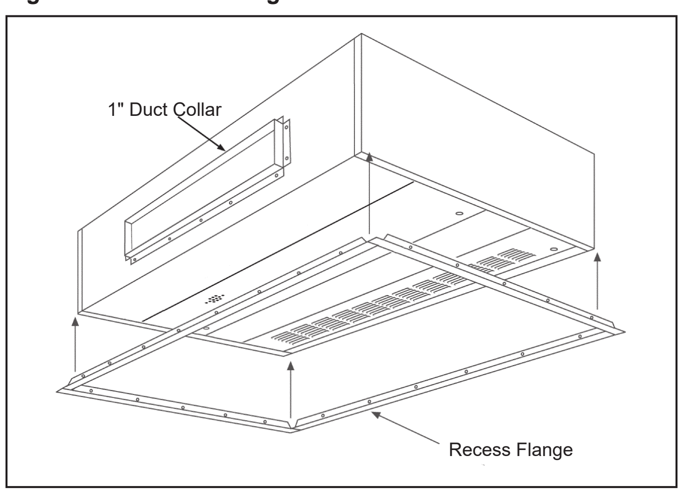


Figure 12: Recess Flange



Controls Flexibility

Multiple control options provide easy, low cost integration of Daikin Applied unit ventilators into the building automation system of your choice (see "MicroTech Controls (Optional)" on page 23). You can also operate these units individually or in a server-client control configuration.

MicroTech controls come with on-board BACnet MS/TP communications with the option for LONTALK to communicate control and monitoring information to your BAS, without the need for costly gateways. Unit controllers are LONMARK certified with the optional LONWORKS communication module.

Controls and communication modules can be factory provided or field-installed by others. Factory integrated and tested controller, sensor, actuator and unit options promote quick, reliable start-up and minimize costly field commissioning.

You can also use our Digital Ready option, where we factory-install and pre-wire control sensors and actuators and the controller is field-installed by others. See "Digital Ready Systems" on page 24.

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., 35-40°F).

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

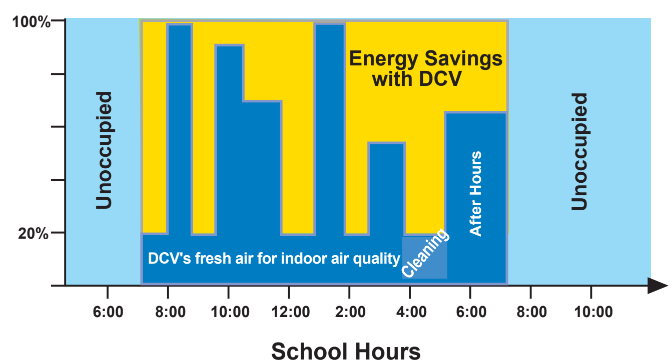
- They provide individual classroom control and comfort.
- They can be cycled on when the room is occupied and cycled off when it is not.
- They bring in fresh air from directly outside the classroom for high indoor air quality.
- During most of the school year, they use outdoor air to keep classrooms comfortable without the expense of mechanical cooling.
- They have their own air-moving device—a fan and fractional horsepower motor—which uses about as much energy as two 100-watt light bulbs. Compare this to the energy consumed by the 20-plus-hp motors used in centralized systems to cool both occupied and unoccupied spaces (at about 1 hp of energy consumed per room).

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 13).
- **Occupancy Mode Operation:** Units can be programmed to operate only sparingly during unoccupied periods and at night to conserve energy.

Figure 13: Energy Savings with Demand Control Ventilation



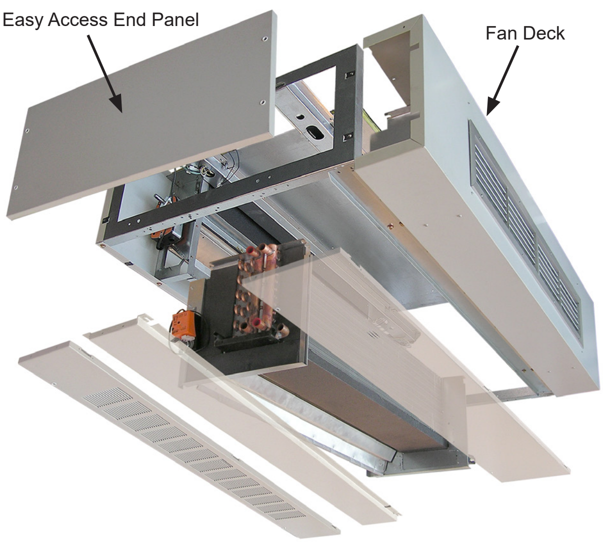
Easy to Maintain

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.

Figure 14: Accessible Fan Deck



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 15: Permanently Lubricated Long-Life Motor Bearing

Easy Access Doors and End Panel

All ceiling units are equipped with hinged access doors to the filter and controls for ease of maintenance.

This enables one person to service the unit instead of a crew. Retainer chains are included to facilitate reduced access panel movement during opening.

End panels ship installed on ceiling units for a clean finish on exposed units (Figure 14) and easy access to the interior.

Figure 16: Access Door Retainer Chain

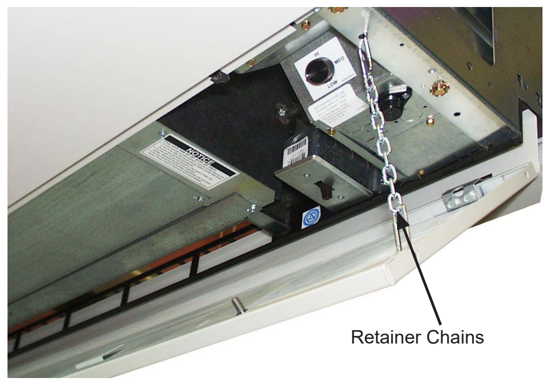


Figure 17: Easy Access to Controls

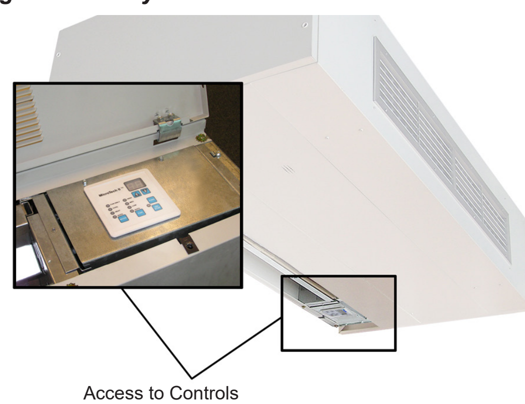


Figure 18: Easy Access for Filter Change

Single-Filter Design

With Daikin Applied's single-filter design, filter change-out takes only seconds. Uneven dust loading is eliminated, which is common to units with separate filters for room and outdoor air, or that use a metal partition to separate filtering of indoor and outdoor air. The result can be longer filter life, which means less maintenance and fewer filters consumed.

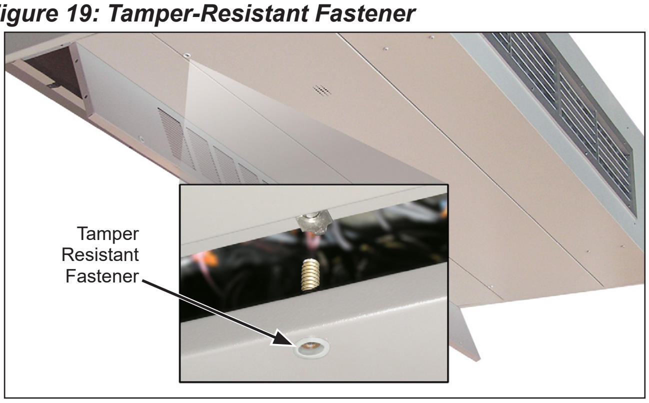
Three filter types are offered:

- Single-use filters which feature fiberglass media and are designed to be used once and discarded. These are standard on all but electric heat units.
- Permanent metal filters may be removed for cleaning and reused numerous times, standard on electric heat units.
- Renewable media filters, consist of a heavy-duty, painted-metal structural frame and renewable fiberglass media.

Tamper-Resistant Fasteners

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 (Figure 19).

Figure 19: Tamper-Resistant Fastener



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.

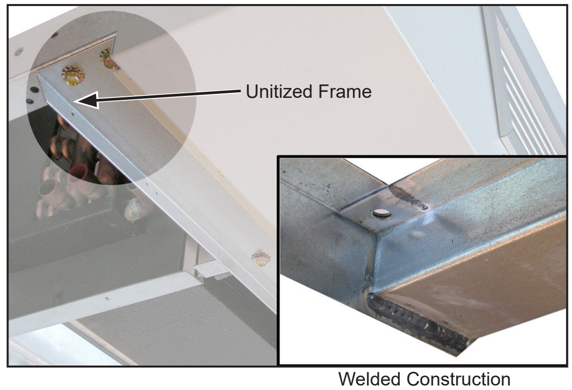
Heavy Duty Frame Construction

Daikin Applied's exclusive, unitized frame (Figure 10) 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.
- Hidden reinforcement that provides additional built-in support for the top section as well as better support for the fan deck assembly.

Figure 20: Heavy-Duty, Welded Chassis



Rugged Exterior Finish

The superior finish of the unit ventilator cabinet 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:

- Exterior cabinet panels are fabricated from high quality, furniture grade steel with no sharp edges.
- 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.
- 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.

Standard EC Motor

An Electrically Commutated Motor (ECM) is standard for applications up to 0.45 ESP, as Figure 10 demonstrates. There is almost no draw down of the unit's airflow (cfm) as static pressures increase. As a result, there is little need to oversize the unit to provide full air volume at high static pressures.

Figure 21: EC Motor

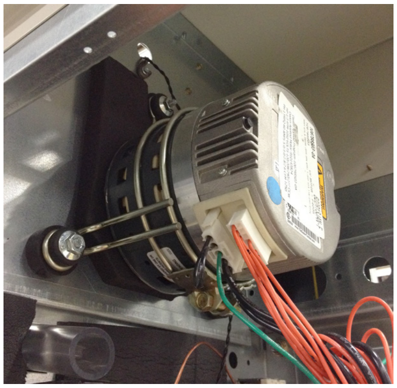
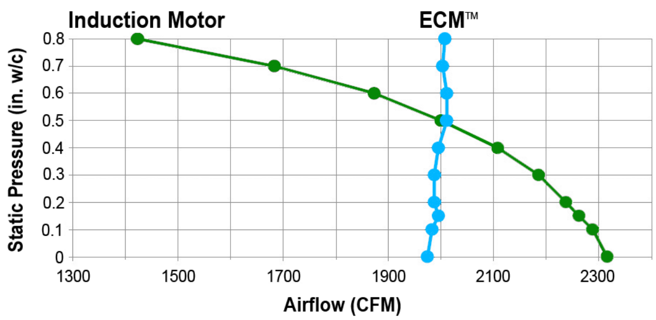


Figure 22: EC Motor Airflow Comparison



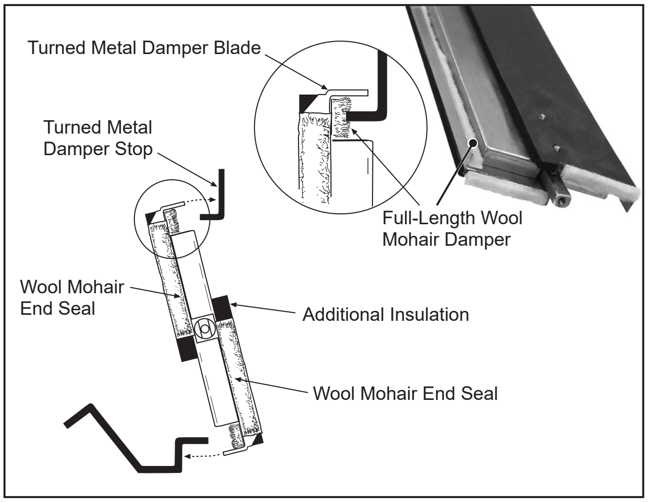
Durable Damper Design

All dampers in Daikin Applied unit ventilators use the turned-metal principle on their long closing edges (Figure 23). 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:

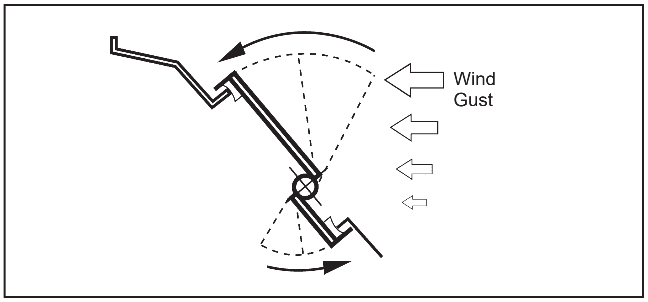
- Face and bypass dampers have a twist-free reinforced aluminum construction for durability. Aluminum is used because it is lightweight and noncorrosive, resulting in low torque and easy movement.
- Outdoor air dampers are made of galvanized steel to inhibit corrosion, with double-wall welded construction for rigidity and encapsulated insulation (Figure 23). Additional insulation is provided on the exterior of the outdoor air damper blade and on the outdoor air entry portion of the unit.

Figure 23: 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 24). 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 24: Room Air Damper Auto-Closed by Wind Gusts



General Data

Model Nomenclature

U	AHF	K	H10	A	S	65	A	B1	AT	26	G	Y	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	AHB	Ceiling, Face & Bypass with Reheat	AHR	Ceiling, Valve Control with Reheat
			AHF	Ceiling, Face & Bypass	AHV	Ceiling, Valve Control
Design Series	3	5	9	Design J		
			K	Design K (for Units with R-32 Refrigerant Coil)		
Nominal Capacity	4	6-8	H07	High Static 750 cfm	V07	EC Motor, Variable Airflow 750 cfm
			H10	High Static 1000 cfm	V10	EC Motor, Variable Airflow 1000 cfm
			H13	High Static 1250 cfm	V13	EC Motor, Variable Airflow 1250 cfm
			H15	High Static 1500 cfm	V15	EC Motor, Variable Airflow 1500 cfm
			H20	High Static 2000 cfm	V20	EC Motor, Variable Airflow 2000 cfm
Voltage	5	9	A	115/60/1	D	208/60/3 (Electric Heat Required)
			C	208/60/1	H	230/60/3 (Electric Heat Required)
			G	230/60/1	K	460/60/3 (Electric Heat Required)
			J	265/60/1		
Coil Options	6	10	U [1]	2-Row CW/HW 2 pipe	V [5]	2-Row CW
	Numerical codes [#] include optional stainless steel drain pan.		D [2]	3-Row CW/HW 2 pipe	S [6]	3-Row CW
			E [3]	4-Row CW/HW 2 pipe	W [7]	4-Row CW
			F [4]	5-Row CW/HW 2 pipe	Y [8]	5-Row CW
			G [9]	DX	Z	None
			M [0]	DX for HP Operation		
Heating Options	7	11-12	12	3 Element Low Cap. Electric Heat	67	3-Row HW
			13	6 Element Low Cap. Electric Heat	68	Steam Low Cap.
			65	1-Row HW	69	Steam High Cap.
			66	2-Row HW	00	None
Hand Orientation	8	13	A	Same Hand LH	E	LH Heating/RH Cooling
			B	Same Hand RH	F	RH Heating/LH Cooling
			D	RH Electric Heat Only	R	Single Coil Left Hand
			G	RH Electric Heat / LH Cool	S	Single Coil Right Hand
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

Code	Description
23	Field Mounted Controls (by Others)
17	Digital Ready

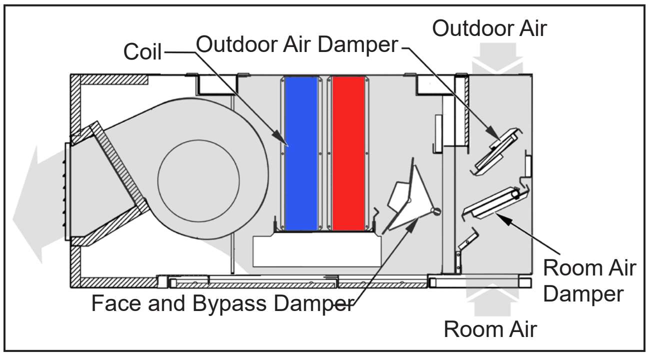
U	**AHF**	**K**	**H10**	**A**	**S**	**65**	**A**	**B1**	**AT**	**26**	**G**	**Y**	**B**	**3**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Category	Code Item	Code Option	Code Designation & Description			
Discharge	10	16-17	AH	Front Discharge Duct Collar - 36″ Length Unit	FD	Front Discharge Duct Collar - 40″ Length Unit
			AT	Front Discharge Double Deflection Grille - 36″ Length	FG	Front Discharge Double Deflection Grille - 40″ Length
			BD	Down Discharge Double Deflection Grille - 40″ Length		
Return Air/ Outside Air	11	18-19	25	Recirculation RA Bottom Grille- No RA/OA Dampers	28	RA Rear Duct Collar & OA Top Duct Collar
			26	RA Bottom Grille & OA Top Duct Collar	29	RA Rear Duct Collar & OA Rear Duct Collar
			27	RA Bottom Grille & OA Rear Duct Collar		
Power Connection	12	20	G	Box w/Switch		
			J	Box w/Switch, w/USB		
			K	Box w/Switch, w/SD		
			M	Box w/Switch, w/USB, w/SD		
Color	13	21	Y	Off White		
SKU Type	14	22	B	Standard Delivery		
Product Style	15	23	1	1st Style Change (No DX Coil)		
			2	R-410 Coil (Service Replacement)		
			3	R-32 Refrigerant		

Model Types

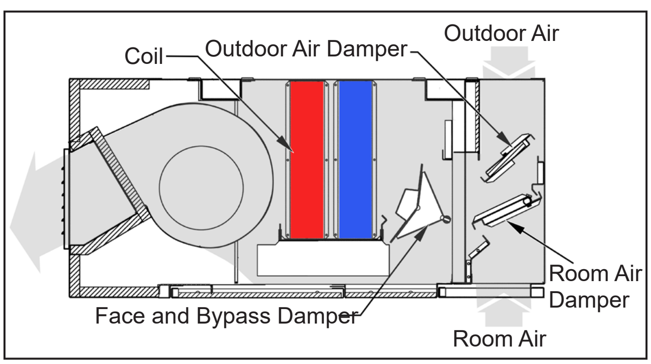
AHF – Face and Bypass

The model type AHF units include a face and bypass damper. By modulating the damper position a portion of the airflow is bypassed around the heating and/or cooling coil(s). The discharge air temperature is controlled by varying the portion of the airflow going across the active coil. In units with independent heating and cooling coils the heating coil will be positioned before the cooling coil. The exception to this rule is with electric heat, which is always installed after any cooling coil.



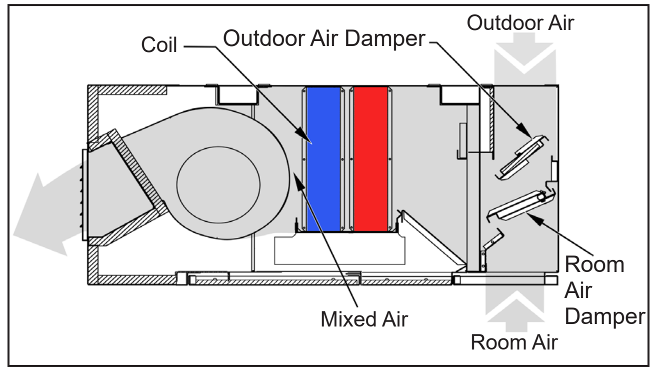
AHB – Face and Bypass, Reheat

The model type AHB units include a face and bypass damper. By modulating the damper position a portion of the airflow is bypassed around the heating and/or cooling coil(s). The discharge air temperature is controlled by varying the portion of the airflow going across the coil. Model AHB units will always have a heating coil positioned after the cooling coil to allow for dehumidification with reheat capability.



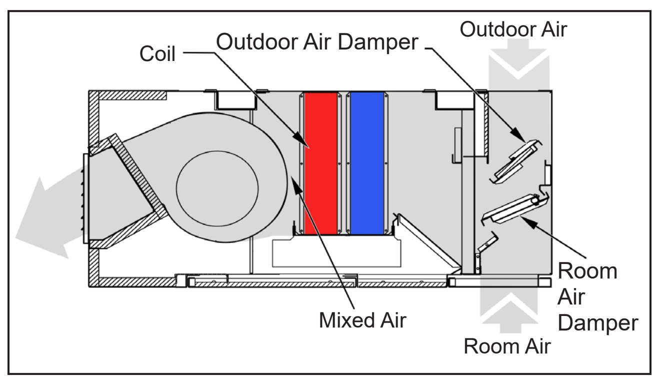
AHV – Valve Control

On model type AHV units the full airflow is directed across the coil(s) at all times. Discharge air temperature is controlled by modulating the heating and/or cooling valve(s). In units with independent heating and cooling coils the heating coil will be positioned before the cooling coil. The exception to this rule is with electric heat, which is always installed after any cooling coil.



AHR – Valve Control, Reheat

On model type AHR units the full airflow is directed across the coil(s) at all times. Discharge air temperature is controlled by modulating the heating and/or cooling valve(s). Model AHR 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.



Available Unit Ventilator Combinations

Table 2: Available Unit Ventilator Combinations

		Face and Bypass Control			Valve Control			
		Basic F and BP	Electric Heat/Cool	Hydronic Reheat	Basic Valve Control	Electric Heat/Cool	Hydronic Reheat	Electric Reheat
		AHF	AHF	AHB	AHV	AHV	AHR	AHR
Air Capacity	**Code 4**							
750 CFM	H07, V07	●	●	●	●	●	●	●
1000 CFM	H10, V10	●	●	●	●	●	●	●
1250 CFM	H13, V13	●	●	●	●	●	●	●
1500 CFM	H15, V15	●	●	●	●	●	●	●
2000 CFM	H20, V20	●	●	●	●	●	●	●
Voltage	**Code 5**							
115 - 60 - 1	A	●		●	●		●	
208 - 60 - 1	C	●		●	●		●	
230 - 60 - 1	G	●	●	●	●	●	●	●
265 - 60 - 1	J	●	●	●	●	●	●	●
208 - 60 - 3	D		●			●		●
230 - 60 - 3	H		●			●		●
460 - 60 - 3	K		●			●		●
Cooling Options	**Code 6**							
2 Row CW/HW 2 Pipe	U or1	●			●			
3 Row CW/HW 2 Pipe	D or 2	●			●			
4 Row CW/HW 2 Pipe	E or 3	●			●			
5 Row CW/HW 2 Pipe	F or 4	●			●			
2 Row CW	V or 5	●	●	●	●	●	●	●
3 Row CW	S or 6	●	●	●	●	●	●	●
4 Row CW	W or 7	●	●	●	●	●	●	●
5 Row CW	Y or 8	●	●	●	●	●	●	●
DX	G or 9	●			●	●	●	●
DX for Heat Pump Operation	M or 0	●			●	●	●	●
None	Z	●			●	●		
Heating Options	**Code 7**							
None	00	●			●			
HW One Row	65	●		●	●		●	
HW Two Row	66	●		●	●		●	
HW Three Row	67	●		●	●		●	
Steam Low Capacity	68	●		●	●		●	
Steam High Capacity	69	●		●	●		●	
Low Electric Heat (3 element)	12		●			●		●
High Electric Heat (6 element)	13					●		●
Coil Hand Orientation	**Code 8**							
LH Heating / RH Cool	E	●		●	●		●	
RH Heating / LH Cool	F	●		●	●		●	
Single Coil LH	R	●			●			
Single Coil RH	S	●			●			
LH Both Coils (Only With Controls By Others)	A	●		●	●		●	
RH Both Coils (Only With Controls By Others)	B	●		●	●		●	
RH Electric Heat / LH Cool	G		●			●		●
RH Electric Heat, One Coil	D					●		

Table 3: Available Unit Ventilator Combinations

		Face and Bypass Control			Valve Control			
		Basic F and BP	Electric Heat/Cool	Hydronic Reheat	Basic Valve Control	Electric Heat/Cool	Hydronic Reheat	Electric Reheat
		AHF	AHF	AHB	AHV	AHV	AHR	AHR
Controls	**Code 9**							
MicroTech	See Note[1]	●	●		●	●	●	●
Digital Ready[2]	17	●	●		●	●		
Field Mounted Controls By Others	23	●	●	●	●	●	●	●
Air Discharge, Unit Length	**Code 10**							
Front Discharge Duct Collar- 36" Length Unit (except 2000 cfm unit)	AH	●	●	●	●	●	●	●
Front Discharge Double Deflection Grille- 36" Length (except 2000 cfm unit)	AT	●	●	●	●	●	●	●
Down Discharge Double Deflection Grille- 40" Length	BD	●	●	●	●	●	●	●
Front Discharge Duct Collar- 40" Length Unit (2000 cfm unit only)	FD	●	●	●	●	●	●	●
Front Discharge Double Deflection Grille- 40" Length (2000 cfm unit only)	FG	●	●	●	●	●	●	●
Return Air/Outside Air Options	**Code 11**							
Recirculation RA Bottom Grille- No RA/OA Dampers	25	●	●	●	●	●	●	●
RA Bottom Grille/OA Top Duct Collar	26	●	●	●	●	●	●	●
RA Bottom Grille/OA Rear Duct Collar	27	●	●	●	●	●	●	●
RA Rear Duct Collar/OA Top Duct Collar	28	●	●	●	●	●	●	●
RA Rear Duct Collar/OA Rear Duct Collar	29	●	●	●	●	●	●	●
Power Connection	**Code 12**							
Box With Switch	G	●	●	●	●	●	●	●
Box w/switch, w/USB	J	●	●		●	●	●	●
Box w/switch, w/SD	K	●	●		●	●	●	●
Box w/switch, w/USB, w/SD	M	●	●		●	●	●	●
Color	**Code 13**							
Off White	W	●	●	●	●	●	●	●

The "●" mark indicates the coil combination listed to the left is available.
[1] See MicroTech Control Availability in "General Data" on page 15.
[2] Some coil combinations and configurations may not be available for Digital Ready controls.

Table 4: MicroTech Controls Combinations

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

Table 5: Available Coil Combinations

		Face and Bypass Control			Valve Control			
		Basic F and BP	Electric Heat/Cool	Hydronic Reheat	Basic Valve Control	Electric Heat/Cool	Hydronic Reheat	Electric Reheat
First Position In Airstream	**Second Position In Airstream**	**AHF**	**AHF**	**AHB**	**AHV**	**AHV**	**AHR**	**AHR**
Heating Only								
65 66 67	Z	•			•			
Z	68 69	•			•			
Z	12 13					•		
Cooling Only								
V S W Y 5 6 7 8	00	•			•			
G M 9 0	00				•			
Heat/Cool								
U D E F 1 2 3 4	00	•			•			
65	V S W Y G M 5 6 7 8 9 0	•			•			
66	V S W G M 5 6 7 9 0	•			•			
67	V S G M 5 6 9 0	•			•			
V S G M 5 6 9 0	68 69	•			•			
V S W 5 6 7	12		•			•		
V S W G M 5 6 7 9 0	12 13					•		
Cool/Reheat								
V S 5 6	65 66 67 68 69			•			•	
W 7	65 66			•			•	
Y 8	65			•			•	
G 9	65 66 67 68 69						•	
V S W 5 6 7	12 13							•
G 9	12 13							•

Notes: 1. Steam and Electric coils are always in the second position.
2. The "•" mark indicates the coil combination listed to the left is available.

Heating and cooling coil type codes:

Heating Coils:
65 = 1 Row Hot Water Coil
66 = 2 Row Hot Water Coil
67 = 3 Row Hot Water Coil
68 = Low Capacity Steam Coil
69 = High Capacity Steam Coil
12 = Low Electric Heat Coil
13 = High Electric Heat Coil
00 = None

Cooling Coils:
U or 1 = 2 Row CW/HW 2-Pipe Coil
D or 2 = 2 Row CW/HW 2-Pipe Coil
E or 3 = 4 Row CW/HW 2-Pipe Coil
F or 4 = 5 Row CW/HW 2-Pipe Coil
V or 5 = 2 Row CW Coil
S or 6 = 3 Row CW Coil
W or 7 = 4 Row CW Coil
Y or 8 = 5 Row CW Coil
G or 9 = Direct Expansion Coil
M or 0 = DX for Heat Pump
Z = None

Discharge Air Arrangements

For all recessed applications (full or partial) carefully check that the inlet air and the discharge air physical locations are compatible with the specific installation.

Also verify that there is sufficient clearance to open and remove the bottom access panels and end panels for routine maintenance.

Duct collars are shipped loose for field installation by others. All dimensions are approximate.

36" Deep Units (750 to 1500 CFM)

Figure 25: Arrangement AT - Unit-Mounted Plenum with Front Discharge Double-Deflection Grille

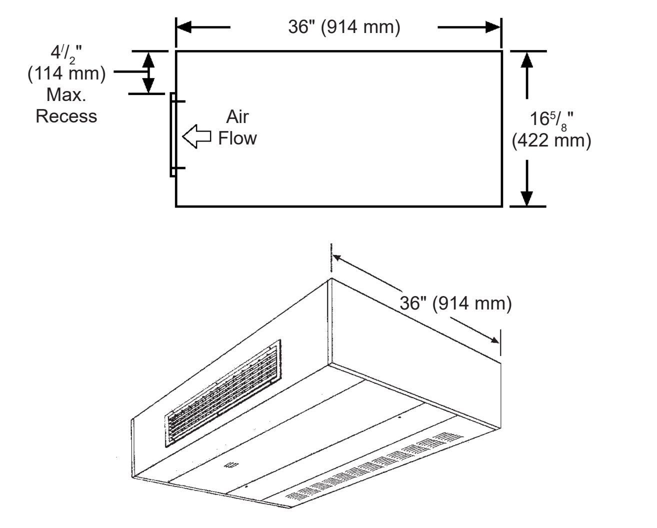
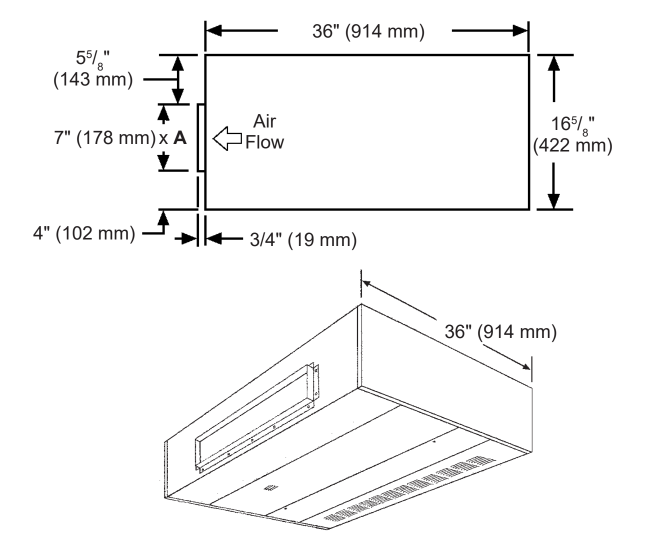


Figure 26: Arrangement AH - Unit-Mounted Plenum with Front Discharge Duct Collar



40" Deep Units (750 to 2000 CFM)

Figure 27: Arrangement BD - Unit-Mounted Plenum with Bottom Discharge Double Deflection Grille

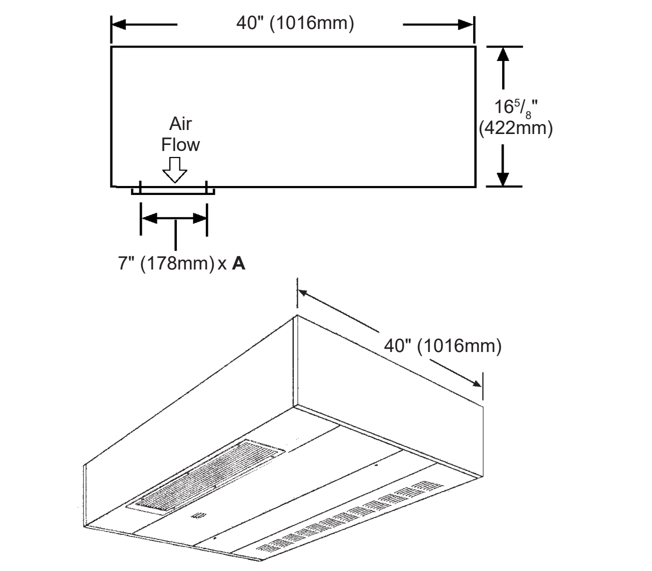


Figure 28: Arrangement FG - Unit-Mounted Plenum with Front Discharge Double Deflection Grille (2000 CFM only)

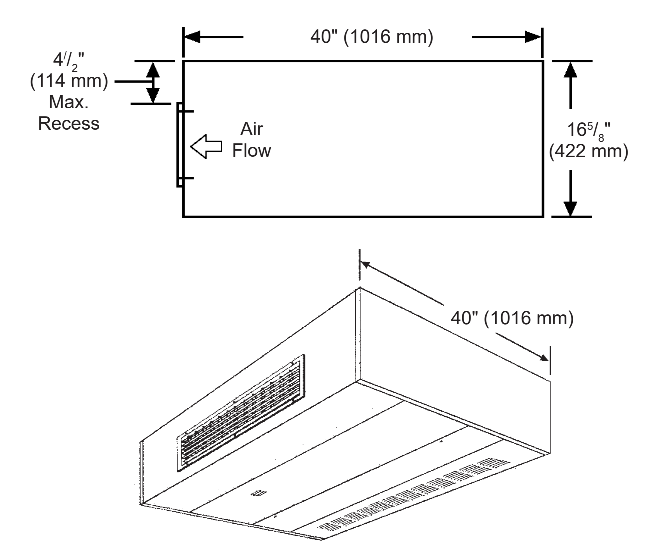
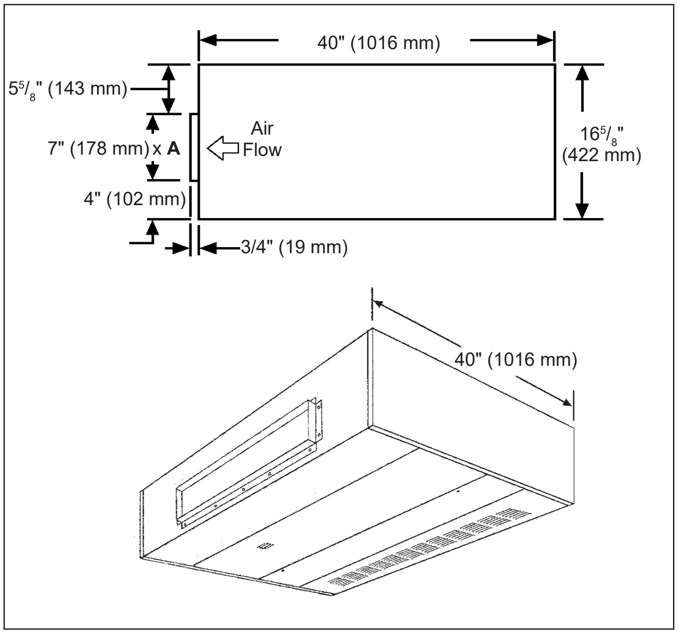


Table 6: Duct dimensions "A" for all units

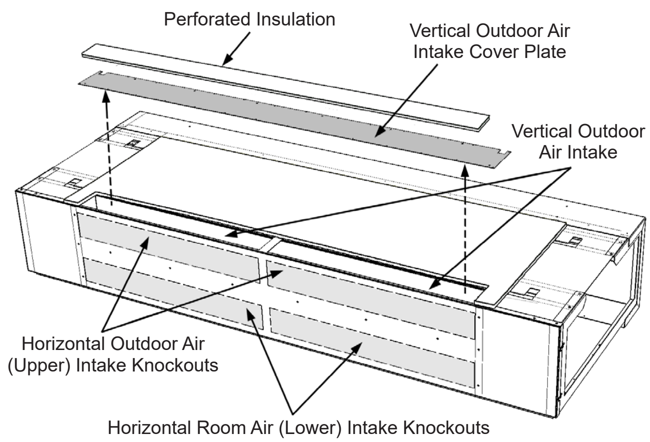
Unit Size		07	10	12	15	20
A	in	36	48	60	72	72
	mm	914	1219	1524	1829	1829

Figure 29: Arrangement FD - Front Discharge with Duct Collar (2000 CFM only)



Intake Air Arrangements

Figure 30: Horizontal Room Air (Lower) Intake Knockouts, Horizontal Outdoor Air (Upper) Intake Knockouts and Vertical Outdoor Air Intake Opening With Cover Plate



For all recessed applications (full or partial) it is necessary to carefully examine both the inlet air and the discharge air physical locations. This must be done for each location individually and in combination with each other to ensure they are compatible with the specific installation. Duct collars are shipped loose for field installation (by others). It is important also to verify there is sufficient clearance to open and remove the bottom access panels and end panels for routine maintenance. The horizontal room air (lower) intake and horizontal outdoor air (upper) intake knockouts are factory provided and must be removed by the installing contractor based on job specifications. The vertical outdoor air (top) intake cover plate is factory provided and must be removed by the installing contractor when top outdoor air ventilation intake is specified.

Figure 31: Arrangement 25 - Recirculating Room Air (No Room Air/Outside Air Dampers)

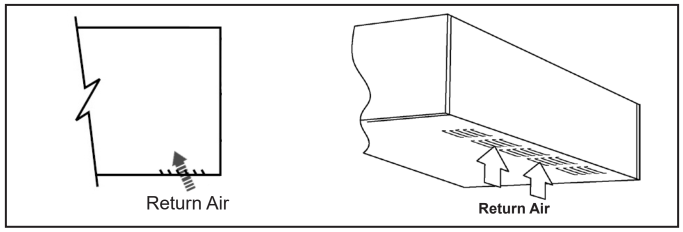


Figure 32: Arrangement 26 - Return Air Bottom Grille/ Outdoor Air Top Duct Collar

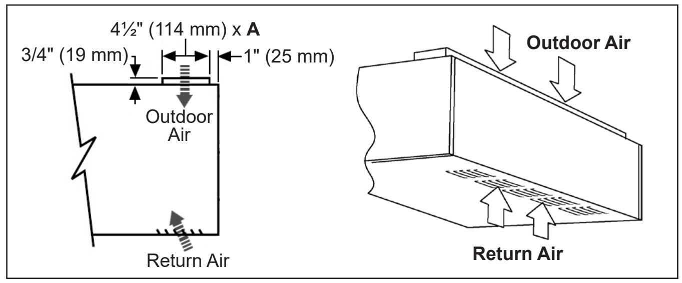


Figure 33: Arrangement 27 - Return Air Bottom Grille/ Outdoor Air Rear Duct Collar

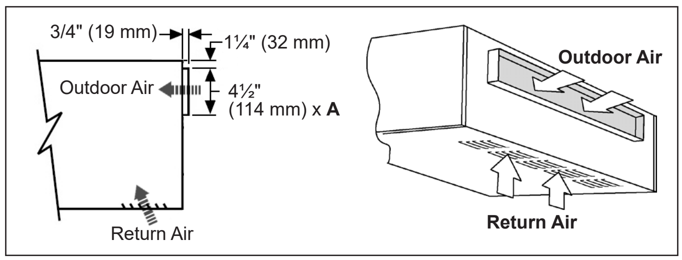


Figure 34: Arrangement 28 - Return Air Rear Duct Collar/ Outdoor Air Top Duct Collar

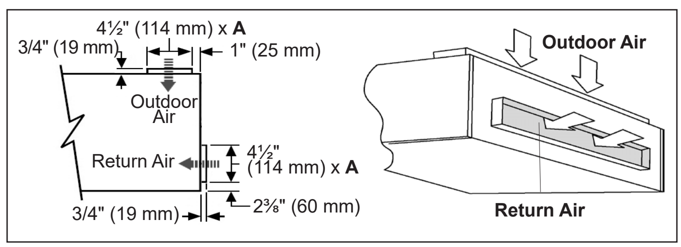


Figure 35: Arrangement 29 - Return Air Rear Duct Collar/ Outdoor Air Rear Duct Collar

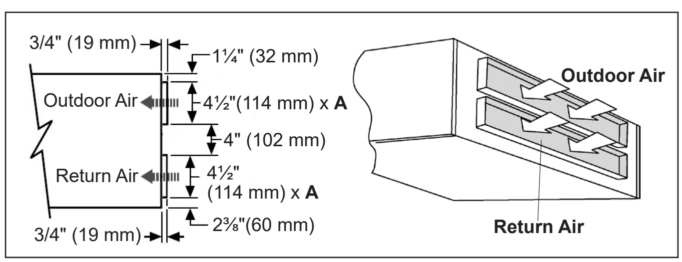
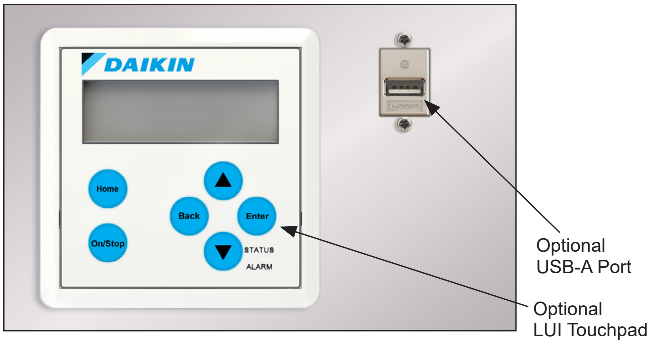


Table 7: Duct dimensions "A" for all units

Unit Size		07	10	12	15	20
A	in	36	48	60	72	72
	mm	914	1219	1524	1829	1829

MicroTech Controls (Optional)



Daikin Applied unit ventilators equipped with MicroTech unit controllers 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, server-client 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 three levels:

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

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.

Server-Client Control

Designate the client and server 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. Unit controllers are LONMARK certified with the optional LONWORKS communication module.

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 96.

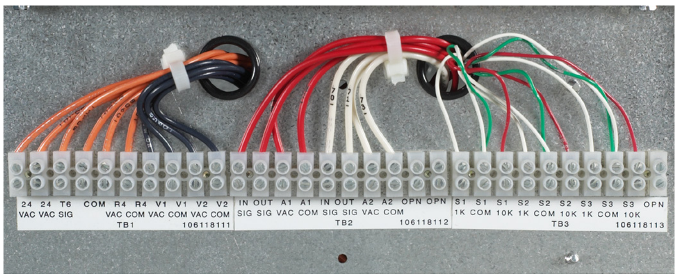
Note: *A 6ft USB-A to USB-A cable can be purchased as an accessory, part number 910295895.*

Digital Ready Systems

For unit ventilator applications where controls are to be supplied by others, specifying a Digital Ready system can greatly simplify control installation.

Digital Ready systems come with a factory-installed, pre-wired package of selected Direct Digital Control (DDC) components. This greatly facilitates the field hook up of a DDC unit ventilator controller that is compatible with these components and that is capable of providing the standard ASHRAE II cycle.

Figure 36: Three 10-pole Europa Type 16 AWG Terminal Strips



Note: *It is the responsibility of the control supplier to ensure the controls operate correctly and protect the unit.*

Digital Ready systems include a non-fused power interrupt switch, a control power transformer, three-speed fan switch, damper actuator(s), sensors and other protection devices. The sensors and actuators are factory wired to a common terminal strip in the control compartment. For a detailed list of components see "Digital Ready Systems" on page 107.

Field Mounted Controls (By Others)

There are many advantages to having the basic temperature controls in Daikin Applied units be MicroTech and factory-installed in the unit ventilator prior to shipment. However, factory installation of controls cannot always be achieved. In such cases, we will ship the unit without any temperature controls. It is the responsibility of the automatic temperature control supplier to provide a control package specifically for installation in the Daikin Applied unit ventilator.

On units with the Field Mounted Controls option the unit will include a non-fused power interrupt switch and three-speed fan switch. Units with DX cooling, hot water or chilled water coils will also have a low limit thermostat.

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.

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 Ω 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 37: Optional CO_2 Sensor

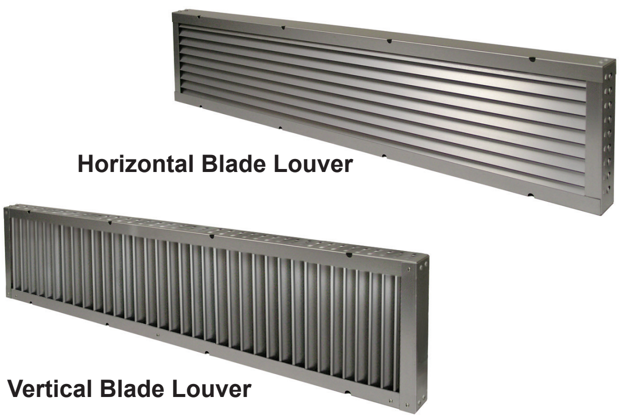
Accessories

Wall Louvers and Grilles

Daikin Applied wall louvers allow outdoor air to be drawn in while blending with the building architecture. They are sized to match the unit outside air opening and provide maximum air intake. Heavy-gauge, all-aluminum construction is standard, with a decorative grille optional.

Both louvers and grilles are available either painted or unpainted. When painted, a specially formulated, environmentally friendly thermosetting urethane powder is applied electrostatically and baked for long lasting beauty as well as resistance to corrosion. The paint is then oven cured to provide correct chemical cross-linking, which can provide years of service. The extruded 6063-T5 aluminum used for louvers and grilles is suitable for color anodizing by others.

Figure 38: Intake Louvers



Louver Details

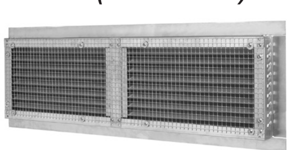
Louvers are available in both horizontal and vertical blade configurations (Figure 38 on page 25):

- **Horizontal blade construction** turns the incoming air to keep moisture from entering. Bottom weep holes drain moisture to the outside.
- **Vertical-blade construction** provides positive water impingement and entrapment. The bottom lip drains moisture to the outside.

Louvers can be supplied with or without flanges:

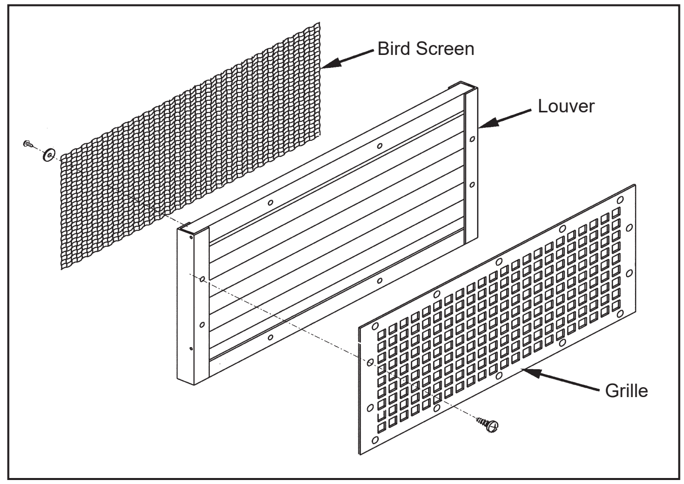
- **Flanged louvers** are typically used for a panel wall finish (Figure 39).
- **Unflanged louvers** are typically used for recessing into a masonry wall.

Figure 39: Flanged Louver (Indoor View)



A diamond pattern mesh bird screen (Figure 40) located on the leaving air side of the louver prevents birds and other small animals from entering. The screen's strong aluminum mesh is designed to minimize air pressure drops, unlike expanded metal mesh.

Figure 40: Louver Assembly with Grille



Grille Details

Daikin Applied decorative intake grilles constructed of heavy-gauge 6063-T5 extruded aluminum are available painted or unpainted with holes for mounting to building exteriors (Figure 41). Their square holes are designed to match the blades of the Daikin Applied louver, maximizing the air opening. See Figure 43 on page 26

Figure 41: Decorative Intake Grille

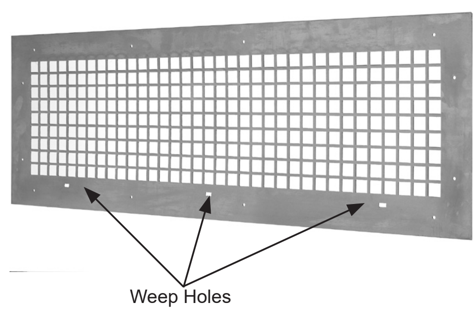


Figure 42: Horizontal Louver with Decorative Intake Grille

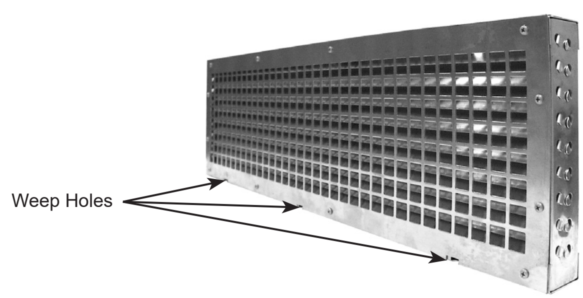
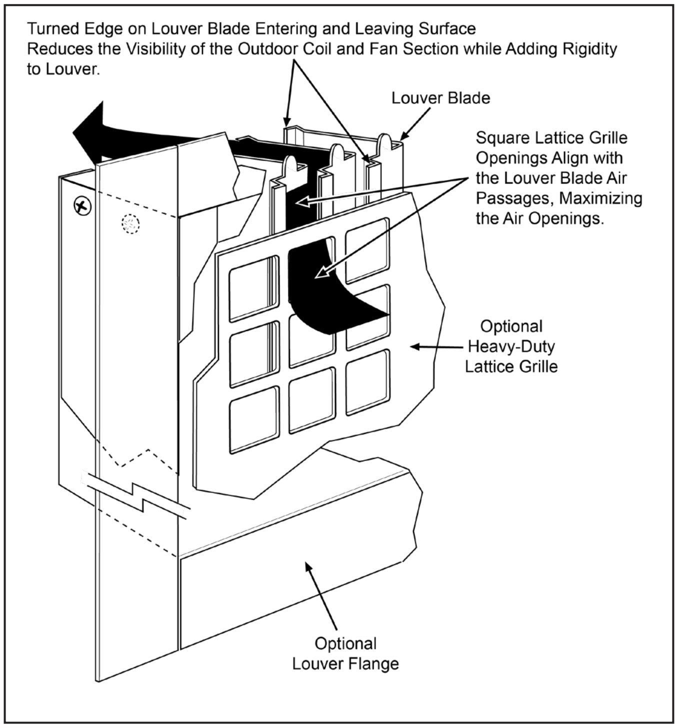


Figure 43: Vertical Louver with Decorative Intake Grille Detail

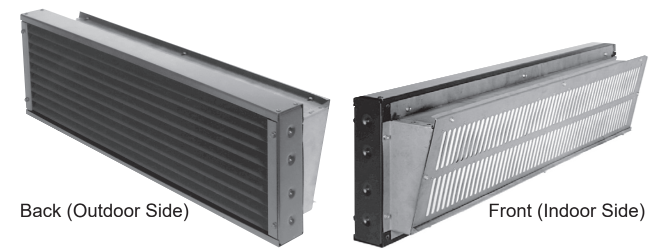


VentiMatic Shutter – Room Exhaust Ventilation

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 44). 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 44: 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's 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.

Details and Dimensions

Physical Data

Table 8: AH General Data

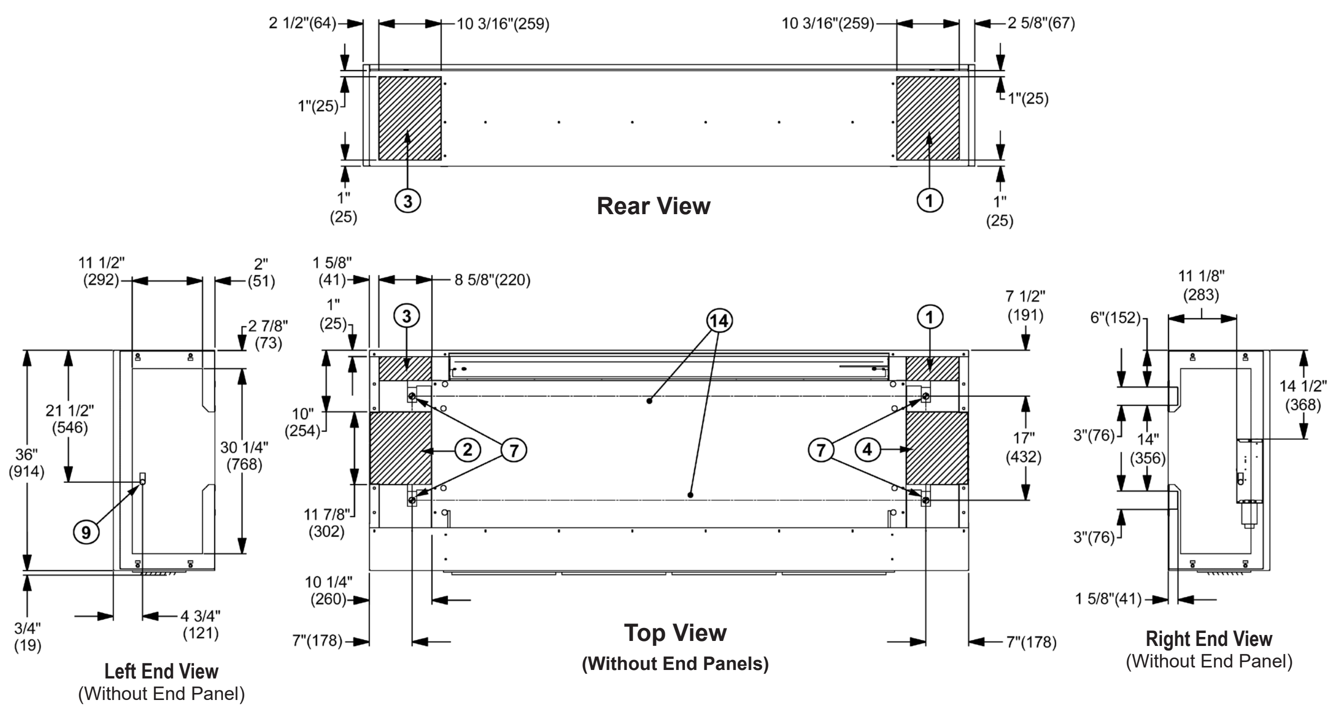
Unit Nominal Capacity			H07, V07	H10, V10	H13, V13	H15, V15	H20, V20
Nominal Airflow - cfm (L/s)			750 (354)	1000 (472)	1250 (590)	1500 (708)	2000 (944)
Fan Data	Number of Fans		2	3	4	4	4
	Size in (mm)	Diameter	8.12 (206)	8.12 (206)	8.12 (206)	8.12 (206)	9½ (241)
		Width	8.25 (210)	8.25 (210)	8.25 (210)	8.25 (210)	6 (152)
	Indoor Fan Motor HP		1/3	1/3	1/3	3/4	3/4
Filter Data	(Quantity) Size	in	(1) 10 x 36½ x 1	(1) 10 x 48½ x 1	(1) 10 x 60½ x 1	(2) 10 x 36½ x 1	(2) 10 x 36½ x 1
		mm	254 x 927 x 25	254 x 1232 x 25	254 x 1587 x 25	254 x 927 x 25	254 x 914 x 25
	Area	ft² (m²)	2.54 (.24)	3.37 (.31)	4.20 (.39)	5.08 (.47)	5.08 (.47)
Shipping Weight lbs (kg)*	Discharge Air Arrangement	AH, AT	350 (159)	425 (193)	495 (225)	570 (259)	N/A
		FD, FG or BD	385 (179)	465 (211)	540 (245)	620 (281)	680 (309)
Coil Water Volume gal (L)	1-Row Coil		.25 (0.95)	.31 (1.17)	.38 (1.44)	.44 (1.67)	.44 (1.67)
	2-Row Coil		.45 (1.70)	.57 (2.16)	.69 (2.61)	.82 (3.10)	.82 (3.10)
	3-Row Coil		.64 (2.42)	.82 (3.10)	1.01 (3.82)	1.19 (4.50)	1.19 (4.50)
	4-Row Coil		.83 (3.14)	1.08 (4.09)	1.32 (5.00)	1.57 (5.94)	1.57 (5.94)
	5-Row Coil		1.03 (3.90)	1.34 (5.07)	1.64 (6.21)	1.95 (7.38)	1.95 (7.38)

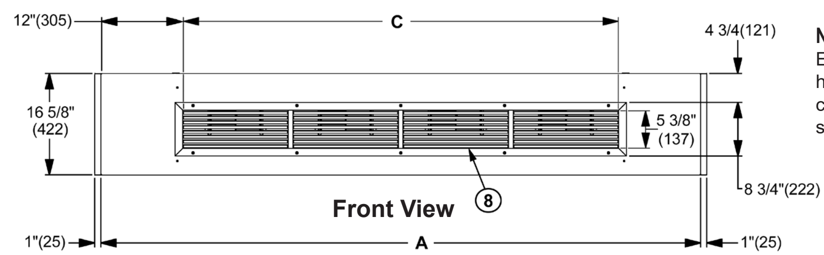
NOTE: *Approximate weights based on Face and Bypass Damper Controlled Unit with 4- row cooling coil, high capacity hot water coil and MicroTech controls.

Arrangement AT

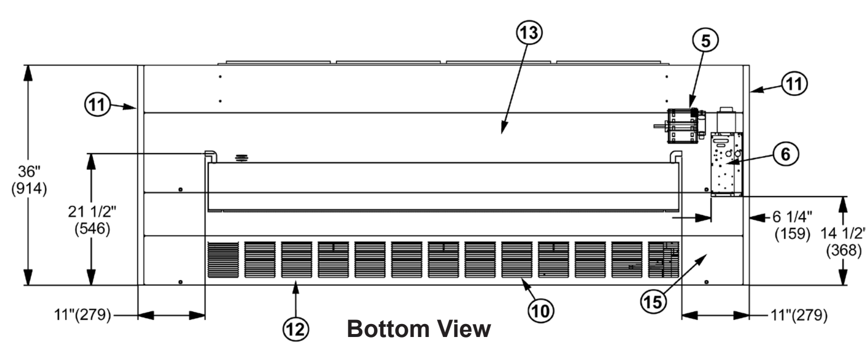
Note: Dimensions are approximate. Unit left or right hand determined by viewing unit facing discharge air.

Figure 45: Arrangement AT: 36" Deep Unit Front Discharge with Double-Deflection Grille





Note:
Electrical box location in right hand end will vary based on control and motor options selected.



Component Description

1 Rear Entry Area – LH
2 Top Entry Area – LH
3 Rear Entry Area – RH
4 Top Entry Area – RH
5 Fan Motor
6 Electrical Connection Box
7 7/8" (22mm) Diameter Ceiling Mounting Holes
8 Duct Collar
9 Condensate Drain (Same end as cooling coil)
10 Return Air Grille (Optional)
11 End Panels
12 Bottom Hinged Access Panel (Filter and Controls)
13 Bottom Hinged Access Panel (Motor and End Bearing)
14 Wire Raceways
15 MicroTech Controller (UVC)

Piping

Piping Entry – Left Hand Coil 1 or 2

Piping Entry – Right Hand Coil 3 or 4

Electrical – Main Power Wiring

Wiring Entry 3 or 4
Wiring Connection (Non-Electric Heat) - 6

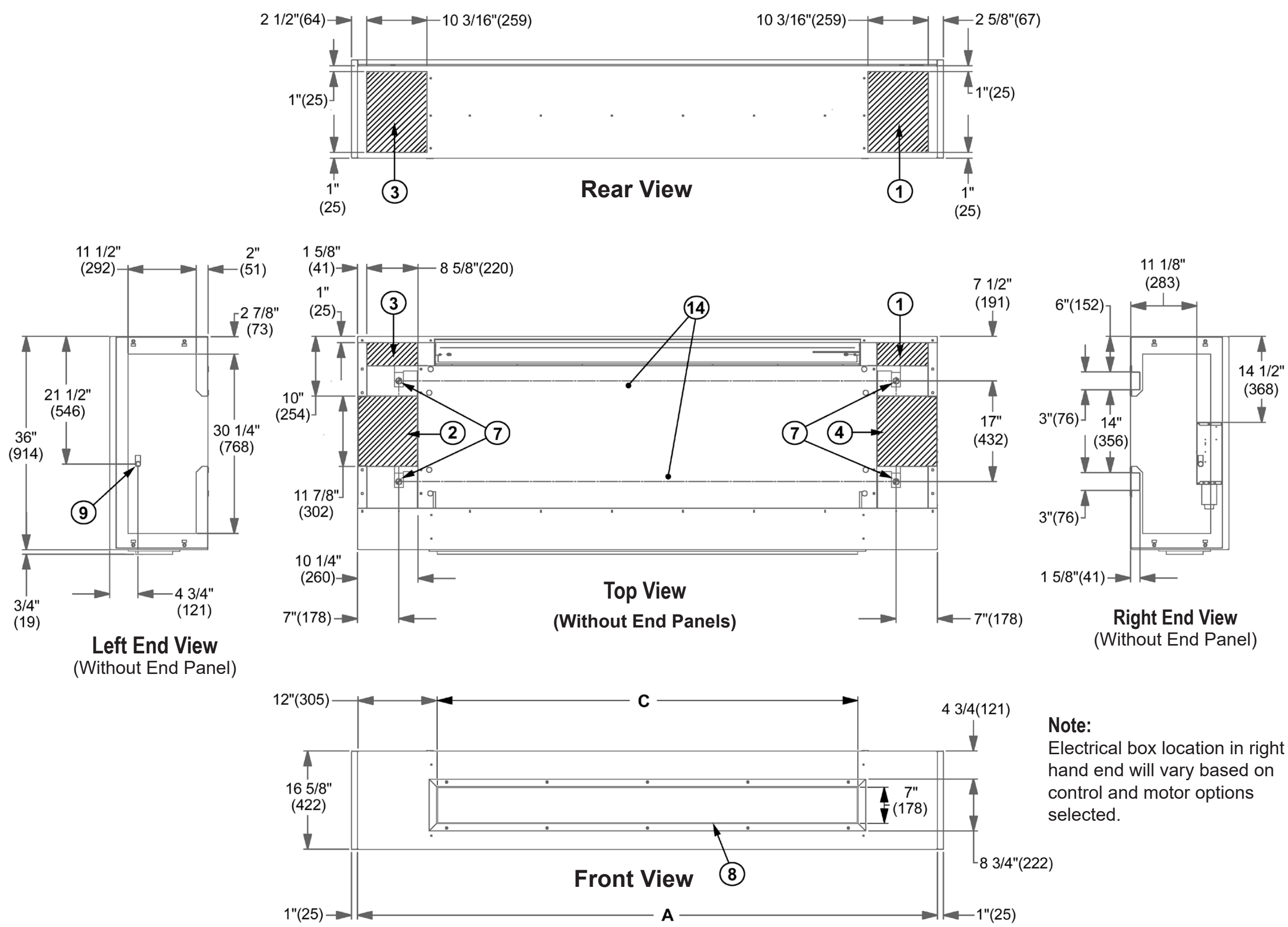
Dimensions

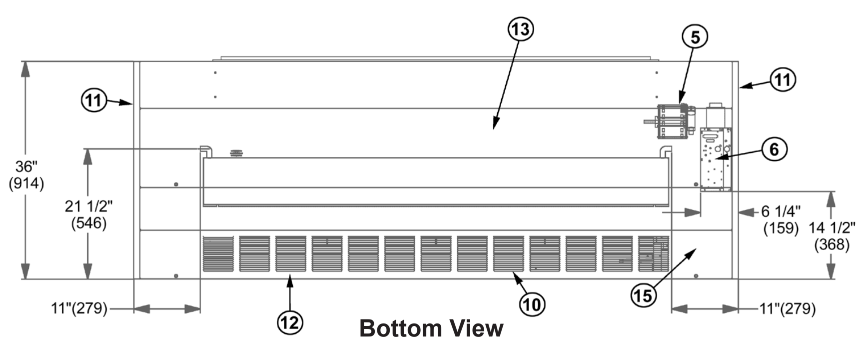
Unit Size	Dim. "A"	MM	Dim. "C"	MM
H07, V07	62	1575	36	914
H10, V10	74	1880	48	1219
H13, V13	86	2184	60	1524
H15, V15	98	2489	72	1829

Arrangement AH

Note: Dimensions are approximate. Unit left or right hand determined by viewing unit facing discharge air.

Figure 46: Arrangement AH: 36" Deep Unit Front Discharge with Duct Collar





Component Description

1. Rear Entry Area – LH
2. Top Entry Area – LH
3. Rear Entry Area – RH
4. Top Entry Area – RH
5. Fan Motor
6. Electrical Connection Box
7. 7/8" (22mm) Diameter Ceiling Mounting Holes
8. Duct Collar
9. Condensate Drain (Same end as cooling coil)
10. Return Air Grille (Optional)
11. End Panels
12. Bottom Hinged Access Panel (Filter and Controls)
13. Bottom Hinged Access Panel (Motor and End Bearing)
14. Wire Raceways
15. MicroTech Controller (UVC)

Piping

Piping Entry – Left Hand Coil 1 or 2

Piping Entry – Right Hand Coil 3 or 4

Electrical – Main Power Wiring

Wiring Entry 3 or 4

Wiring Connection (Non-Electric Heat) - 6

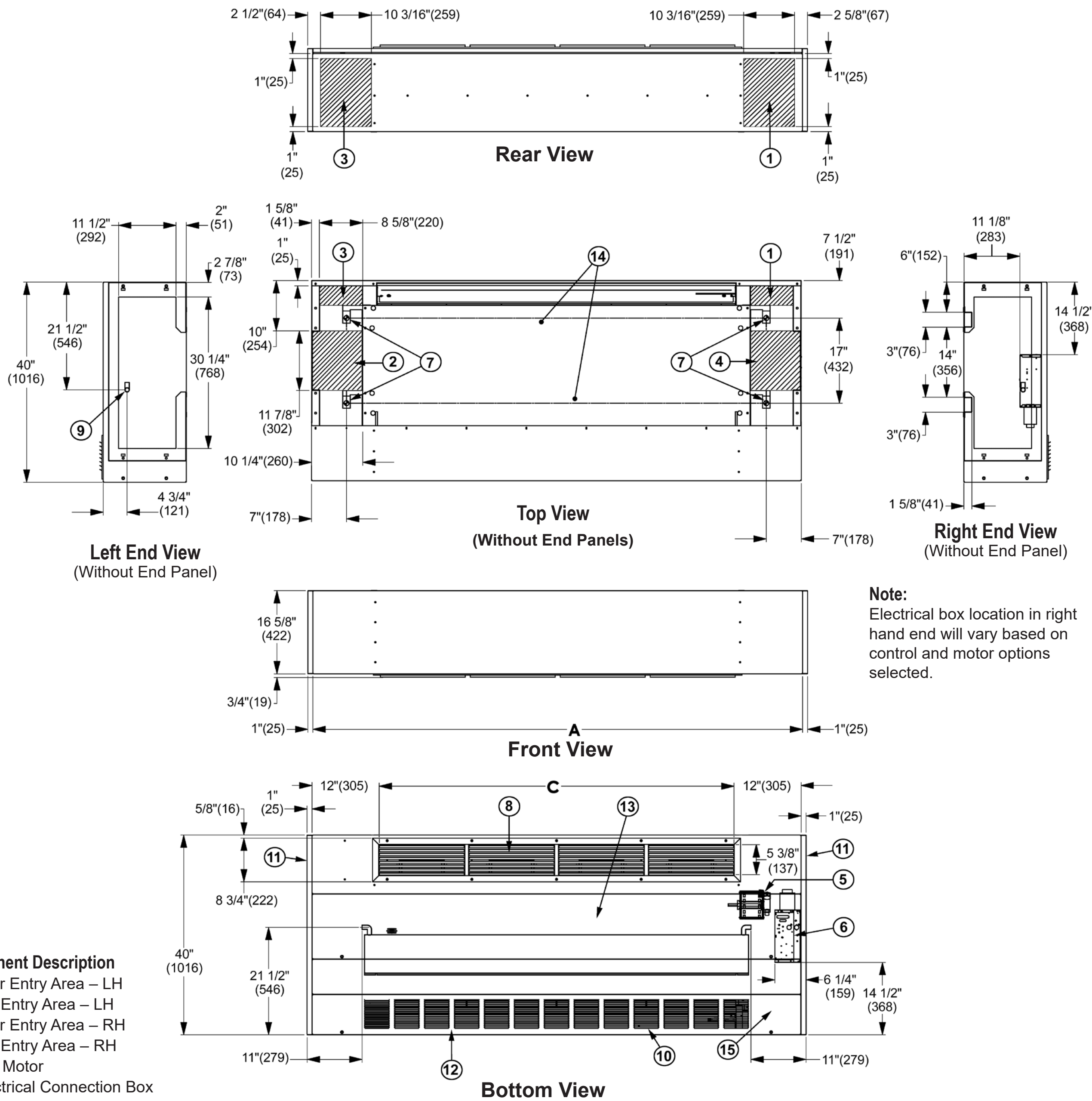
Dimensions

Unit Size	Dim. "A"	MM	Dim. "C"	MM
H07, V07	62	1575	36	914
H10, V10	74	1880	48	1219
H13, V13	86	2184	60	1524
H15, V15	98	2489	72	1829

Arrangement BD

Note: Dimensions are approximate. Unit left or right hand determined by viewing unit facing discharge air.

Figure 47: Arrangement BD: 40" Deep Unit Bottom Discharge with Double-Deflection Grille



Component Description

1 Rear Entry Area – LH
2 Top Entry Area – LH
3 Rear Entry Area – RH
4 Top Entry Area – RH
5 Fan Motor
6 Electrical Connection Box
7 7/8" (22mm) Diameter Ceiling Mounting Holes
8 Duct Collar
9 Condensate Drain (Same end as cooling coil)
10 Return Air Grille (Optional)
11 End Panels
12 Bottom Hinged Access Panel (Filter and Controls)
13 Bottom Hinged Access Panel (Motor and End Bearing)
14 Wire Raceways
15 MicroTech Controller (UVC)

Piping

Piping Entry – Left Hand Coil 1 or 2

Piping Entry – Right Hand Coil 3 or 4

Electrical – Main Power Wiring

Wiring Entry 3 or 4

Wiring Connection (Non-Electric Heat) - 6

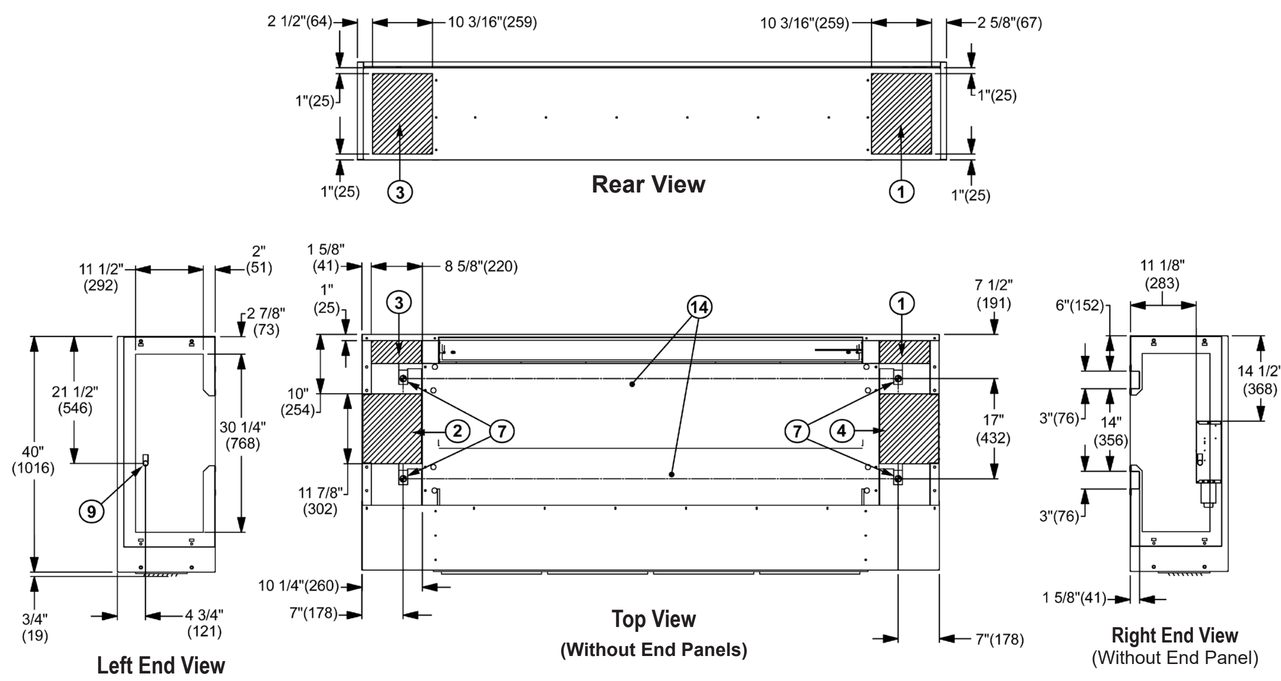
Dimensions

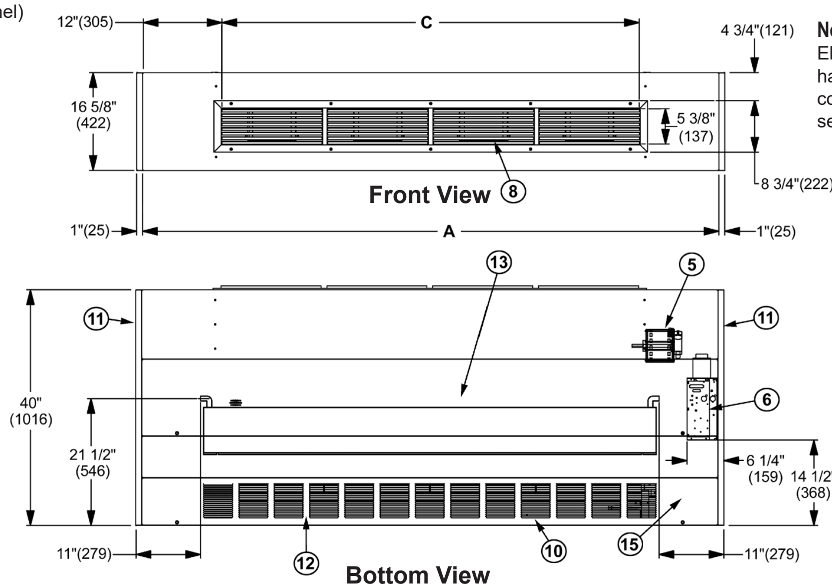
Unit Size	Dim. "A"	MM	Dim. "C"	MM
H07, V07	62	1575	36	914
H10, V10	74	1880	48	1219
H13, V13	86	2184	60	1524
H15, H20, V15, V20	98	2489	72	1829

Arrangement FD, Double Deflection Grille

Note: Dimensions are approximate. Unit left or right hand determined by viewing unit facing discharge air.

Figure 48: Arrangement FG: 40" Deep Unit Front Discharge, Double Deflection Grille (2000 cfm Only)





Note:
Electrical box location in right hand end will vary based on control and motor options selected.

Component Description

1 Rear Entry Area – LH
2 Top Entry Area – LH
3 Rear Entry Area – RH
4 Top Entry Area – RH
5 Fan Motor
6 Electrical Connection Box
7 7/8" (22mm) Diameter Ceiling Mounting Holes
8 Duct Collar
9 Condensate Drain (Same end as cooling coil)
10 Return Air Grille (Optional)
11 End Panels
12 Bottom Hinged Access Panel (Filter and Controls)
13 Bottom Hinged Access Panel (Motor and End Bearing)
14 Wire Raceways
15 MicroTech Controller (UVC)

Piping

Piping Entry – Left Hand Coil 1 or 2

Piping Entry – Right Hand Coil 3 or 4

Electrical – Main Power Wiring

Wiring Entry 3 or 4
Wiring Connection (Non-Electric Heat) - 6

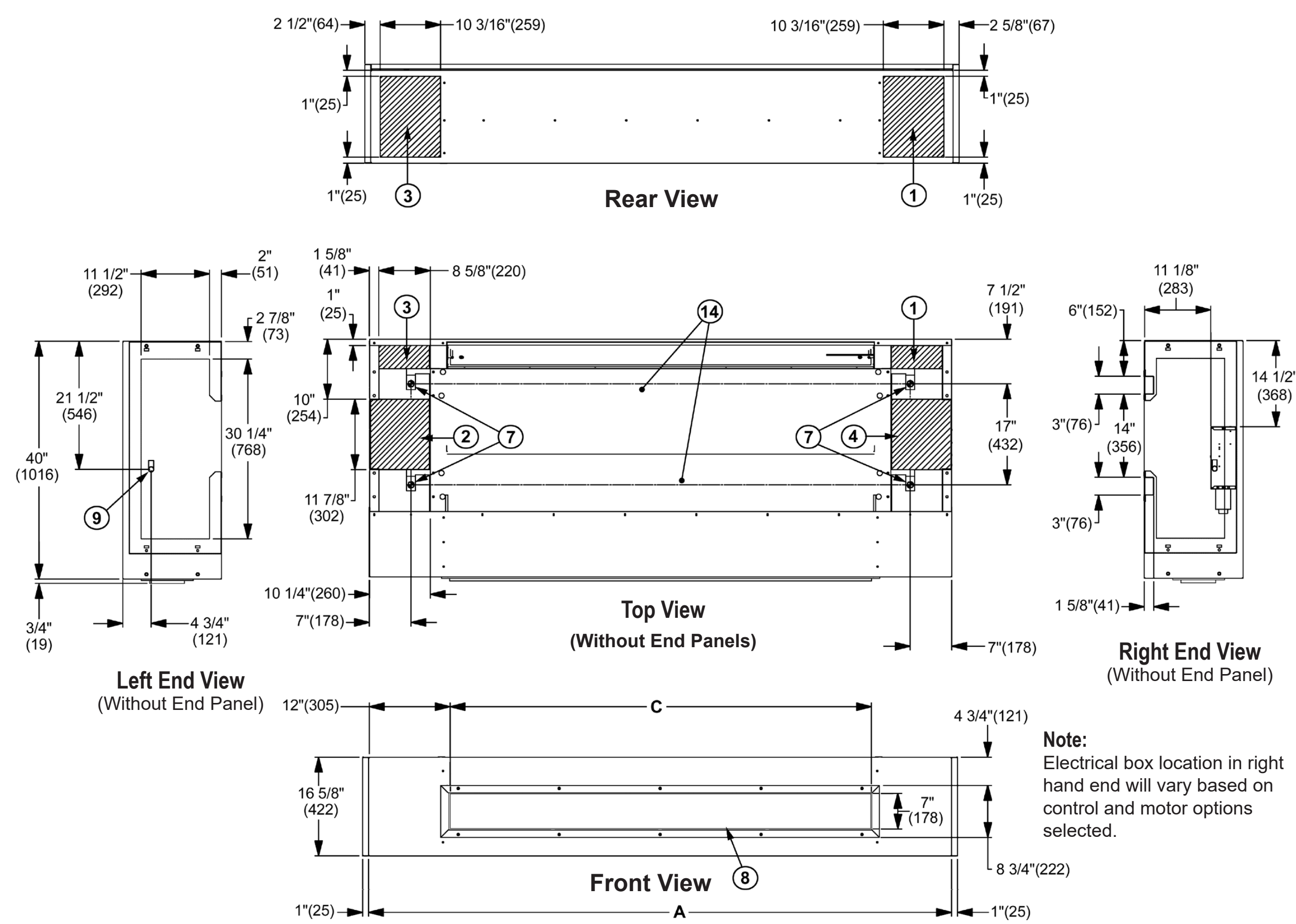
Dimensions

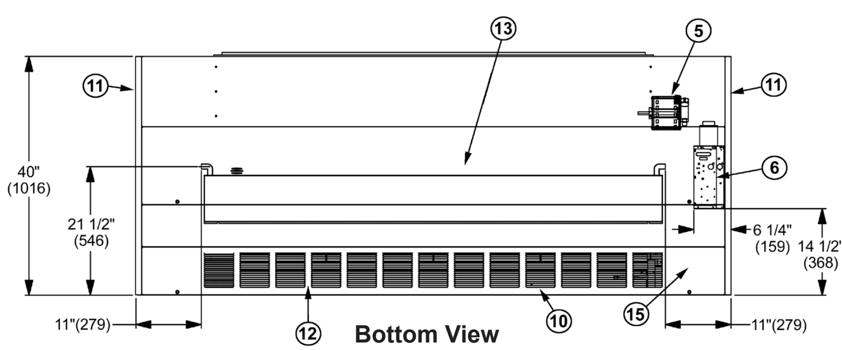
Unit Size	Dim. "A"	MM	Dim. "C"	MM
H20, V20	98	2489	72	1829

Arrangement FD with Duct Collar

Note: Dimensions are approximate. Unit left or right hand determined by viewing unit facing discharge air.

Figure 49: Arrangement FD: 40" Deep Unit Front Discharge with Duct Collar (2000 cfm Only)





Component Description

1 Rear Entry Area – LH
2 Top Entry Area – LH
3 Rear Entry Area – RH
4 Top Entry Area – RH
5 Fan Motor
6 Electrical Connection Box
7 7/8" (22mm) Diameter Ceiling Mounting Holes
8 Duct Collar
9 Condensate Drain (Same end as cooling coil)
10 Return Air Grille (Optional)
11 End Panels
12 Bottom Hinged Access Panel (Filter and Controls)
13 Bottom Hinged Access Panel (Motor and End Bearing)
14 Wire Raceways
15 MicroTech Controller (UVC)

Piping

Piping Entry – Left Hand Coil 1 or 2

Piping Entry – Right Hand Coil 3 or 4

Electrical – Main Power Wiring

Wiring Entry 3 or 4
Wiring Connection (Non-Electric Heat) - 6

Dimensions

Unit Size	Dim. "A"	MM	Dim. "C"	MM
H20, V20	98	2489	72	1829

Coil Connections

The dimensional drawings in this section show the location of coil connections for all coil configurations. The drawings are broken into sections as follows:

- “Heat/Cool Units” beginning on page 34
- “Reheat Units” beginning on page 35
- “Heating Only Units” on page 37
- “Cooling Only Units” on page 38

The following notes apply to all units:

I. All coils have same-end supply and return connections.

2. 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.

3. Steam/hot water connections may be on the same end as cooling coil connections, but are recommended to be on the opposite end to facilitate piping. (Must be opposite end when using MicroTech controls.)

4. Cooling condensate drain pan is shipped in the level position, with the ability to field adjust the slope front-to-back and left-to-right for full condensate draining.

5. Electric heating coil power connections are right end only. Junction box has 1" (25 mm) and 2" (51 mm) (trade size) knockouts, 10-1/2" (267 mm) from right end of the unit.

6. For limitations with coil combinations see "Available Coil Combinations" on page 20.

7. Coil connections are 7/8" I.D. (female) and terminate 9" (229 mm) from the end of the unit.

8. Steam coils are 1-1/8" female (sweat) connections and terminate 9" (229 mm) from the end of the unit.

9. DX coils (G) have O.D. sweat connections Interconnecting tube is supplied by others. See Table 9: DX Coil (G) Connection Tubing" below for correct tubing size.

10. All dimensions are approximate.

11. Abbreviations used in drawing are as follows:

R = Return **S** = Supply

LL = Liquid Line **SL** = Suction Line

EH = Electric Heat

Table 9: DX Coil (G) Connection Tubing

Unit Series	H07, V07		H10, V10		H13, V13		H15, V15		H20, V20	
	in	mm	in	mm	in	mm	in	mm	in	mm
Suction Line OD:	3/4	19	3/4	19	3/4	19	3/4	19	3/4	19
Liquid LIne OD:	1/2	12.7	1/2	12.7	1/2	12.7	1/2	12.7	1/2	12.7

Heat/Cool Units (Right Hand)

Notes: *1. Linear dimensions referenced from rear of unit. Right hand views shown, dimensions are identical for left-hand configurations. Connection hand is determined by facing discharge air grille.*

2. Numerical codes [#] denote optional stainless steel drain pan (cooling coils).

Figure 50: Chilled/Hot Water (2-pipe) Unit (Coils U[1], D[2], E[3], F[4])

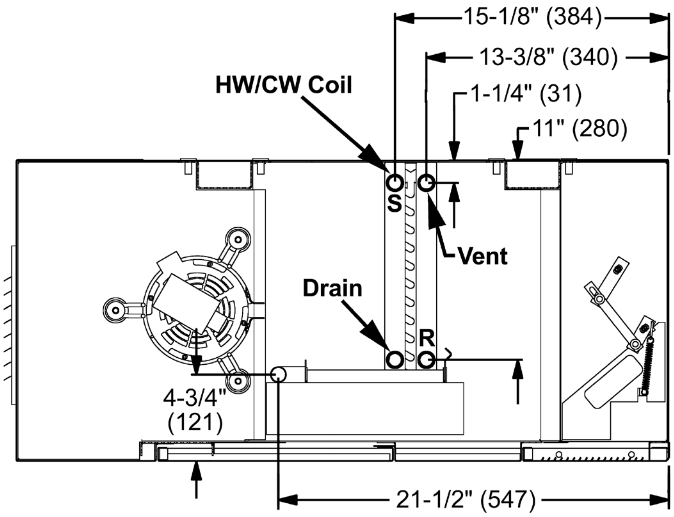


Figure 51: Chilled and Hot Water Unit (Cooling Coils V[5], S[6], W[7] Y[8]; Heating Coils 65, 66, 67)

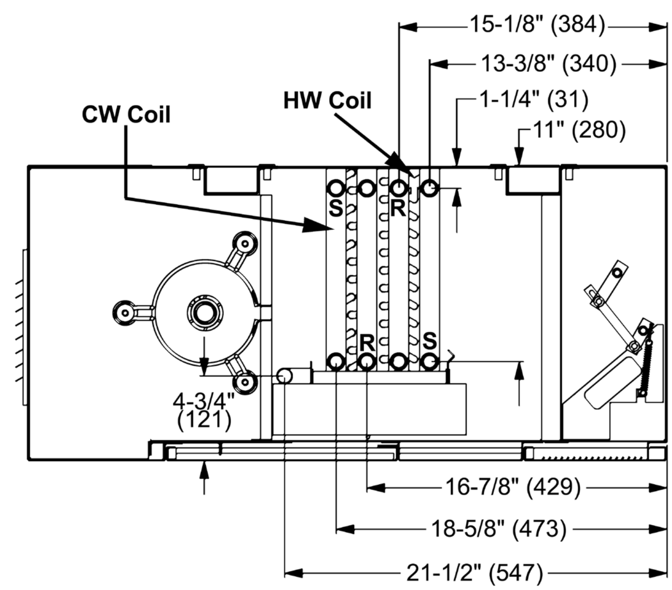


Figure 52: Chilled Water and Steam Unit (Cooling Coils V[5], S[6]; Heating Coils 68, 69)

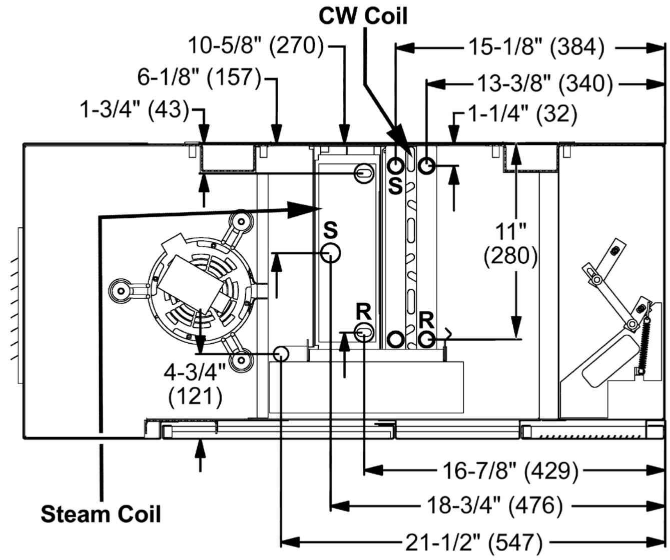


Figure 53: Chilled Water (1st Position) and Electric Heating (Cooling Coils V[5], S[6], W[7]; Heating Coil 12, 13)

Note: *Electric heat, right hand only. Chilled water left hand only.*

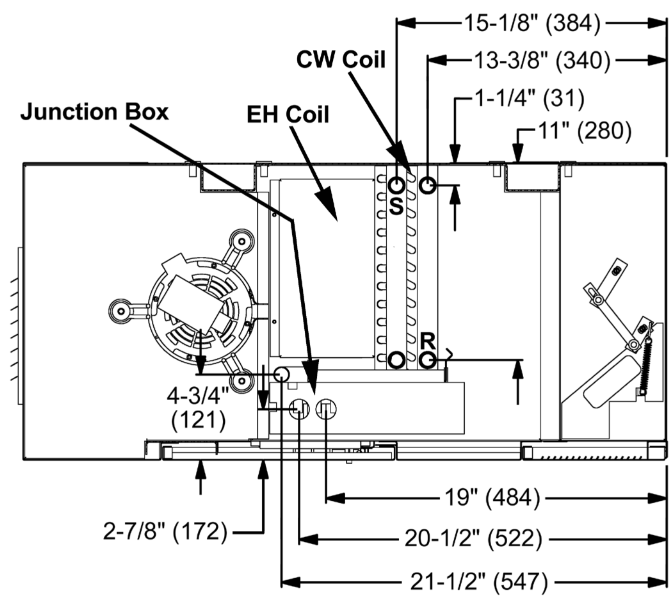


Figure 54: Direct Expansion and Hot Water Unit (Cooling Coil G[9], M[0], Heating Coils 65, 66, 67)

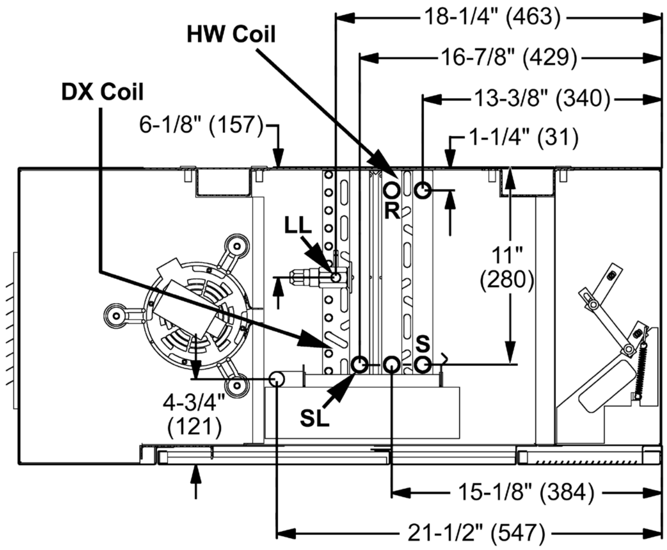


Figure 55: Direct Expansion (1st Position) and Steam Unit (Cooling Coil G[9], M[0], Heating Coils 68, 69)

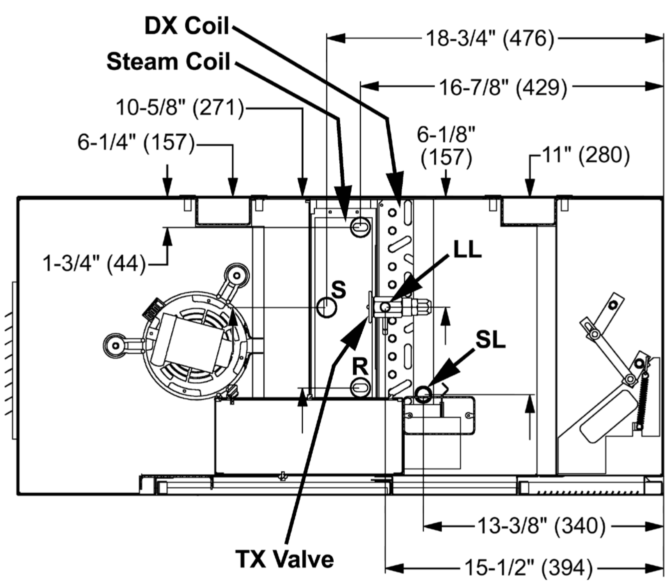
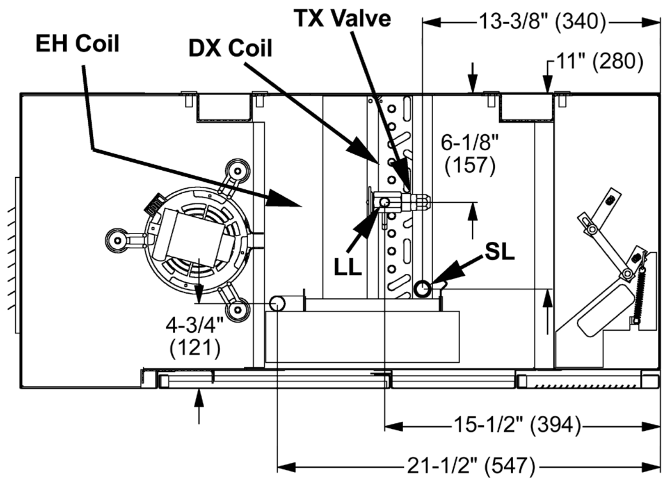


Figure 56: Direct Expansion (1st Position) and Electric Heating (Cooling Coil G[9], M[0], Heating Coil 12, 13)

Note: *Electric heat, right hand only. Direct expansion (DX) left hand only.*



Reheat Units (Right Hand)

Notes: 1. *Linear dimensions referenced from rear of unit. Right hand views shown, dimensions are identical for left-hand configurations. Connection hand is determined by facing discharge air grille.*

2. *Numerical codes [#] denote optional stainless steel drain pan (cooling coils).*

Figure 57: Chilled Water and Hot Water Unit (Cooling Coils V[5], S[6], W[7], Y[8]; Heating Coils 65, 66, 67)

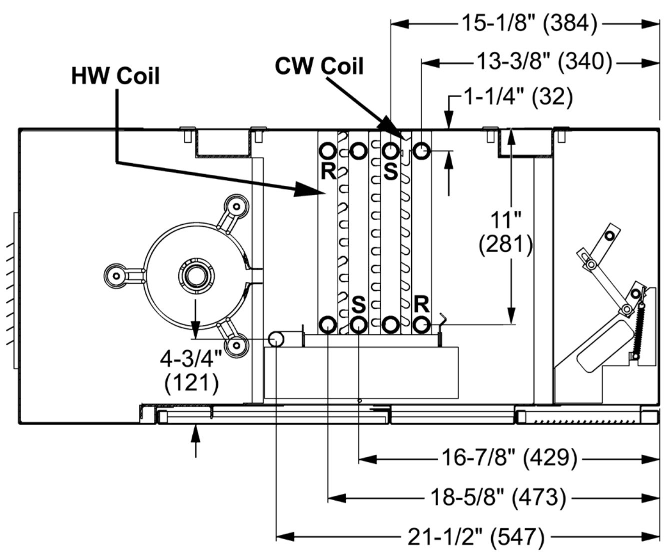


Figure 58: Chilled Water and Steam Unit (Cooling Coils V [5], S[6]; Heating Coils 68, 69)

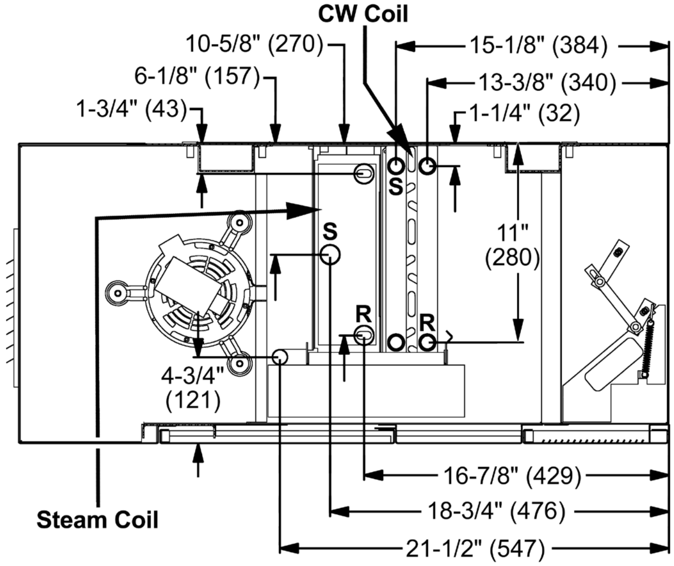


Figure 59: Chilled Water (1st Position) and Electric Heating (Cooling Coils V[5], S[6], W[7]; Heating Coil 12, 13)

Note: *Electric heat, right hand only. Chilled water left hand only.*

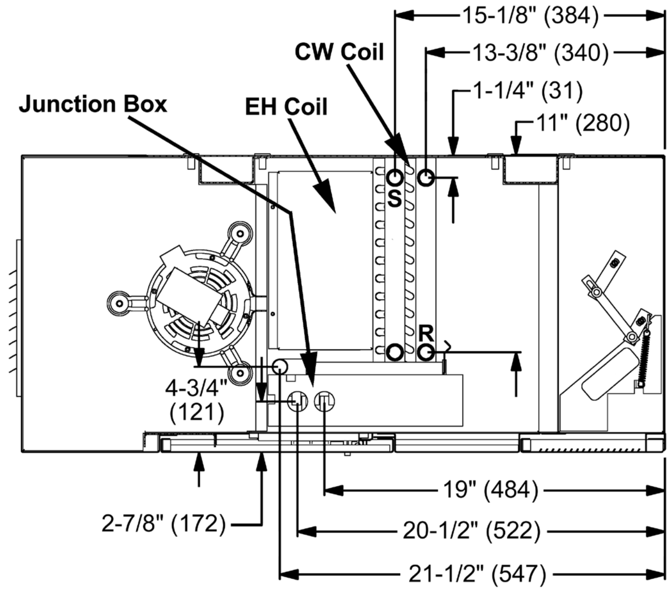


Figure 60: Direct Expansion and Hot Water Unit (Cooling Coil G[9], M[0], Heating Coils 65, 66, 67)

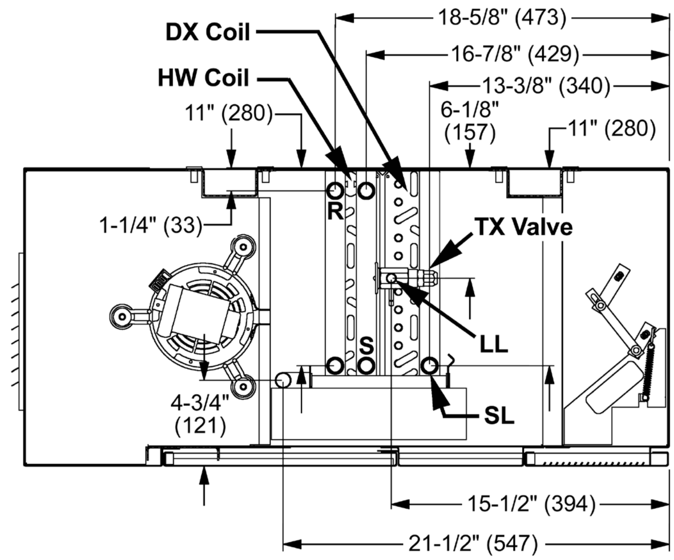


Figure 61: Direct Expansion and Steam Unit (Cooling Coil G[9], M[0], Heating Coils 68, 69)

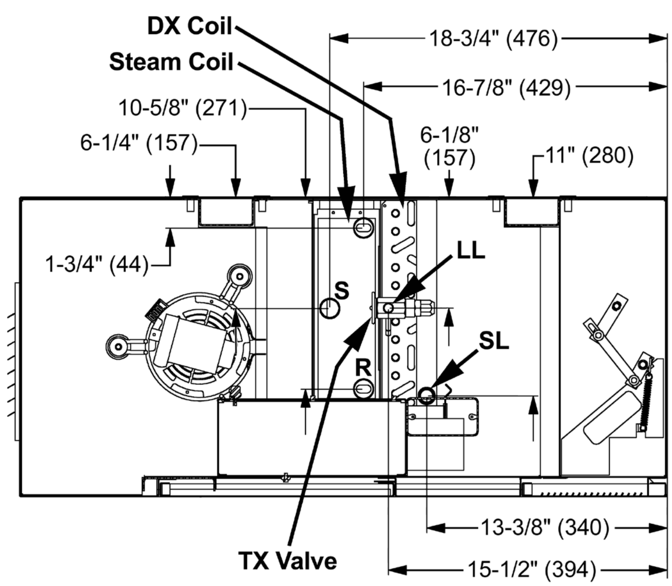
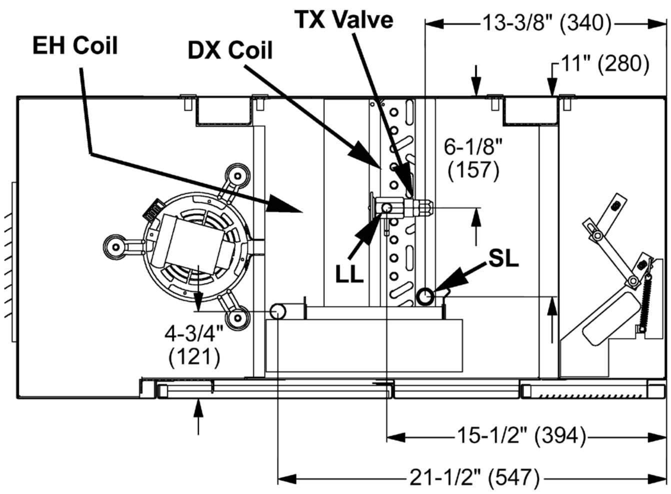


Figure 62: Direct Expansion and Electric Heating Unit (Cooling Coil G[9], M[0], Heating Coils 12, 13)



Heating Only Units

Note: *Dimensions are same for left hand units. Connection hand is determined by facing discharge air grille.*

Figure 63: Hot Water Heating Only Unit (Coils 65, 66, 67)

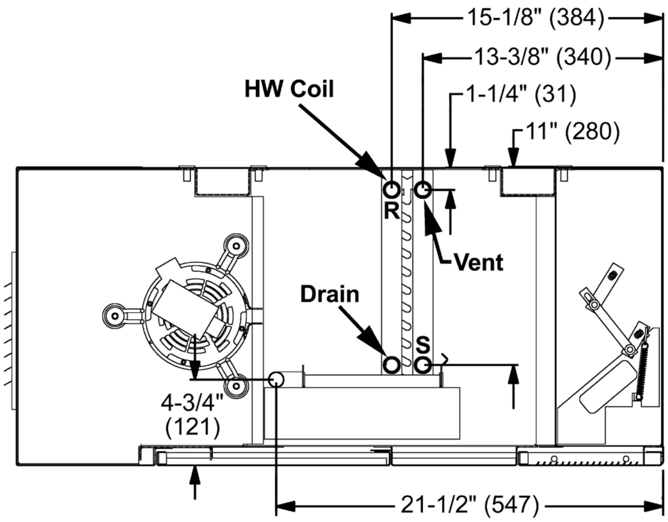


Figure 64: Steam Heating Only Unit (Coils 68, 69)

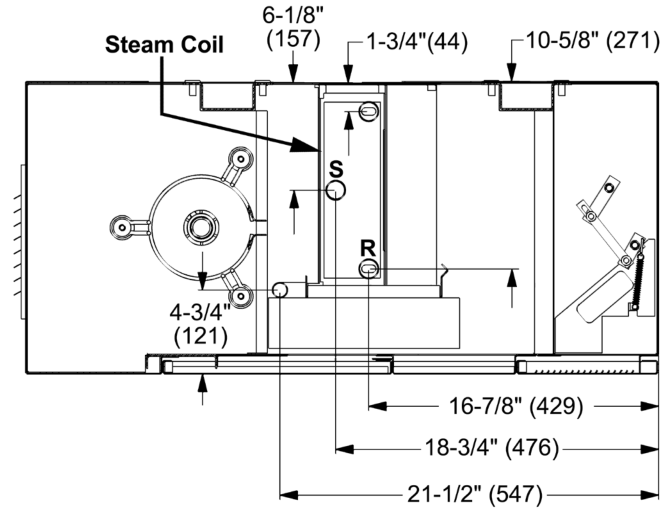
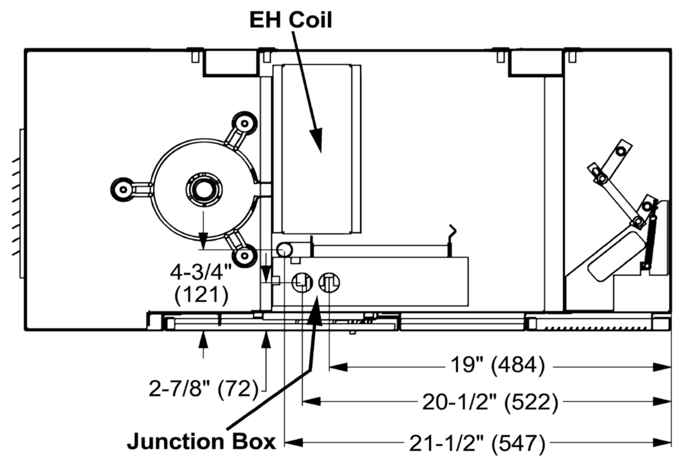


Figure 65: Electric Heating Only Unit (Coils 12, 13)

Note: *This arrangement available on AHV units only.*



Cooling Only Units (Right Hand)

Notes: *1. Linear dimensions referenced from rear of unit. Right hand views shown, dimensions are identical for left-hand configurations. Connection hand is determined by facing discharge air grille.*

2. Numerical codes [#] denote optional stainless steel drain pan (cooling coils).

Figure 66: Chilled Water Cooling Only Unit (Coils V[5], S[6], W[7], Y[8])

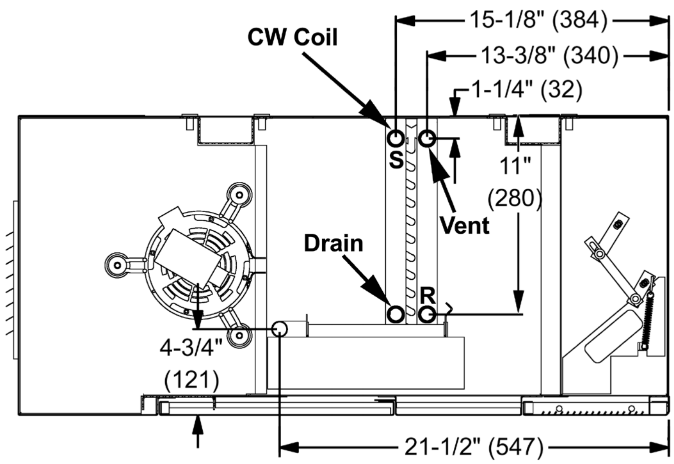
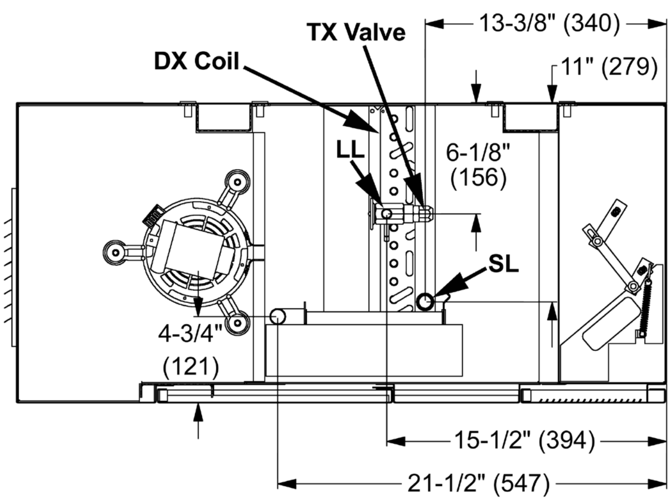


Figure 67: Direct Expansion Cooling Only Unit (Coil G[9], M[0])



Condensate Drain Connections

Note: *Dimensions exclude 1" (25 mm) end panel.Condensate drain stub is 7/8" (22 mm) x 1/8" (3 mm) wall thickness.*

Figure 68: Condensate Drain

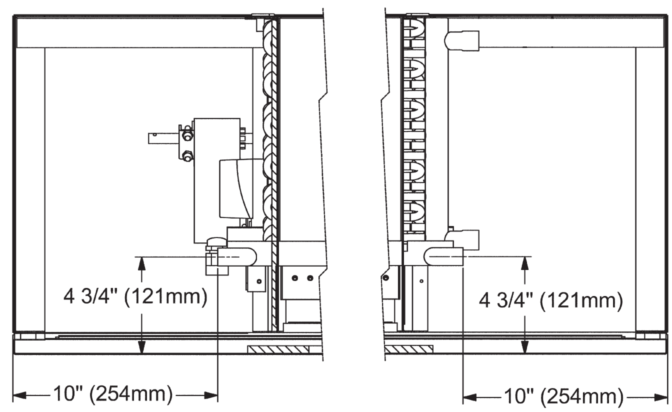
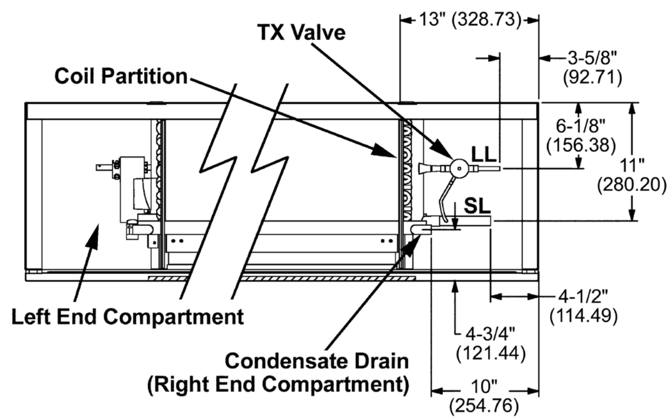


Figure 69: Condensate Drain and DX Coil Connections



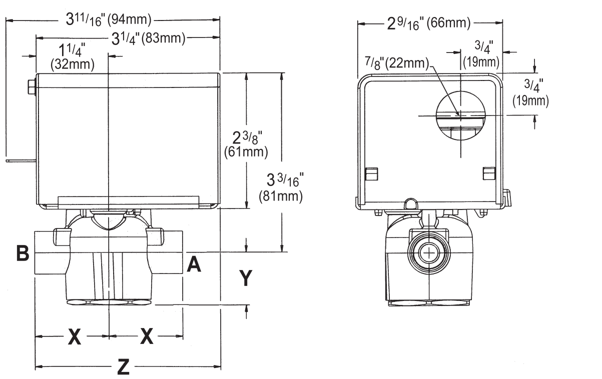
Valves

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 70: 2-Way EOC Valve Dimensions



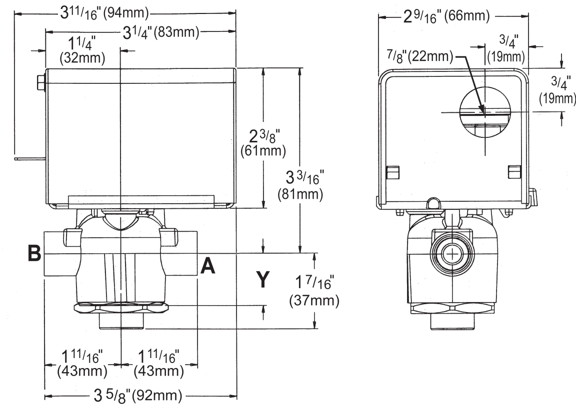
Connection	Cv	X	Y	Z
3/4" (19 mm) FNPT	7.5	1 11/16" (43 mm)	15/16" (24 mm)	3⅝" (92 mm)

3-Way End of Cycle 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" (51mm) 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.

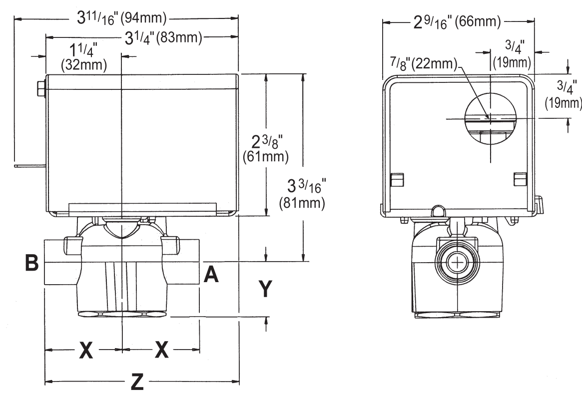
When using MicroTech controls, they must be opposite end. The End of Cycle valve accessory must be field installed on the unit for which it was selected.

Figure 71: 3-Way EOC Valve Dimensions



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

Figure 72: 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)

Table 10: 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 11: FandBP 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 and 15 psi (90 and 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)

2-Way Modulating Valve (Chilled Water, Hot Water or Combination)

Two-way modulating control valves for MicroTech are designed to regulate the flow of chilled water, hot water or the combination. 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 (CW, HW, CW/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 13: 2-Way Valve Body Specifications (CW, HW, CW/HW)

Service	chilled, 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

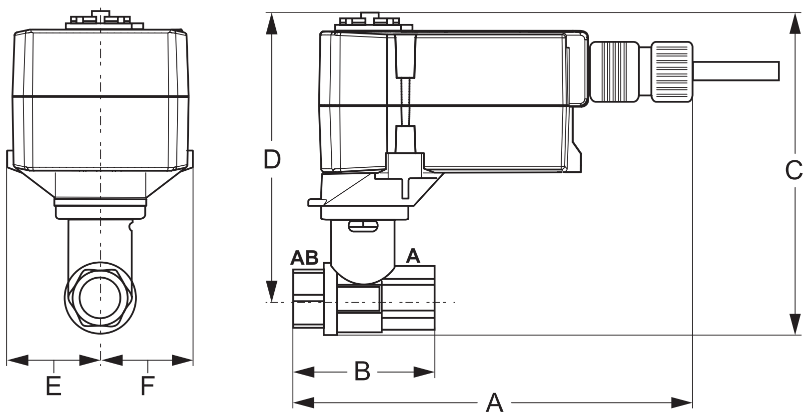
2-Way Modulating Valve Specifications (CW, HW, CW/HW)

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 Chilled 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 15, 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.



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 14: 2-Way Modulating Valve 1/2" – Dimensions (CW, HW, CW/HW)

Valve Part No.	Cv	Connection Size	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 12: 2-Way Actuator Specifications (CW, HW, CW/HW)" on page 40" and "Table 13: 2-Way Valve Body Specifications (CW, HW, CW/HW)" on page 40.

Table 15: 2-Way Modulating Water Valve 1/2" – Pressure Drop (CW, HW, CW/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 16: 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 17: 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.

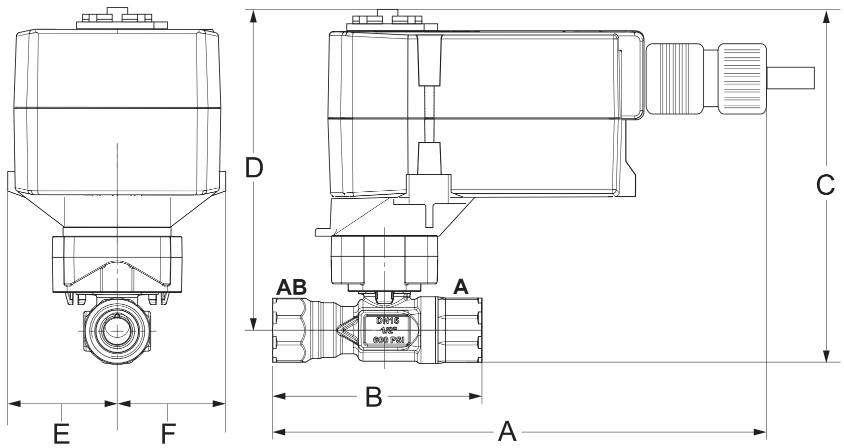


Table 18: 2-Way Modulating Steam Valve 1/2" – Dimensions

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 16: 2-Way Actuator Specifications (Steam)" on page 42" and "Table 17: Valve Body Specifications (Steam)" on page 42.

Table 19: 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 Valve (Chilled Water, Hot Water or Combination)

Three-way modulating control valves for MicroTech are designed to regulate the flow of hot or chilled water or the combination. 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 20: 3-Way Actuator Specifications (CW, HW, CW/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 21: 3-Way Valve Body Specifications (CW, HW, CW/HW)

Service	chilled, 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

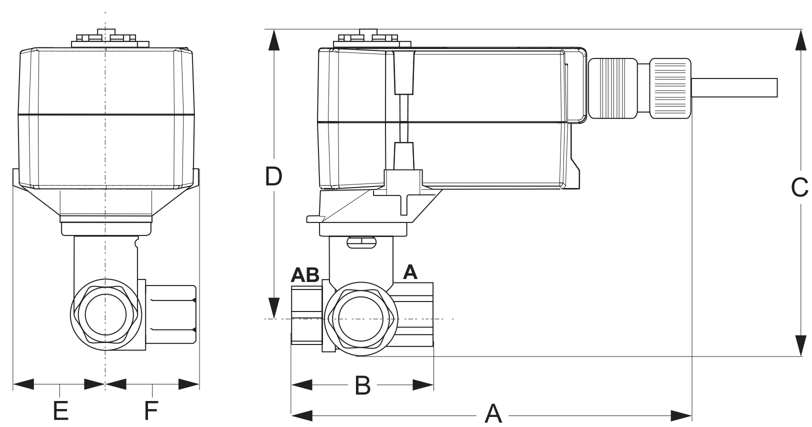
Hot Water, Chilled Water or 2-Pipe CW/HW Modulating Valve Selection

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, Chilled Water or 2-pipe CW/HW 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 23, 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.



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 22: 3-Way Modulating Valve 1/2" – Dimensions

Valve Part No.	Cv	Connection Size (inches)	A	B	C	D	E	F	Weight	
									Valve Body	Actuator
B309(B)	0.8	1/2"	6.59" (167 mm)	2.38" (60 mm)	4.9" (124 mm)	4.32" (110 mm)	1.53" (38 mm)	1.2" (31 mm)	.07 lb. (.03 kg)	1.8 lb. (.08 kg)
B310(B)	1.2									
B311(B)	1.9									
B312(B)	3.0		6.59" (167 mm)	2.38" (60 mm)	4.9" (124 mm)	4.71" (120 mm)	1.53" (38 mm)	1.29" (33 mm)		
B313(B)	4.7									

Note: *See "Table 20: 3-Way Actuator Specifications (CW, HW, CW/HW)" on page 44" and "Table 21: 3-Way Valve Body Specifications (CW, HW, CW/HW)" on page 44.*

Table 23: Modulating 3-Way Hot Water, Chilled Water or 2-Pipe CW/HW 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

Wall Intake Louvers and Grilles

Louvers are available in both horizontal and vertical blade configurations:

- **Horizontal blade** construction turns the incoming air to keep moisture from entering. Bottom weep holes drain moisture to the outside.
- **Vertical-blade** construction provides positive water impingement and entrapment. The bottom lip drains moisture to the outside.

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.

A half-inch-square mesh bird screen located on the leaving air side of the louver prevents birds and other small animals from entering. The screen's strong aluminum mesh is designed to minimize air pressure drops, unlike expanded metal mesh.

Table 24: Louver Specifications

Unit	Nominal Air Flow		Louver Dimensisons ± 1/16" (± 2 mm)		Recommended Wall Opening	
	CFM	L/s	L = Length	Height	Length	Height
H07, V07	750	354	36" (914 mm)	10-3/8" (264 mm)	36-1/4" (921 mm)	10-1/2" (267 mm)
H10, V10	1000	472	48" (1219 mm)		48-1/4" (1225 mm)	
H13, V13	1250	590	60" (1524 mm)		60-1/4" (1530 mm)	
H15/H20, V15/V20	1500/ 2000	708	72" (1829 mm)		72-1/4" (1835 mm)	

Figure 73: Louver with Flange (Horizontal Blades Shown)

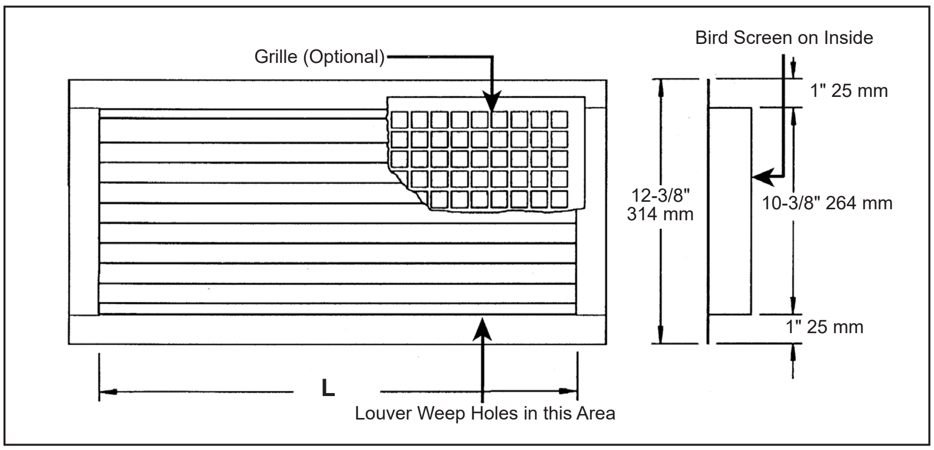
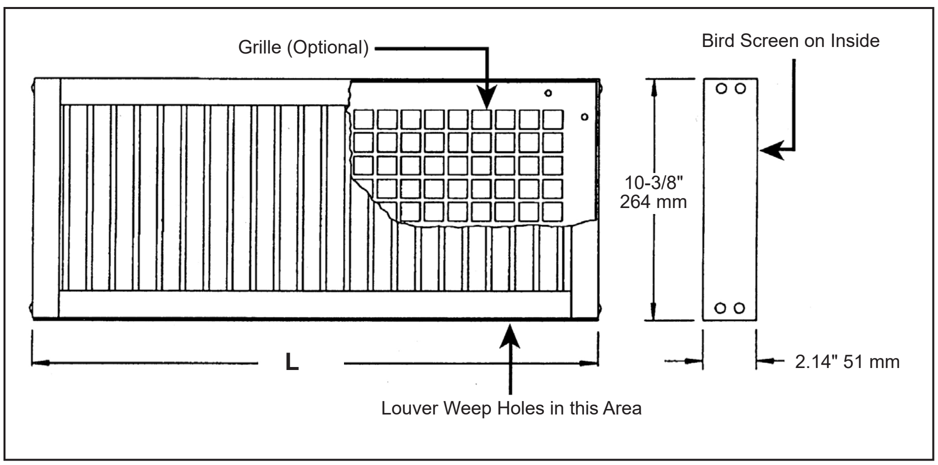


Figure 74: Louver without Flange (Vertical Blades Shown)



VentiMatic Shutter

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 75: VentiMatic Shutter Assembly with Optional Grille

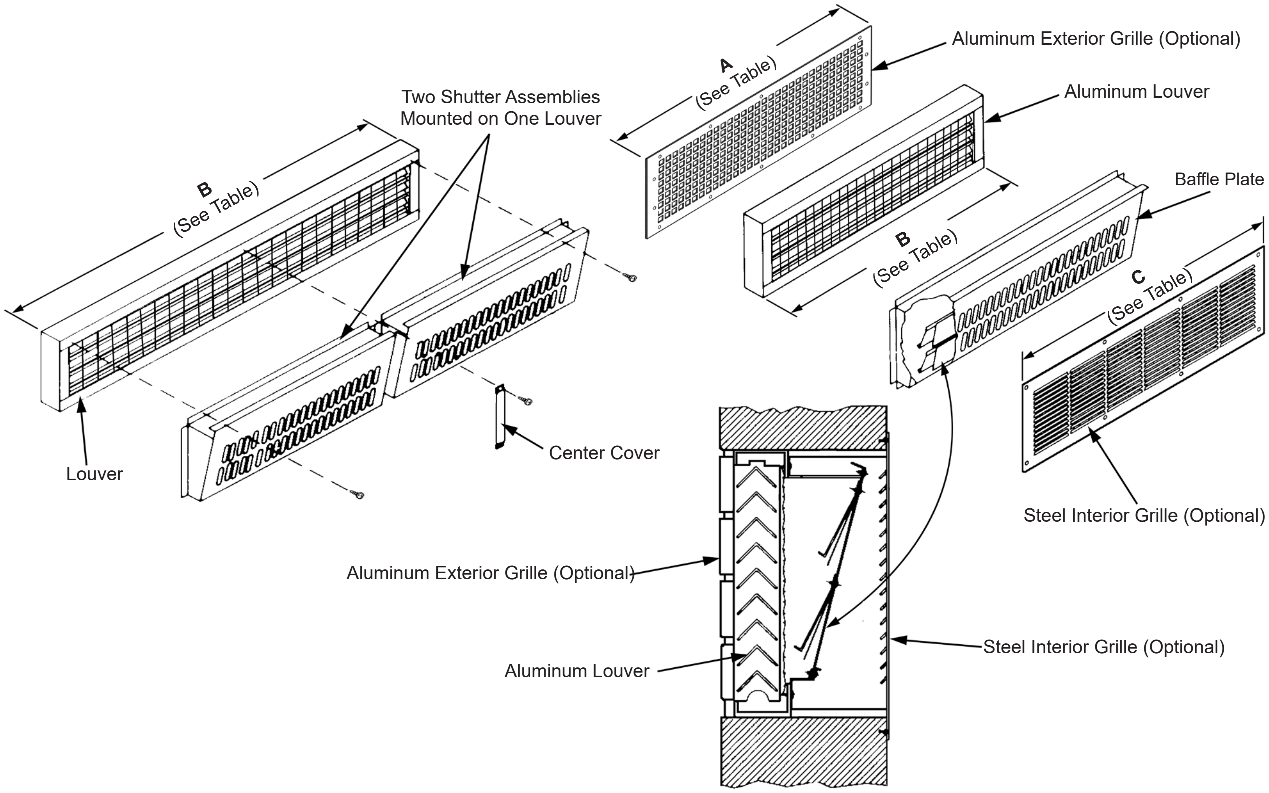


Table 25: Recommended Wall Openings and Max Air Capacities for VentiMatic Shutter Assembly

Exterior Grille Width		Louver Width		Interior Grille Width		Recommended Wall Opening For Louver				Max Number of VentiMatic Shutters To Mount On Standard Louver		VentiMatic Shutter(s) Max Air Capacity	
A		B		C									
						Length		Width		24" (610 mm) Shutter	36" (914 mm) Shutter		
inches	mm	inches	mm	inches	mm	inches	mm	inches	mm			CFM	L/s
23-3/4	603	24	610	27	686	24-1/4	616	10-1/2	267	1	0	500	236
36-3/4	933	36	914	39	991	36-1/4	921			0	1	750	354
47-3/4	1213	48	1219	51	1295	48-1/4	1225			2	0	1000	472
59-3/4	1518	60	1524	63	1600	60-1/4	1530			1	1	1250	590
71-3/4	1822	72	1829	75	1905	72-1/4	1835			0	2	1500	708

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.

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.

Table 26: Chilled Water Cooling Capacity Btuh

	80/67°F Entering Air Temperature; 45°F Entering Water Temperature; 10°F Water Temperature Rise				
Rows	750 cfm	1000 cfm	1250 cfm	1500 cfm	2000 cfm
2	15,700	23,600	31,500	38,700	45,800
3	19,000	33,200	41,000	51,200	62,300
4	24,500	35,600	43,300	56,700	71,600
5	30,800	35,900	47,200	57,600	87,600

Table 27: Hot Water Heating Capacity Btuh

	60°F Entering Air Temperature; 160°F Entering Water Temperature; 6 Gpm Water Flow				
Rows	750 cfm	1000 cfm	1250 cfm	1500 cfm	2000 cfm
1	37,000	49,500	57,000	66,000	74,200
2	48,300	62,000	74,100	97,200	111,500
3	56,800	72,000	84,500	97,500	111,900
4*	62,500	81,000	95,000	110,000	126,900

Note: **4-row coil only available with 2-pipe CW/HW system. HW will be piped for counter-flow*

Table 28: Steam Heating Capacity Btuh

0°F Entering Air Temperature; 2 PSI Steam at 218.5°F		
750 cfm	Std Cap	50,300
	Hi Cap	66,500
1000 cfm	Std Cap	75,200
	Hi Cap	89,900
1250 cfm	Std Cap	89,000
	Hi Cap	112,500
1500 cfm	Std Cap	111,500
	Hi Cap	128,500
2000 cfm	Std Cap	130,700
	Hi Cap	154,000

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 (see Table 29).

Table 29: Outdoor Air Ventilation Sensible Cooling Capacities Based On 75°F Room Temperature

Unit Series	Nominal CFM	Outdoor Air Temperature	
		55°F	60°F
H07, V07	750	16.3 MBH	12.2 MBH
H10, V10	1000	21.7 MBH	16.3 MBH
H13, V13	1250	27.1 MBH	20.3 MBH
H15, V15	1500	32.6 MBH	24.4 MBH
H20, V20	2000	43.4 MBH	32.5 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 30 gives the recommended number of room air changes per hour.

Table 30: 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,and Kitchens	4-1/2 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:

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:

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 750, 1000, 1250, 1500, and 2000 CFM.

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.

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.

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 "Modulating Valve Sizing and Piping" on page 124. One of the steps below should be followed.

Chilled Water

Carry out one of the following steps to help protect against freezing:

- Drain the chilled water system during cold weather.
- Open the chilled water coil valves and operate the chilled water circulating pump any time the outside air temperature is below 35°F.
- Use antifreeze in the system.

Hot Water

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. Freezestat is factory-furnished on units with hydronic coils. (See page 111 through page 113 for details).

Step 6: Units With Antifreeze

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

1. Divide the heating and/or cooling loads determined in Step 2 by the applicable capacity correction factor shown in Table 31 and Table 32 below to arrive at the calculated unit capacity required to take care of the capacity reduction caused by the glycol solution.

Table 31: Capacity Correction Factors for Ethylene Glycol

Ethylene Glycol% Weight	20%	30%	40%
Chilled Water	0.92	0.84	0.75
Hot Water	0.94	0.90	0.84

Table 32: Capacity Correction Factors for Propylene Glycol

Propylene Glycol% Weight	20%	30%	40%
Chilled Water	0.86	0.73	0.62
Hot Water	0.98	0.96	0.92

2. Determine the GPM required by entering the appropriate chilled water cooling capacity table or 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 33 and Table 34 on page 50.

Table 33: Pressure Drop Correction Factors for Ethylene Glycol

Ethylene Glycol% Weight	20%	30%	40%
Chilled Water	1.15	1.22	1.34
Hot Water	1.08	1.11	1.19

Table 34: Pressure Drop Correction Factors for Propylene Glycol

Propylene Glycol% Weight	20%	30%	40%
Chilled Water	1.24	1.27	1.35
Hot Water	1.07	1.11	1.15

Chilled Water 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) = 43.4 MBH
- Minimum sensible capacity (SC) = 28.3 MBH
- Minimum outdoor air = 20%
- Room volume = 9,000 cubic feet
- Desired number of air changes per hour = 8
- Supply water temperature = 45°F EWT

Step 3: Determine Air Quantity Required

"CFM For Given Rate Of Circulation" on page 48 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 an H13 unit ventilator should be used which delivers 1250 CFM.

Step 4: Select Unit Size

Determine the water flow (GPM), water temperature rise and the coil pressure drop 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 35 on page 51). Enthalpy (H) is calculated as follows:

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

$$\text{Enthalpy (H)} = 30.06\ (0.8) + 37.66\ (0.2) = 31.58 \text{ btu/lb}$$

Referring to Table 35 on page 51, EWB for 31.58 btu/lb = 67°F

Look Up Capacities

Look up the Chilled Water Cooling Coil Capacity Table for our calculated values and cooling loads (ED-18517):

- Unit size: 1250 cfm
- Entering dry bulb (EDB) = 80
- Entering wet bulb (EWB) = 67°F
- Supply water temperature (EWT) = 45°F

Under these conditions, the 4-row coil produces:

- 43.4 MBH (TC)
- 28.3 MBH (SC)
- 8.8 GPM
- 6.7 ft. H20 (WPD)
- 10°F (TR)

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

$$\text{LDB} = \text{EDB} - \frac{\text{SC(Btuh)}}{\text{CFM} \times 1.085} = 80 - \frac{28300}{1250 \times 1.085} = 59.1°\text{F}$$

$$\text{LWBH} = \text{EWBH} - \frac{\text{TC(Btuh)}}{\text{CFM} \times 4.5} = 31.62 - \frac{43400}{1250 \times 4.5} = 23.9$$

From Table 35 on page 51:

LWB at 23.9 H = 56.1°F.

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

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

Table 35: 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 three capacities. The low-capacity (65) coil and the high-capacity (66) coil can be used as heating only or in conjunction with a chilled-water or direct expansion cooling coil. The 3-row hot water coil (67) can be used as a super-high-capacity hot water coil in applications that require high heating capacities, such as in extremely cold climates or when a high percentage of outdoor air is utilized.

A 4-row heating coil cannot be used in conjunction with a separate cooling (4-row) coil since there is only sufficient space in the unit to accommodate a total of 6 rows of coil. See "Available Coil Combinations" on page 20.

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 88 MBH. Then,

ΔT = 180 - 55 = 125

and,

MBH/ΔT = 88/125 = 0.7

Assume we want to size for the H13, 1250 cfm unit determined in the coil selection example previously given for cooling. Referring to Figure 76 on page 53 through Figure 79 on page 55:

1. Enter each chart at MBH/ΔT = 0.7.
2. Move horizontally to the right to intersect the unit 1250 curve.
3. Project downward for GPM requirement.

It is quickly seen that the 1-row coil (Figure 76 on page 53) does not meet the heating load. The 2-row coil (Figure 77 on page 54) can meet the requirement with 5.0 GPM. The 3-row coil (Figure 78 on page 54) is somewhat oversized.

Two-Pipe Chilled-Water/Hot-Water Applications

The foregoing selection procedures are for heating-only or for 4-pipe heating/cooling applications using separate heating and cooling coils.

In 2-pipe chilled-water/hot-water applications, the same coil is used for chilled water during the cooling season and for hot water during the heating season. In this case, the same GPM will be used for hot water as was required for chilled water. It is necessary to determine only the supply water temperature required to satisfy the heating requirements. To do so:

1. Enter the appropriate chart at the known GPM.
2. Project upward to the size unit that is to be used.
3. Project a line horizontally across to obtain MBH/ΔT.
4. Divide the required MBH by the MBH/ΔT factor obtained from the chart.

This will give the required temperature difference between the supply water temperature and the entering air temperature. Supply water temperature can then be determined by adding the entering air temperature to this temperature difference.

Note: *For 2-pipe chilled-water/hot-water coils, heating capacity is approximately 4 to 5% higher than that for standard capacity coils at the same GPM.*

Table 36: Hot Water Coil Pressure Drop (ft H_2O)

Unit Size	Coil Rows	Water Flow (GPM)						
		2	4	6	8	10	12	14
H07, V07 750 cfm Nominal	1 row coil	0.6	2.5					
	2 row coil	1.2	4.9	11.0	19.5			
	3 row coil		2.6	5.8	10.3	16.1		
	4 row coil			6.6	11.7	18.2	26.2	
	5 row coil			7.2	12.1	18.1	25.1	
H10, V10 1000 cfm Nominal	1 row coil	0.6	2.5	5.7				
	2 row coil		3.4	7.7	13.7			
	3 row coil		2.9	6.4	11.4	17.8	25.7	
	4 row coil			4.3	7.7	12.0	17.3	23.6
	5 row coil			2.7	4.7	7.3	10.4	14.0
H13, V13 1250 cfm Nominal	1 row coil	0.6	2.6	5.8	10.3			
	2 row coil		2.3	5.2	9.2			
	3 row coil			2.9	5.1	7.9	11.4	
	4 row coil			3.1	5.5	8.7	12.5	17.0
	5 row coil			3.2	5.4	8.2	11.6	15.4
H15, V15 1500 cfm Nominal	1 row coil	0.7	2.8	6.4	11.4			
	2 row coil		2.6	5.9	10.5			
	3 row coil			3.3	5.9	9.2	13.2	
	4 row coil			2.4	4.2	6.6	9.4	12.9
	5 row coil			3.4	5.9	9.0	12.7	17.0
H20, V20 2000 cfm Nominal	1 row coil	0.7	2.8	6.4	11.4			
	2 row coil		2.6	5.9	10.5			
	3 row coil			3.3	5.9	9.2	13.2	
	4 row coil			2.4	4.2	6.6	9.4	12.9
	5 row coil			3.4	5.9	9.0	12.7	17.0

Note: *The 2 gpm shown for capacity data is minimum recommended. Less than 2 gpm results in laminar flow in which heat transfer is unstable and therefore unpredictable.*

Two-Pipe Selection Example

In the example previously given for cooling, the required flow rate was 12.5 GPM for the 4 row coil in an H13 unit with 1250 cfm. If we assume a heating load of 74 MBH, we can determine the required temperature difference as follows:

1. Enter the 4-row table (Figure 79 on page 55) with 12.5 GPM.
2. Project up to the 1250 curve.
3. Project horizontally to the left to determine the MBH/ ∆T factor of about 1.03.
4. Divide the required MBH (74) by the MBH/∆T factor obtained (1.03) from the chart. The resulting temperature difference is 70.

With a room design temperature of 70°F and assuming 20% outdoor air, the entering air temperature would be:

0 (.20) + 70 (.80) = 56°F

Therefore, the required supply water temperature would be: 70°F + 56°F = 126°F

Note: *The 4 row coil has a very high heating capacity since it is sized for air conditioning. For this reason, a low entering water temperature will usually satisfy the heating requirements. This temperature may be too low for other equipment (such as radiation or convectors) in the system. It is important that supply water temperature be kept as close to that required by the unit ventilator as possible. Higher than required water temperature can result in poor temperature control resulting in overheating.*

Figure 76: 1-Row Hot Water Coil

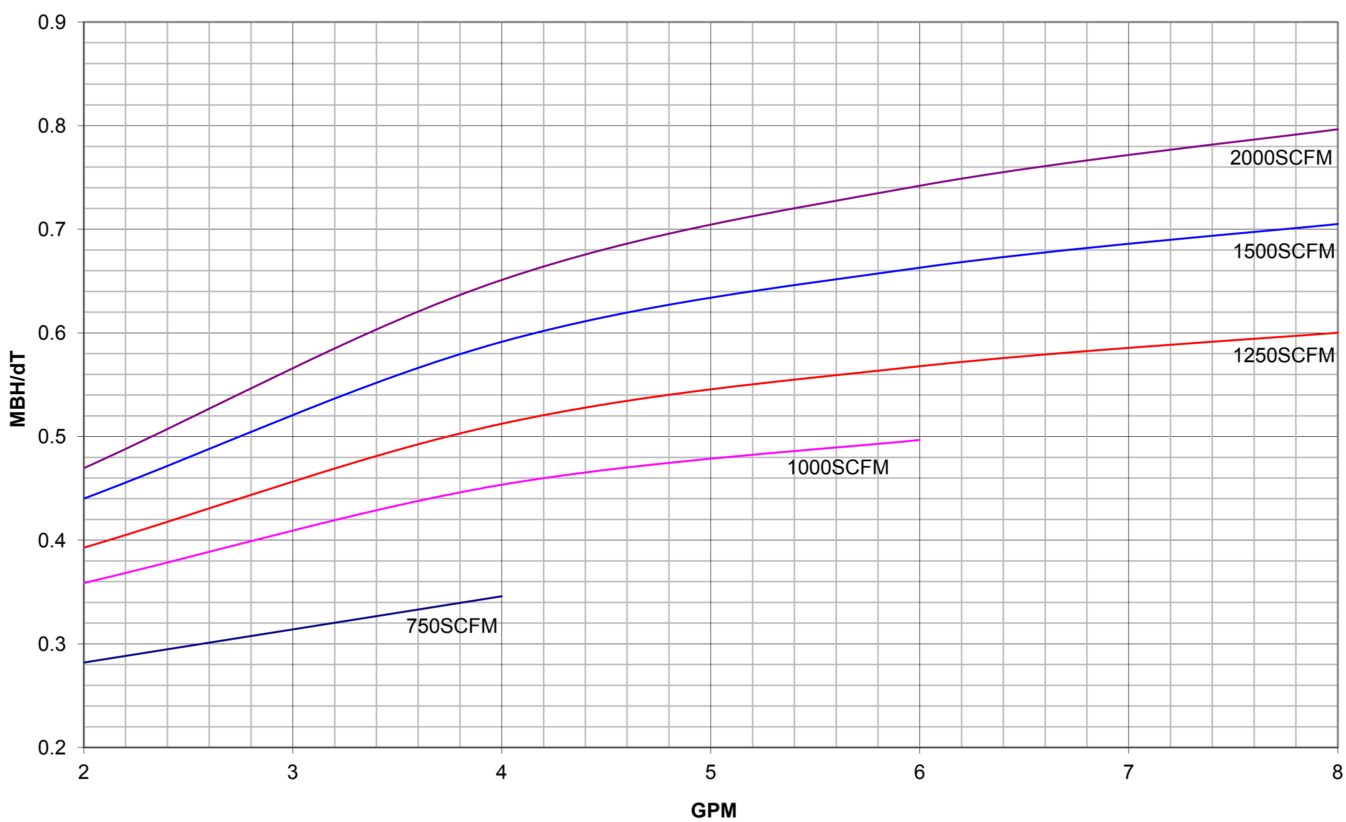
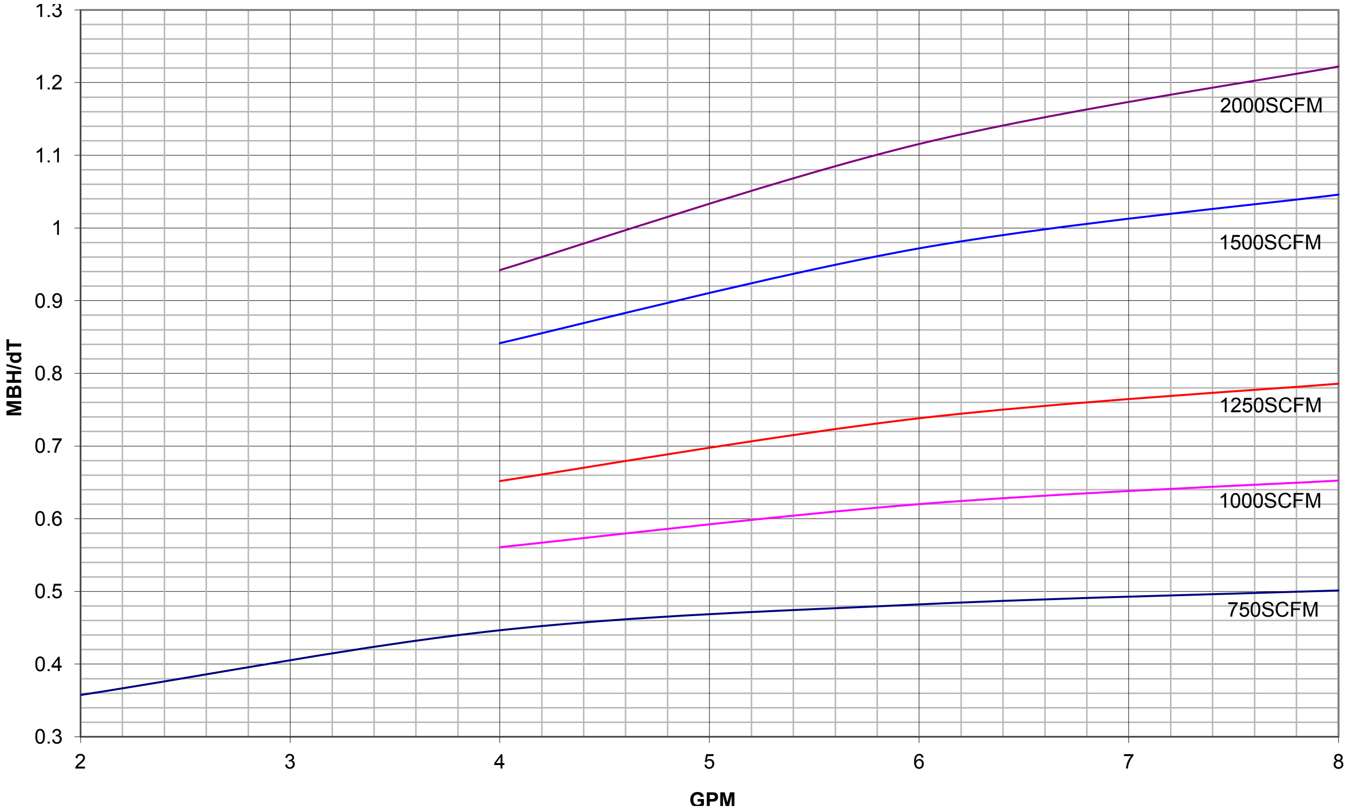
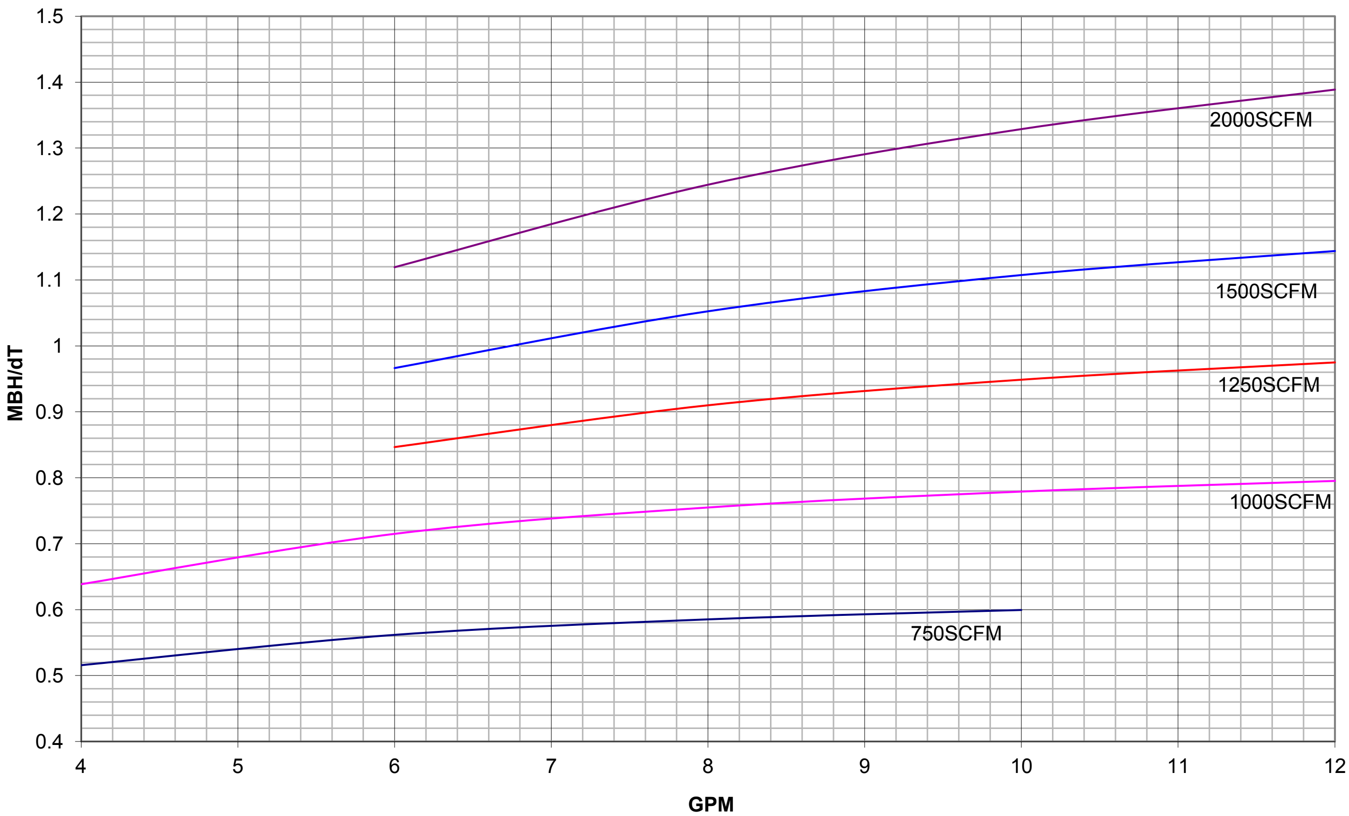


Figure 77: 2-Row Hot Water Coil (Parallel Flow)



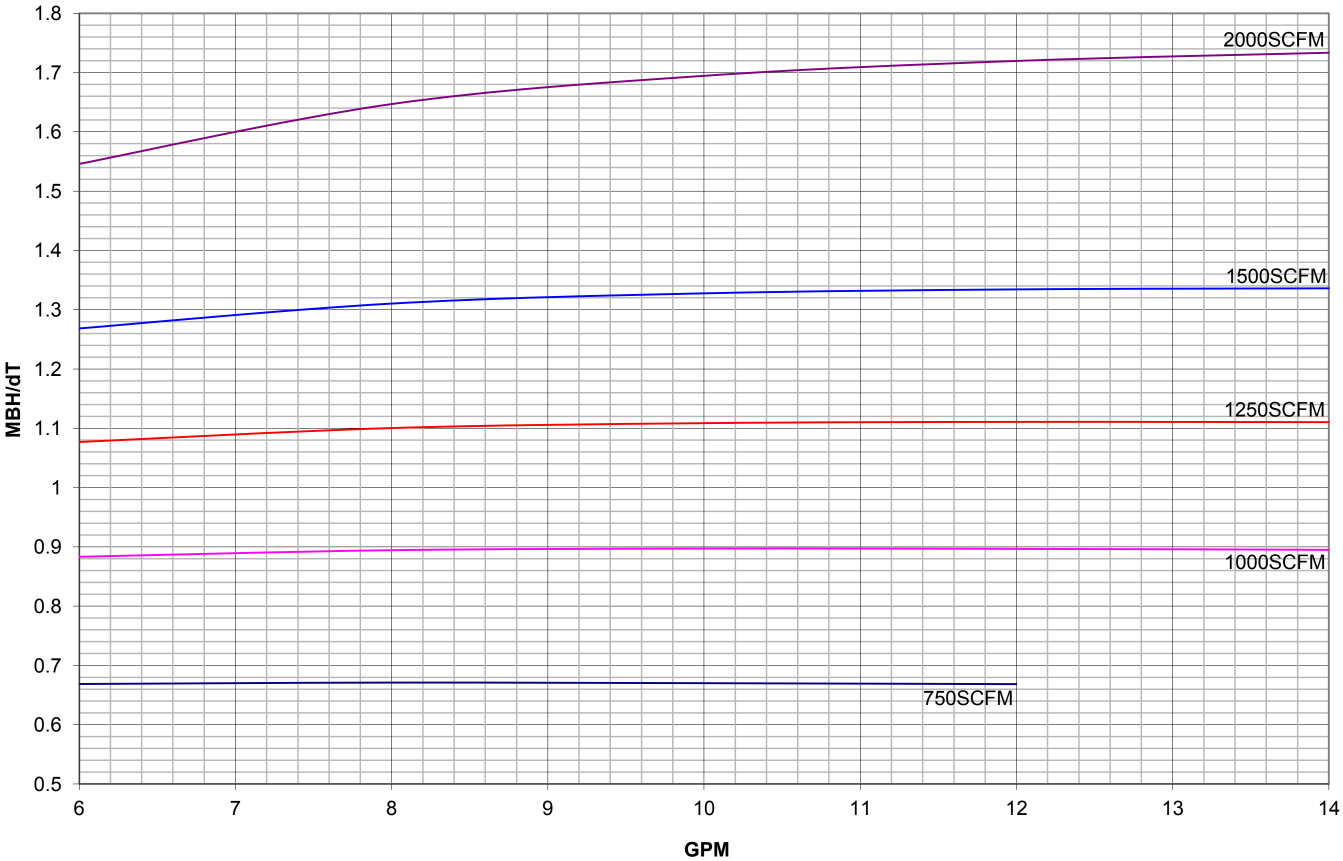
Note: For 2-pipe CW/HW coils, heating capacity is approximately 4 to 5% higher for standard capacity coils at the same GPM.

Figure 78:3-Row Hot Water Coil (Parallel Flow)



Note: For 2-pipe CW/HW coils, heating capacity is approximately 4 to 5% higher for standard capacity coils at the same GPM.

Figure 79: 4-Row, 2-Pipe Cold Water/Hot Water Coil (Counter 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 37 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, multiply the total capacity given by the proper constant from the Steam Capacity Correction Factor in Figure 78.

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 37: Steam Heating Capacities - 2# Steam Coils[1]

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
750	Std	750	55.1	47.8	52.7	54.9	50.3	61.8	47.8	68.8	45.3	75.7	42.7	82.6	40.0	89.2	37.3	95.9	35.6	103.8	32.9	110.5
	High		73.0	69.8	69.8	75.8	66.5	81.8	63.2	87.7	59.8	93.5	56.4	99.3	52.7	104.8	49.1	110.4	45.4	115.8	41.6	121.1
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
2000	Std	2000	142.3	45.6	136.5	52.9	130.7	60.3	124.8	67.5	118.9	74.8	112.8	82.0	106.6	89.1	100.3	96.3	94.0	103.3	87.5	110.4
	High		167.8	57.3	160.9	64.2	154.0	71.0	146.9	77.7	139.8	84.5	133.7	91.6	126.4	98.3	119.0	104.9	111.5	111.4	103.8	117.9

[1] *Data based on 2 psig steam pressure @ 10°F superheat steam vapor.*

Table 38: 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 39: Electric Heat Capacities

Unit Type	AHF AHV AHR	AHV AHR	AHF AHV AHR	AHV AHR	AHF AHV AHR	AHV AHR	AHF AHV AHR	AHV AHR	AHF AHV AHR	AHV AHR
CFM	750 (H07)		1000 (H10)		1250 (H13)		1500 (H15)		2000 (H20)	
Number of Electric Elements	3	6	3	6	3	6	3	6	3	6
208 Volt Units										
KW	6.0	12.0	8.0	16.0	10.0	20.0	12.0	24.0	12.0	24.0
MBH	20.5	41	27.3	54.6	34.1	68.3	41	81.9	41	81.9
Final Air Temp °F (70°F Entering Air Temp)	95.2	120.3	95.2	120.3	95.2	120.3	95.2	120.3	89.0	107.9
Air Temperature Rise	25.2	50.3	25.2	50.3	25.2	50.3	25.2	50.3	19.0	37.9
230, 265 or 460 Volt Units										
KW	5.5	11.0	7.4	14.7	9.2	18.4	11.0	22.0	11.0	22.0
MBH	18.8	37.5	25.3	50.2	31.4	62.8	37.5	75.1	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	93.2	116.2	87.4	104.8
Air Temperature Rise	23.2	46.2	23.2	46.2	23.2	46.2	23.2	46.2	17.4	34.8

Direct Expansion Cooling Coil Selection

Proper sizing of the field-supplied condensing units is important for trouble-free operation. An oversized condensing unit can reduce performance and cause operational problems such as:

- Compressor short cycling due to rapid pull down.
- Poor temperature and humidity control.
- Low saturated evaporator coil conditions.
- Low discharge air temperatures.

To properly size the unit ventilator, determine the cooling load based on May and September conditions at 1 pm when the classroom is occupied. Do not select units for July and August after 3 pm when the classroom is unoccupied. If the calculated cooling load falls between two unit sizes, select the smaller of the two units to minimize the potential problems seen with oversized units.

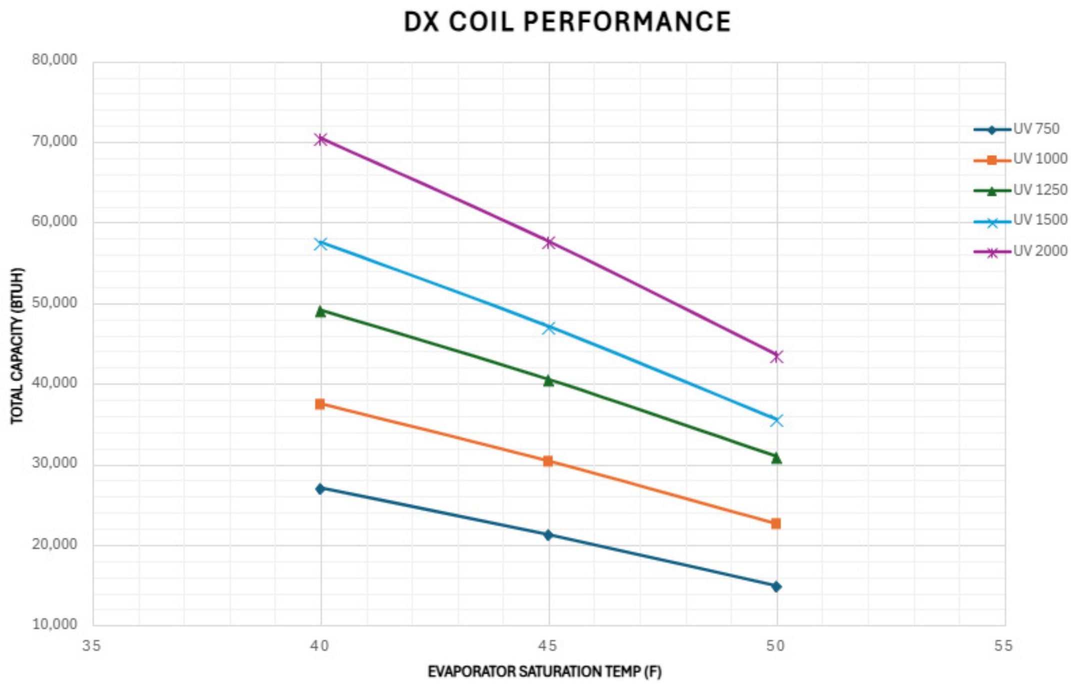
Figure 80 shows the total capacity of the unit ventilator versus saturated evaporator temperature. The condensing unit manufacturer's capacity versus saturated suction temperature can be cross-plotted on this chart with an allowance for suction line loss. The total capacity and saturated suction temperature for the total system can be determined from this cross plot. The sensible capacity can be determined by multiplying the total capacity by the sensible heat factor shown in Table 40.

Table 40: Sensible Factor At 43°F Saturation Temperature

750	1000	1250	1500	2000
0.74	0.75	0.74	0.76	0.76

NOTE: *This table is for estimation purposes only. For more information, refer to the Daikin Select Tools™ (DST) selection program.*

Figure 80: DX Coil Estimated Performance (Mbh at 115°F Liquid Temperature)



Electrical Data

Table 41: Electrical Data/Motor Data and Unit Amp Without Electric Heat

Unit Series	CFM		ESP		Motor		Unit Current				Unit MCA				Fuse or Breaker			
	Nominal	L/s	iwc	Pa	HP	Watts	115V	208V	230V	265V	115V	208V	230V	265V	115V	208V	230V	265V
H07/V07	750	354	0-.45	0-112.5	1/3	246	5.0	3.0	2.8	2.6	6.3	3.8	3.5	3.3	15	15	15	15
H10/V10	1000	472	0-.45	0-112.5	1/3	246	5.0	3.0	2.8	2.6	6.3	3.8	3.5	3.3	15	15	15	15
H13/V13	1250	590	0-.45	0-112.5	1/3	246	5.0	3.0	2.8	2.6	6.3	3.8	3.5	3.3	15	15	15	15
H15/V15	1500	708	0-.45	0-112.5	3/4	560	9.6	7.3	6.8	5.5	12.0	9.1	8.5	6.9	15	15	15	15
H20/V20	2000	944	0-.45	0-112.5	3/4	560	9.6	7.3	6.8	5.5	12.0	9.1	8.5	6.9	15	15	15	15

NOTE 1: Unit wire sizing should be determined in accordance with NEC and local codes.

NOTE 2: # Amps at unit voltage, 60 Hz, single phase

Table 42: Standard Motor Electric Heat Capacities, Amps, Wire Sizing, and Over Current Protection

	Unit Type	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR
	CFM	750			1000			1250			1500			2000		
	Indoor Fan Motor HP	0.33			0.33			0.33			0.75			0.75		
	# of Electric Heater Elements	–	3	6	–	3	6	–	3	6	–	3	6	–	3	6
115-60-1	Indoor Fan Motor Nameplate Amps	5.0	—	—	5.0	—	—	5.0	—	—	9.6	—	—	9.6	—	—
	Electric Heater Amps	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Unit MCA	6.25	—	—	6.25	—	—	6.25	—	—	12	—	—	12	—	—
	Max Fuse Size or Circuit Breaker	15	—	—	15	—	—	15	—	—	15	—	—	15	—	—
208-60-1	Indoor Fan Motor Nameplate Amps	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	7.3	7.3	7.3	7.3	7.3	7.3
	Electric Heat KW	—	6.0	12.0	—	8.0	16.0	—	10.0	20.0	—	12.0	24.0	—	12.0	24.0
	Electric Heater Amps	—	28.8	57.7	—	38.5	76.9	—	48.1	96.2	—	57.69	115.38	—	57.7	115.4
	Unit MCA	3.75	39.75	75.88	3.75	51.88	99.88	3.75	63.88	124.00	9.13	81.25	153.38	9.13	81.25	153.38
	Max Fuse Size or Circuit Breaker	15	40	80	15	60	100	15	70	125	15	90	175	15	90	175
230-60-1	Indoor Fan Motor Nameplate Amps	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	6.8	6.8	6.8	6.8	6.8	6.8
	Electric Heat KW	—	5.5	11.0	—	7.4	14.7	—	9.2	18.4	—	11	22.1	—	11.0	22.1
	Electric Heater Amps	—	25.0	50.0	—	33.3	66.7	—	41.7	83.3	—	50	100	—	50.0	100.0
	Unit MCA	3.5	34.75	66.00	3.50	45.13	86.88	3.50	55.59	107.63	8.5	71	133.5	8.50	71.00	133.50
	Max Fuse Size or Circuit Breaker	15	35	70	15	50	90	15	60	110	15	80	150	15	80	150
265-60-1	Indoor Fan Motor Nameplate Amps	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	5.5	5.5	5.5	5.5	5.5	5.5
	Electric Heat KW	—	5.5	11.0	—	7.4	14.7	—	9.2	18.4	—	11	22.1	—	11.0	22.1
	Electric Heater Amps	—	21.7	43.3	—	28.9	57.8	—	36.1	72.2	—	43.32	86.64	—	43.3	86.6
	Unit MCA	3.25	30.38	57.38	3.25	39.38	75.50	3.25	48.38	93.50	6.88	61	115.13	6.88	61.00	115.13
	Max Fuse Size or Circuit Breaker	15	35	60	15	40	80	15	50	100	15	70	125	15	70	125

	Unit Type	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR	AHF AHB AHV AHR	AHF AHV AHR	AHV AHR
	CFM	750			1000			1250			1500			2000		
	Indoor Fan Motor HP	0.33			0.33			0.33			0.75			0.75		
	# of Electric Heater Elements	–	3	6	–	3	6	–	3	6	–	3	6	–	3	6
208-60-3	Indoor Fan Motor Nameplate Amps	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	7.3	7.3	7.3	7.3	7.3	7.3
	Electric Heat KW	—	6.0	12.0	—	8.0	16.0	—	10.0	20.0	—	12	24	—	12.0	24.0
	Electric Heater Amps	—	16.7	33.3	—	22.2	44.4	—	27.8	55.5	—	33.34	66.69	—	33.3	66.7
	Unit MCA	3.75	24.63	45.38	3.75	31.50	59.25	3.75	38.50	73.13	9.13	50.75	92.5	9.13	50.75	92.50
	Max Fuse Size or Circuit Breaker	15	25	50	15	35	60	15	40	80	15	60	100	15	60	100
230-60-3	Indoor Fan Motor Nameplate Amps	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	6.8	6.8	6.8	6.8	6.8	6.8
	Electric Heat KW	—	5.5	11.0	—	7.4	14.7	—	9.2	18.4	—	11	22.1	—	11.0	22.1
	Electric Heater Amps	—	14.5	28.9	—	19.3	38.5	—	24.1	48.2	—	28.9	57.8	—	28.9	57.8
	Unit MCA	3.5	21.63	39.63	3.5	27.63	51.63	3.5	33.63	63.75	8.5	44.63	80.75	8.5	44.63	80.75
	Max Fuse Size or Circuit Breaker	15	25	40	15	30	60	15	35	70	15	45	90	15	45	90
460-60-3	Indoor Fan Motor Amps *	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	9.6	9.6	9.6	9.6	9.6	9.6
	Electric Heat KW	—	5.5	11.0	—	7.4	14.7	—	9.2	18.4	—	11	22.1	—	11.0	22.1
	Electric Heater Amps	—	7.2	14.5	—	9.6	19.3	—	12.0	24.1	—	14.45	28.9	—	14.5	28.9
	Unit MCA	6.25	10.60	19.63	6.25	13.60	25.69	6.25	16.61	31.69	12	21.06	39.13	12	21.06	39.13
	Max Fuse Size or Circuit Breaker	15	15	20	15	15	30	15	20	35	15	25	40	15	25	40

NOTE: Electric heat disconnect provided.

Wiring Diagrams

Typical MicroTech Wiring Diagrams

Figure 81: Electromechanical Controls – A2L Leak Mitigation

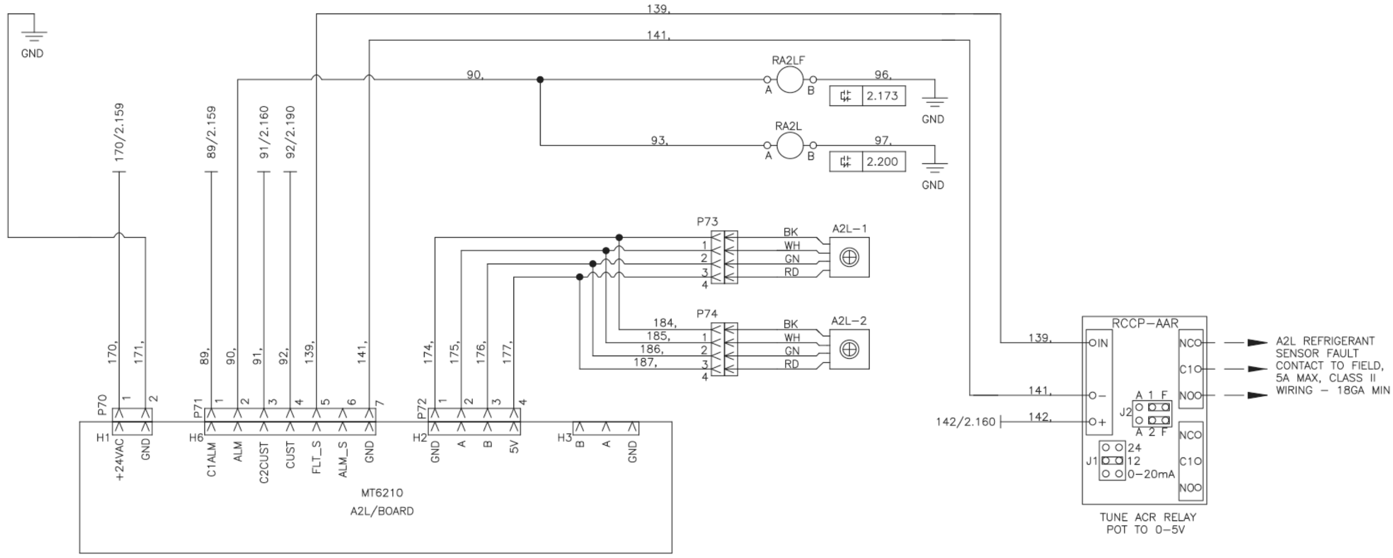


Figure 82: Typical MicroTech Wiring – 115 Volt/60 Hz /1 Ph

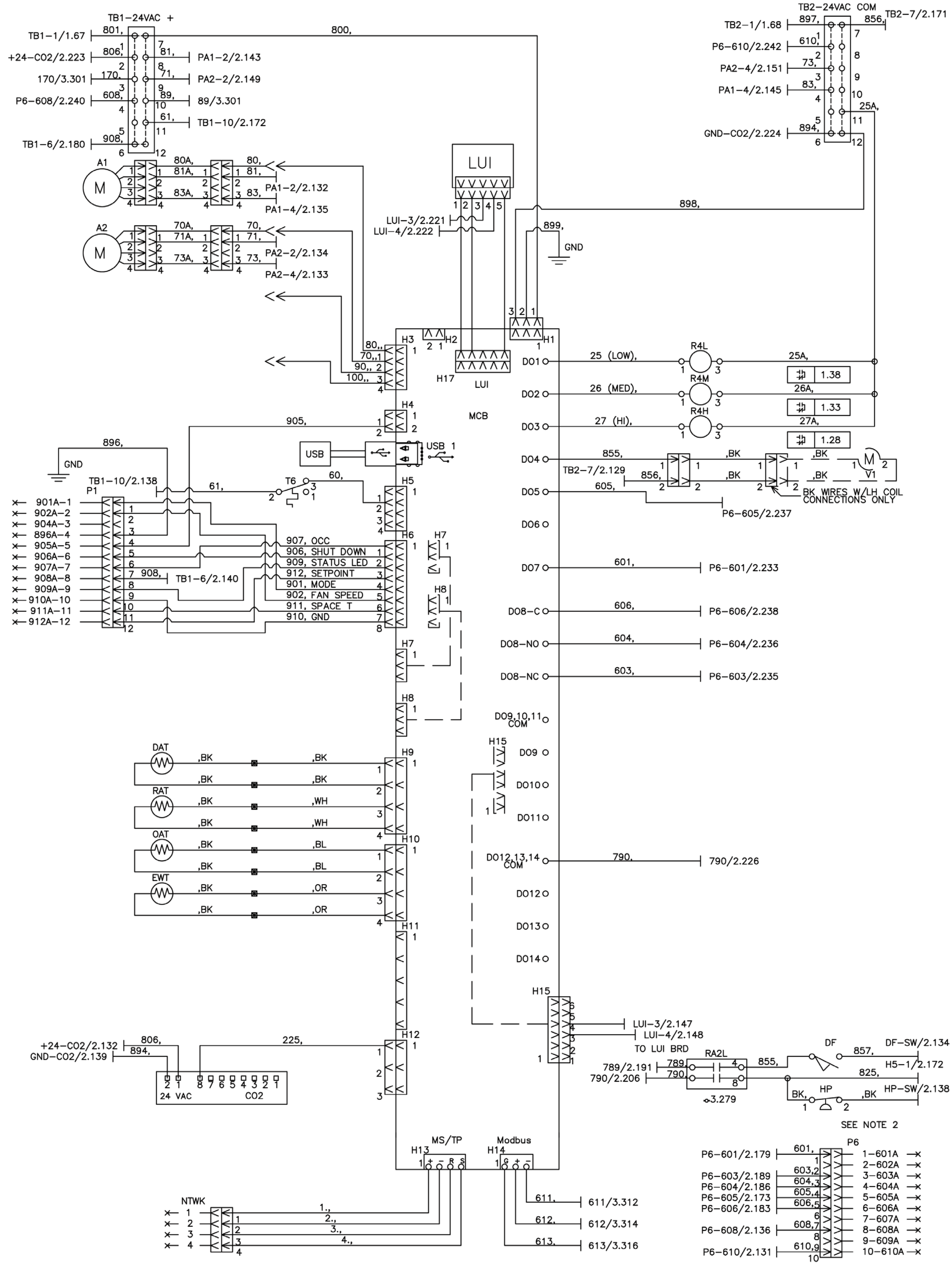
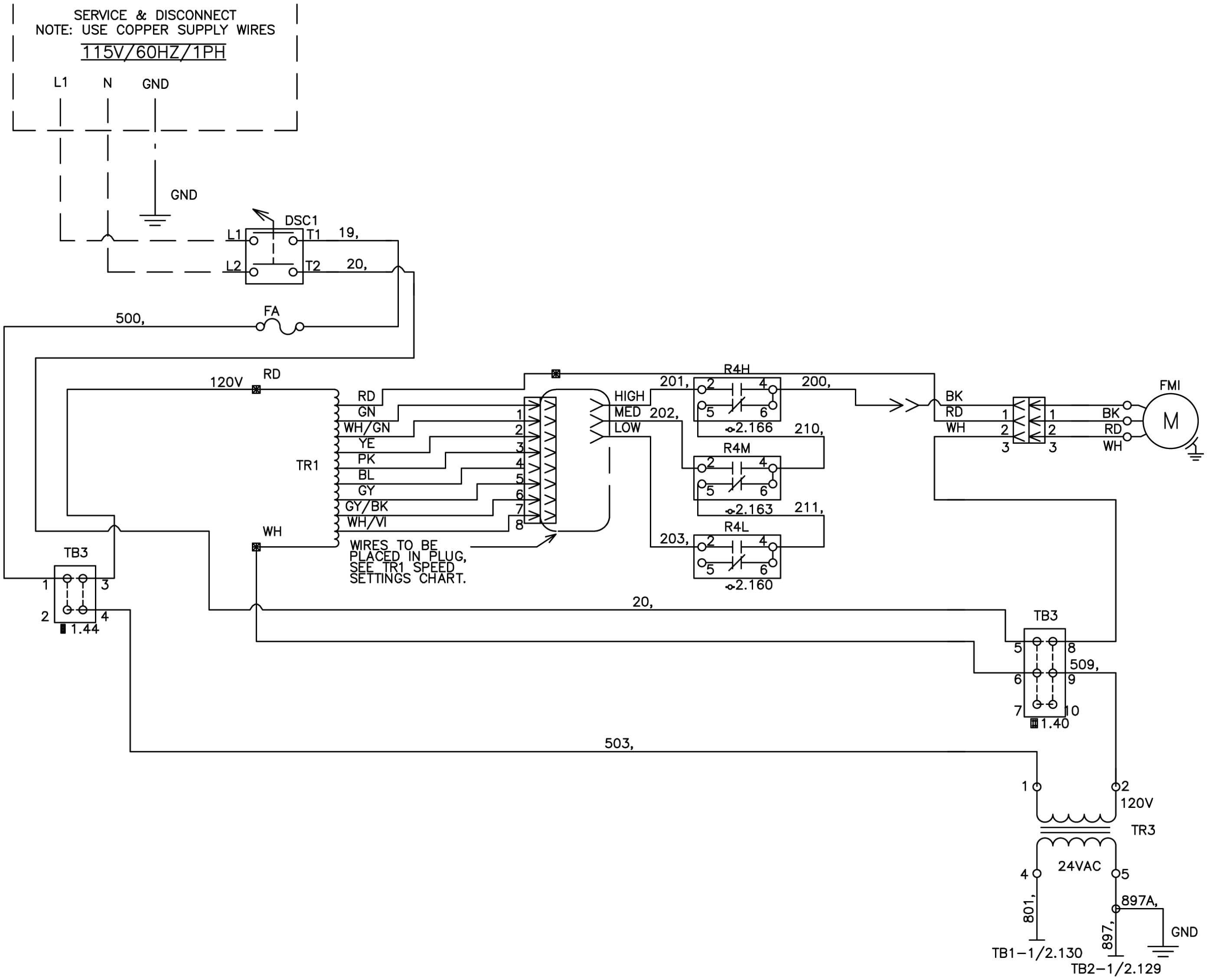


Figure 83: Typical MicroTech Wiring Diagram – Service and Disconnect, 115 Volt/60 Hz/1 Ph



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
F1A/F1B	Fuse - Compressor	**RV**	Reversing Valve
F2A/F3C	Fuse - Electric Heat	**T6**	Thermostat - Freeze Stat
FA/FB	Fuse– Control, Load	**TB1**	Terminal Block - 24VAC+
FC/FD	Fuse– Control, Transformer	**TB2**	Terminal Block – 24VAC Gnd
FMI	Motor - Room Fan	**TB3**	(A, B) Terminal Block – Main Power
FMO	Motor Outdoor Air	**TBE**	Terminal Block - Electric Heat
HP	High Pressure Switch	**TR1**	Transformer - Motor Speed
ICT	Sensor - Indoor DX Coil Temperature	**TR3**	Transformer - 208 / 230V-24V, 75VA
IH	Sensor - Indoor Humidity	**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				
	750	**1000**	**1250**	**1500**
High	PK	YE	WH/GN	GN
Med	GY	GY	PK	YE
Low	GY/BK	GY/BK	GY	PK

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.

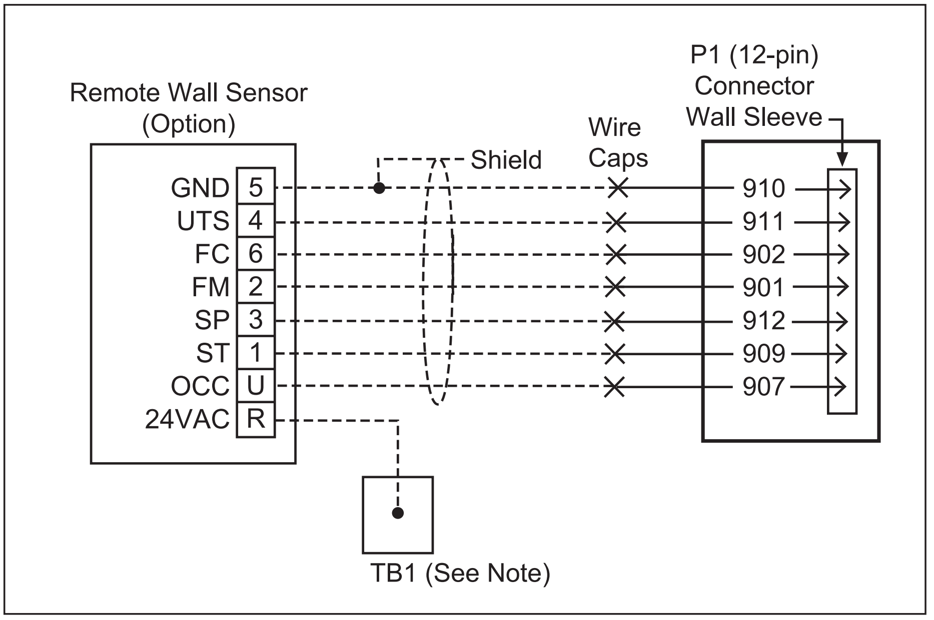
NOTE 3: EC Motors are factory programmed for specified airflow. Contact Daikin Applied for replacement.

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

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

Typical Wall Sensors Diagram

Figure 84: Wall-Mounted Temperature Sensor Wiring



Power and Control Field Wiring

Figure 85: External Input Wiring Examples with or without Daisy Chaining of Units

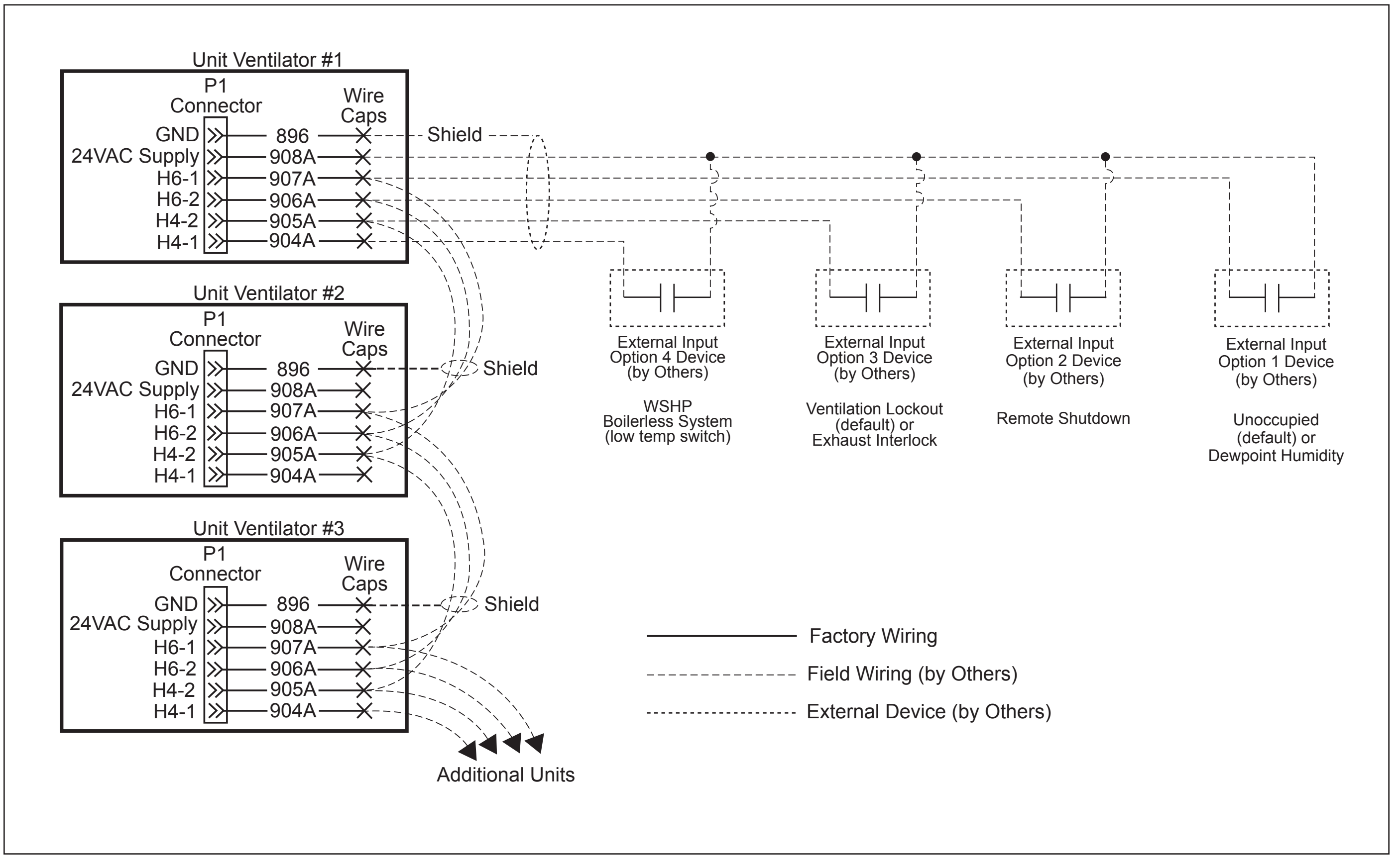


Figure 86: External Output Wiring - Single Unit

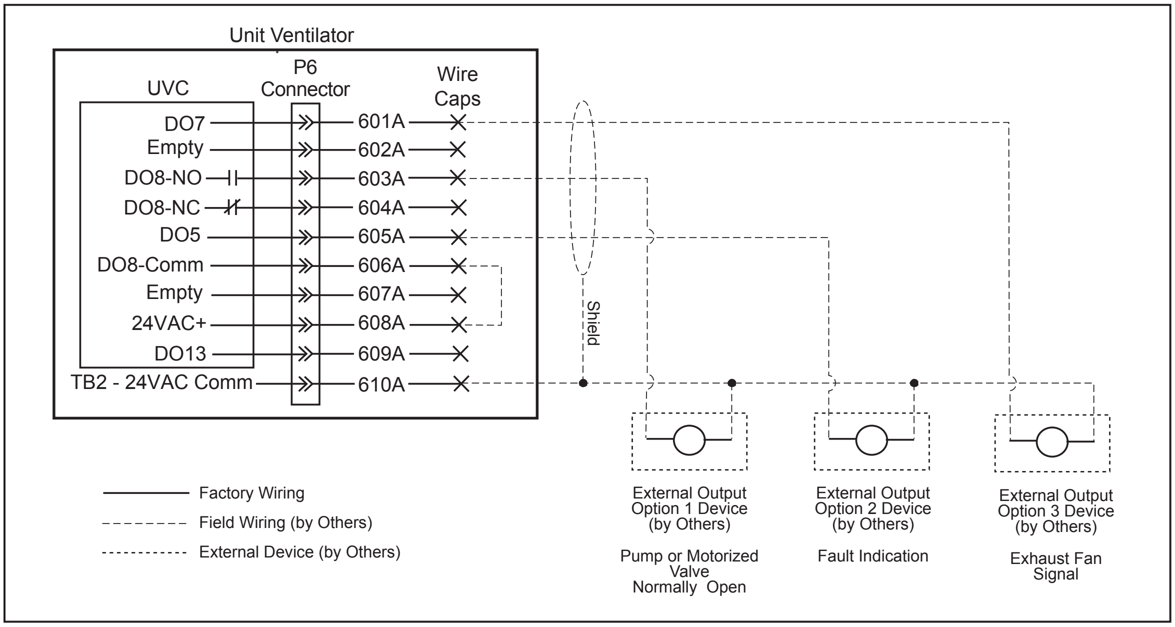


Figure 87: Split-System Condensing Unit Signal Wiring

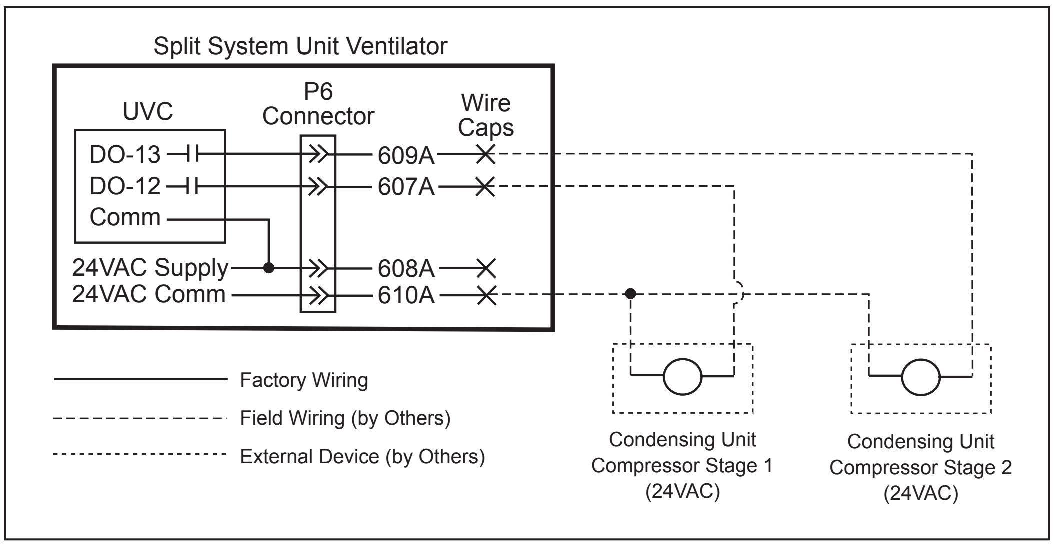
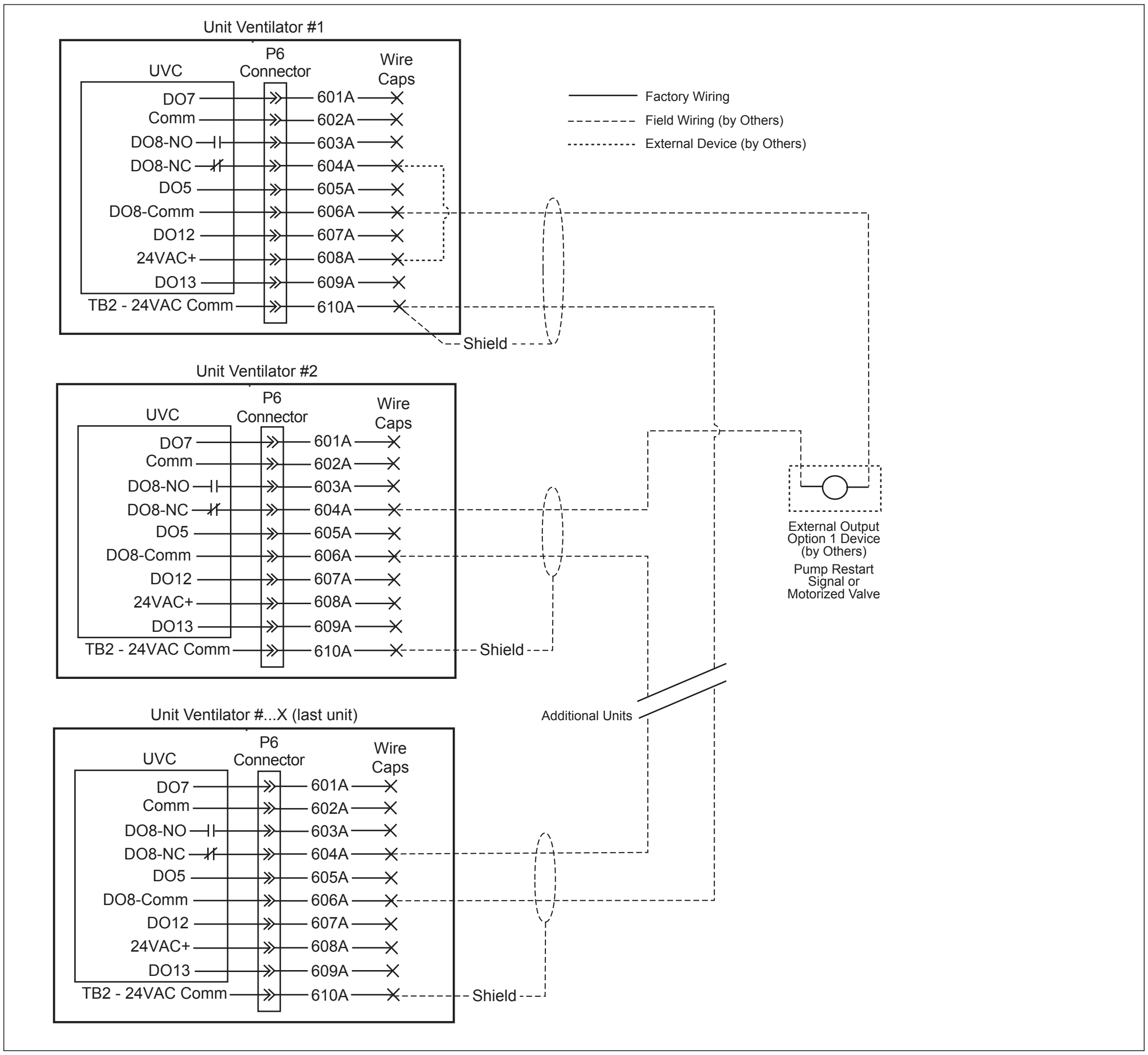


Figure 88: External Output Wiring - Multiple Units Shown



Digital Ready Face and Bypass Control Wiring Diagrams

Figure 89: Digital Ready Face and Bypass Control - 208-230 V/60 Hz/1 Ph

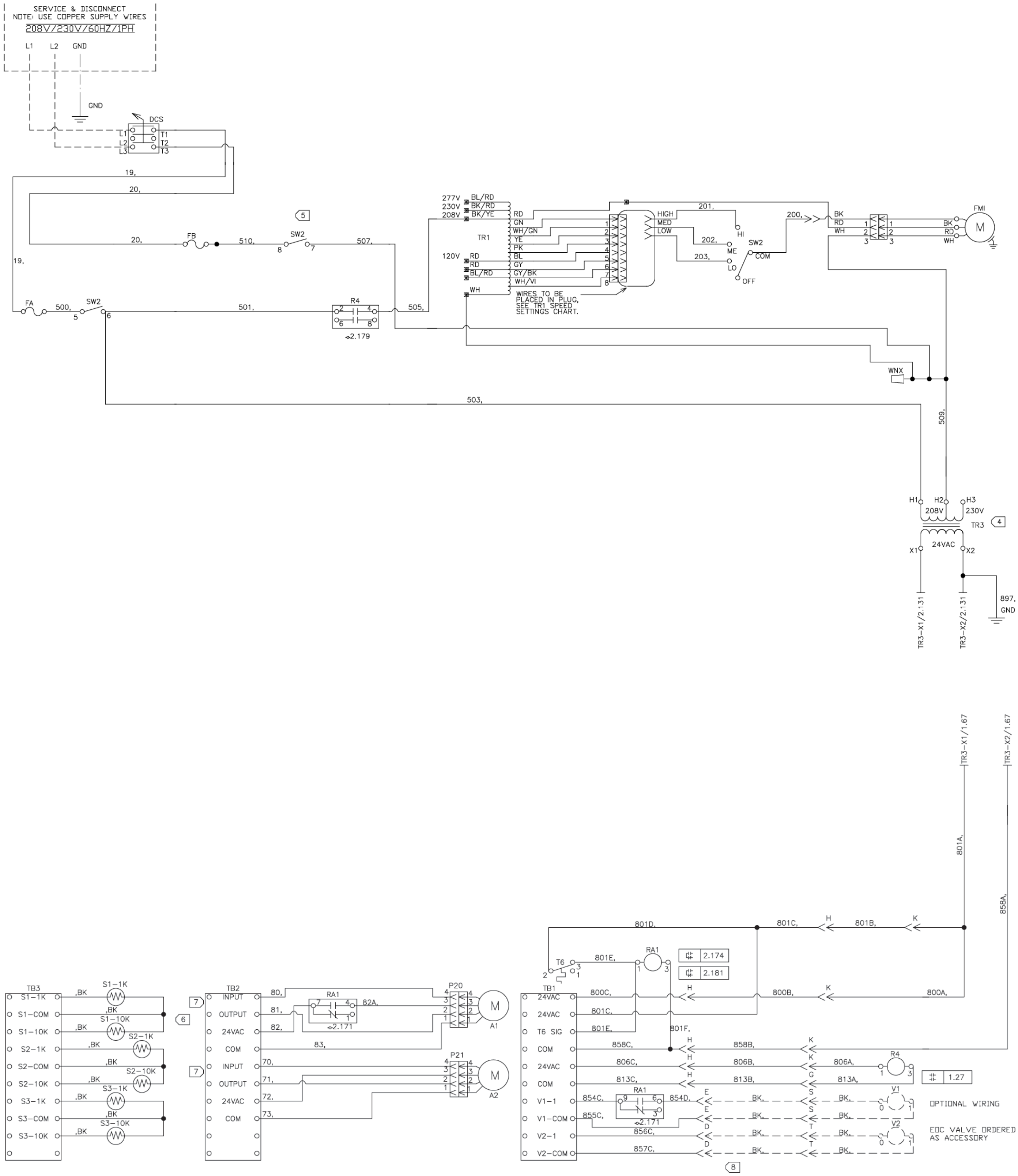
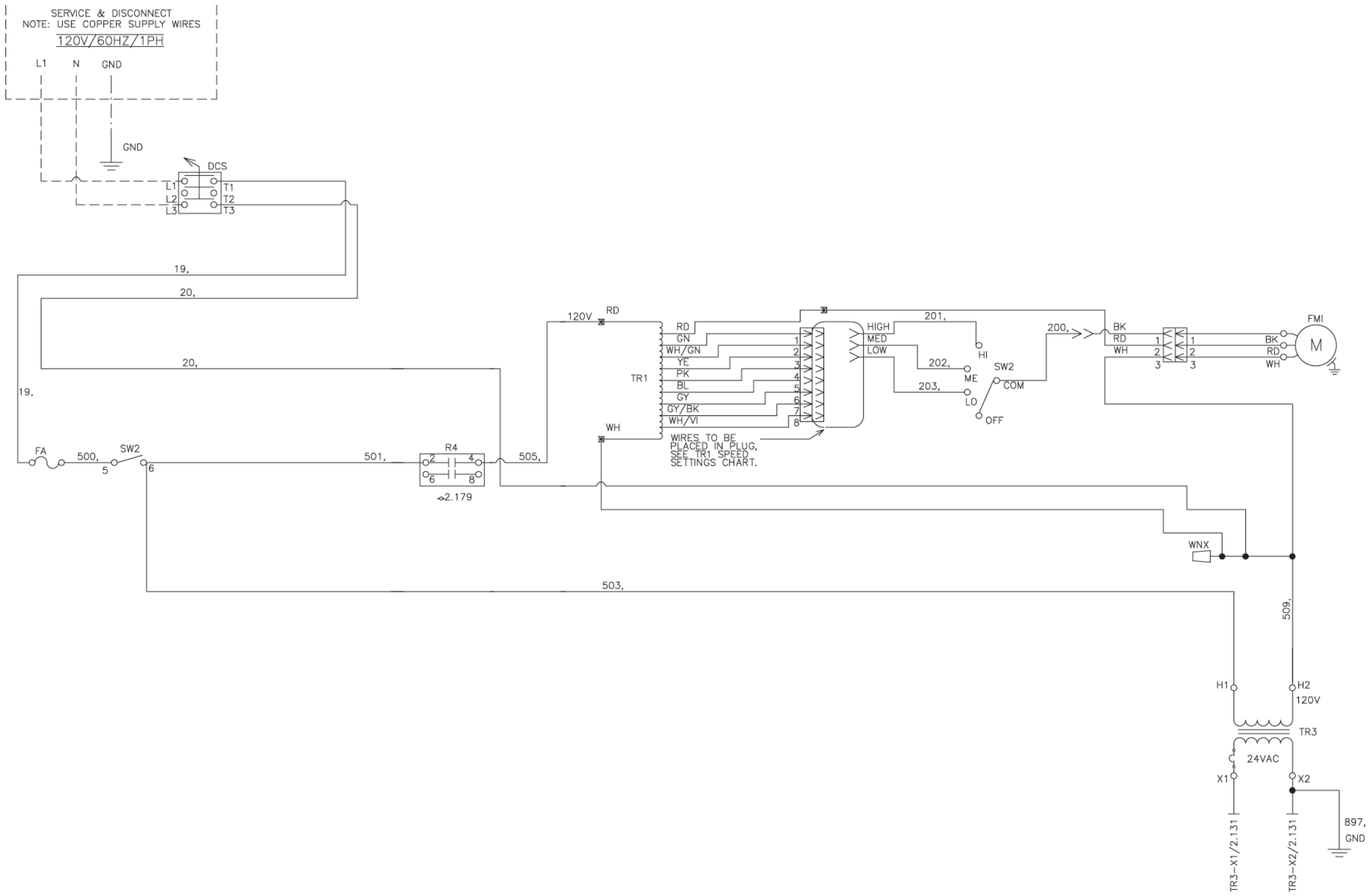


Figure 90: Digital Ready Face and Bypass Control - 120 V/60 Hz/1 Ph



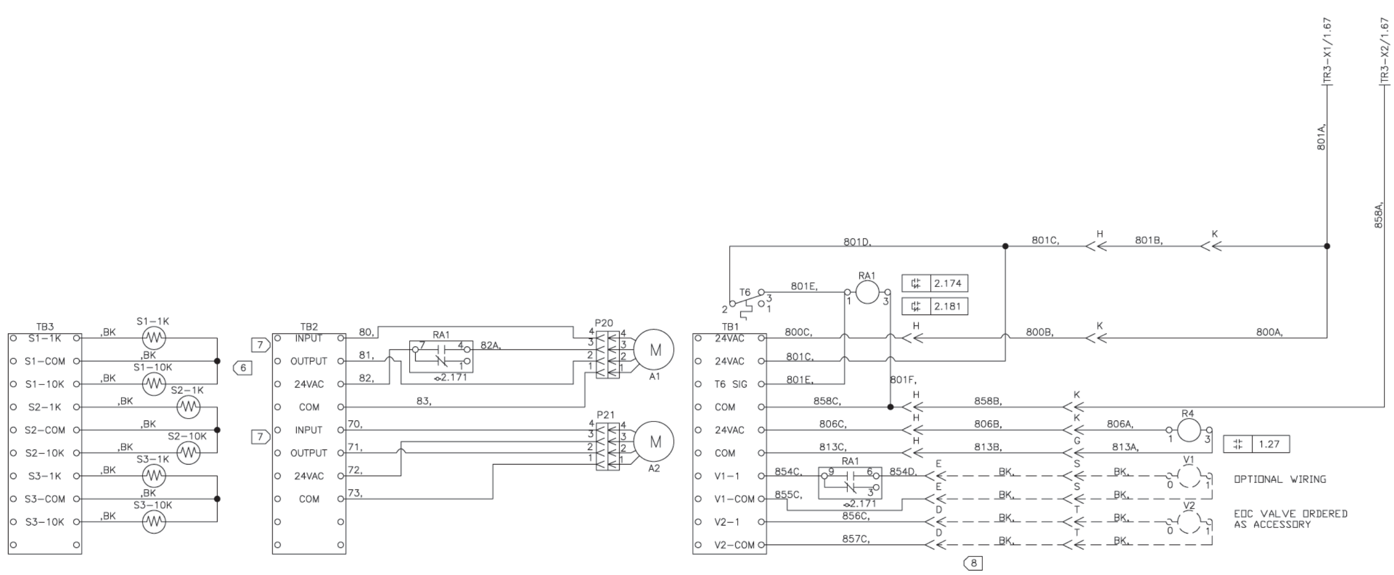
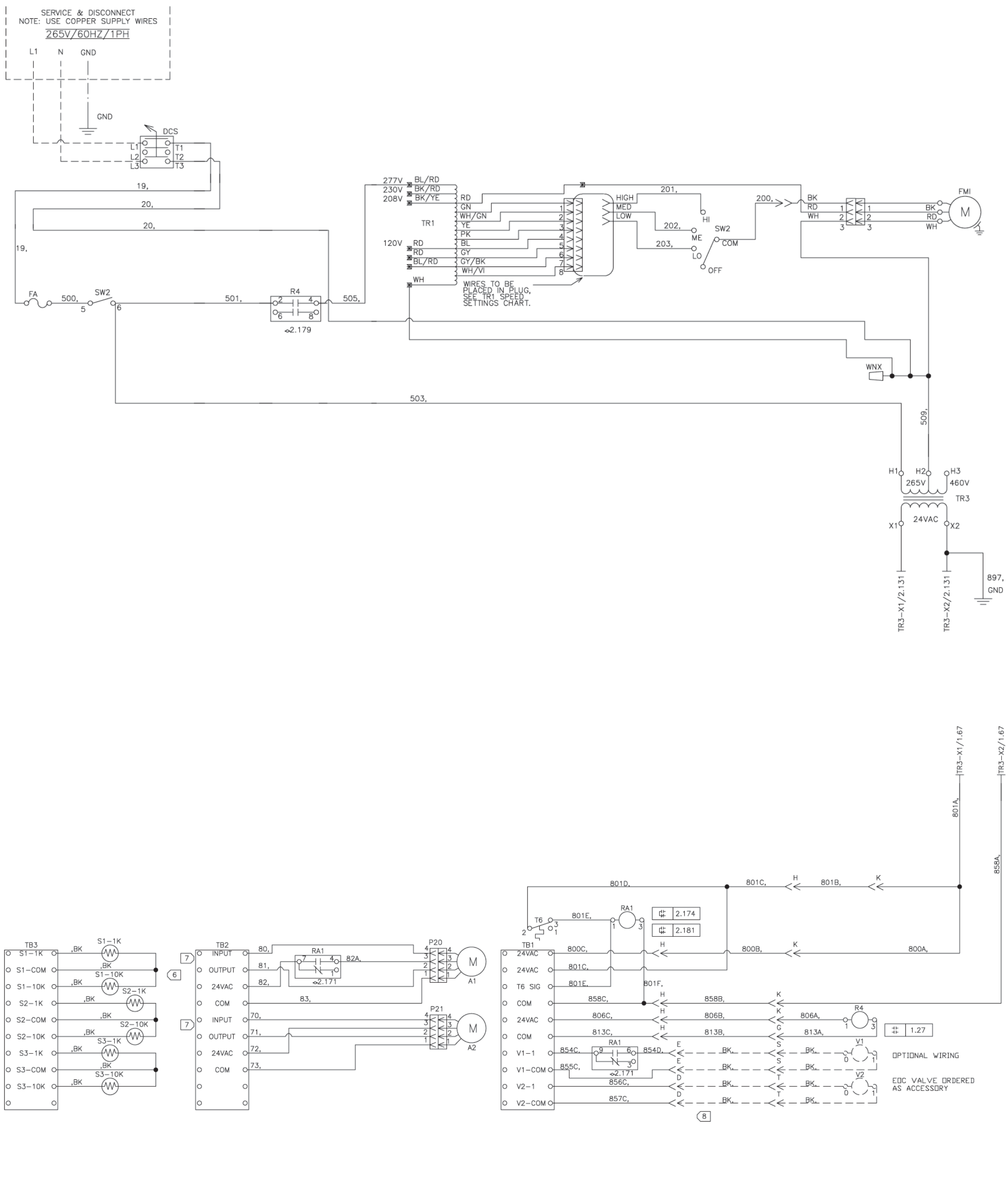


Figure 91: Digital Ready Face and Bypass Control - 265 V/60 Hz/1 Ph



Wiring Schematics Legend for "Digital Ready Face and Bypass Control Wiring Diagrams"

Legend			
A1	Actuator- Outdoor Air	**SW1**	Switch Disconnect
A2	Actuator- Face & Bypass	**SW2**	Switch - On, Off, and Fan Speed
DCS	Switch - Unit Power	**T6**	Thermostat - Freeze Stat
FA/FB	Fuse– Control, Load	**TB1**	Terminal Board Control
FMI	Motor - Room Fan	**TB2**	Terminal Board Control
R2A	Relay – Actuator/Valve	**TB3**	Terminal Board Control
R4	Relay – Fan Coil (24VAC)	**TR1**	Transformer - Motor Speed
S1	Sensor - Room Air	**TR3**	Transformer - 24V, 75VA
S2	Sensor - Discharge Air	**V1**	Valve - Heating N.O. Spring Return
S3	Sensor - Outdoor Air	**V2**	Valve - Cooling N.O. Spring Return

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 #)

Motor Size	SW2 Term	TR1 Speed Settings			
		750	1000	1250	1500
1/4 HP 0.00-0.20 ESP	High	PK	YE	WH/GN	GN
	Med	GY	GY	PK	YE
	Low	GY/BK	GY/BK	GY	PK

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

NOTE 2: Automatic temperature control supplier is responsible to ensure controls operate correctly and protect the unit.

NOTE 3: Cap all unused transformer leads.

NOTE 4: For 230V operation, switch wire 509 to 240V terminal in the transformer.

NOTE 5: Fuse FB, wire 510, and wire 507 furnished on 208/230 volt units only.

NOTE 6: 1K thermistor is positive temperature coefficient. 10K thermistor is negative temperature coefficient.

NOTE 7: Actuators, 24VAC for 2 to 10 VCD control input. For A 4 to 10 mA input control signal, add a 500 Ω resistor across WHT and BLK. Output signal of 2 to 10 VDC for position feedback.

NOTE 8: Cord furnished on right hand connections.

NOTE 9: Devices in legend may or may not be on unit.

Typical Controls by Others – Units with Optional EC Motor with Variable Airflow

Figure 92: Variable Airflow 208-230V /60 Hz/1 Ph – Motor Switchbox, Non-Electric Heat Units

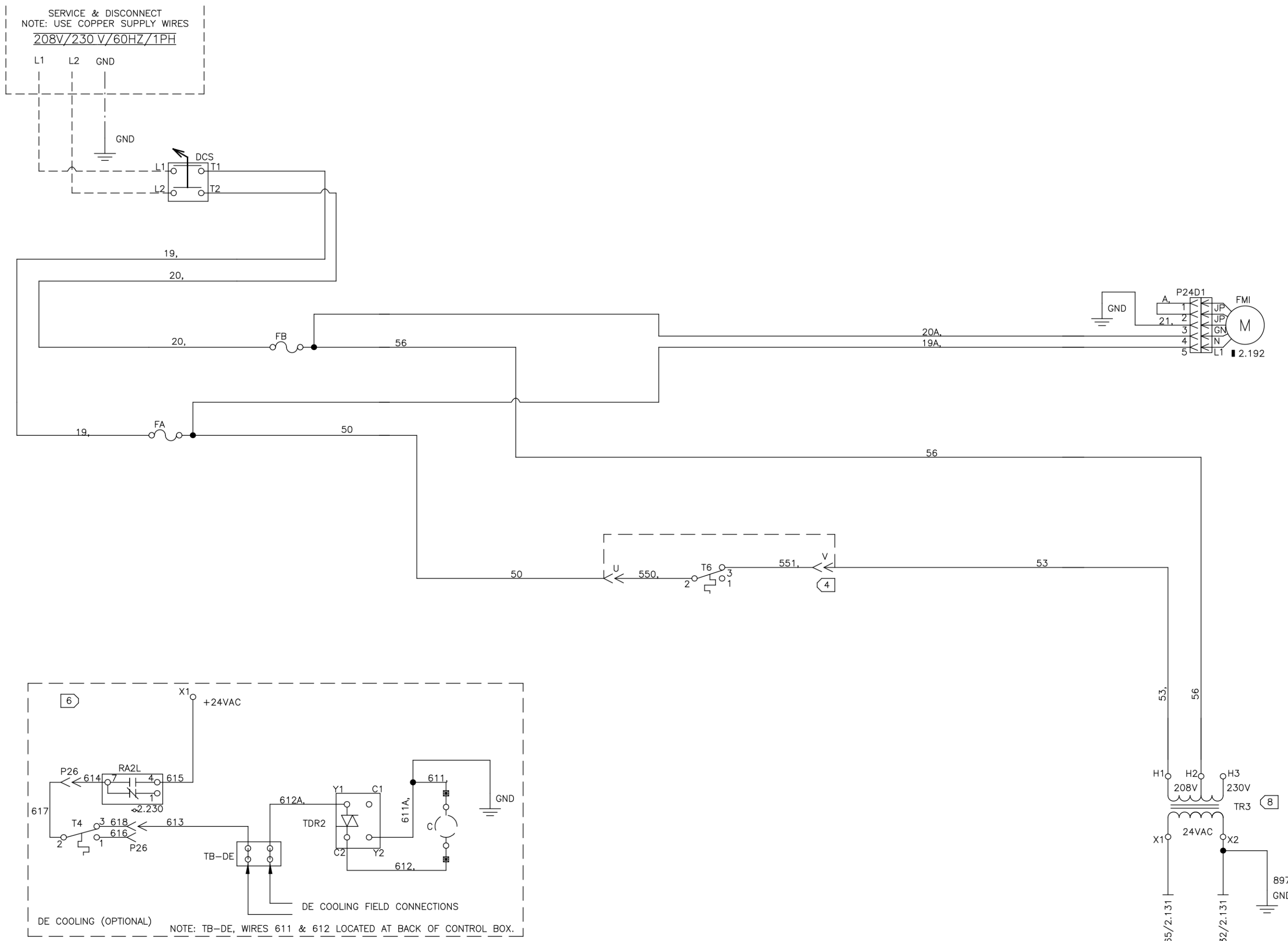


Figure 93: Variable Airflow 208-230V /60 Hz/1 Ph – Motor Switchbox, Non-Electric Heat Units

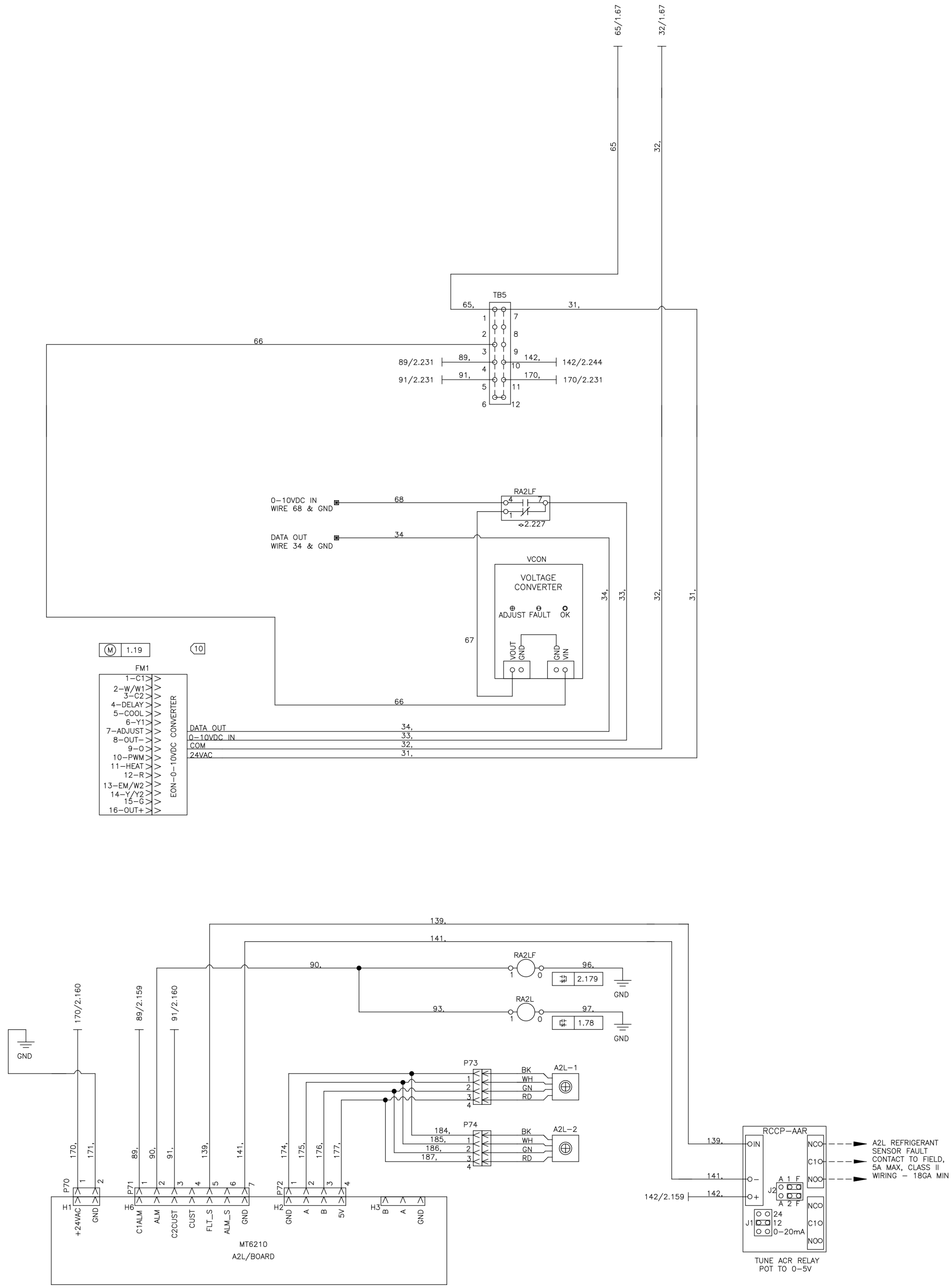


Figure 94: Variable Airflow 115 V/60 Hz/1 Ph – Motor Switchbox, Non-Electric Heat Units

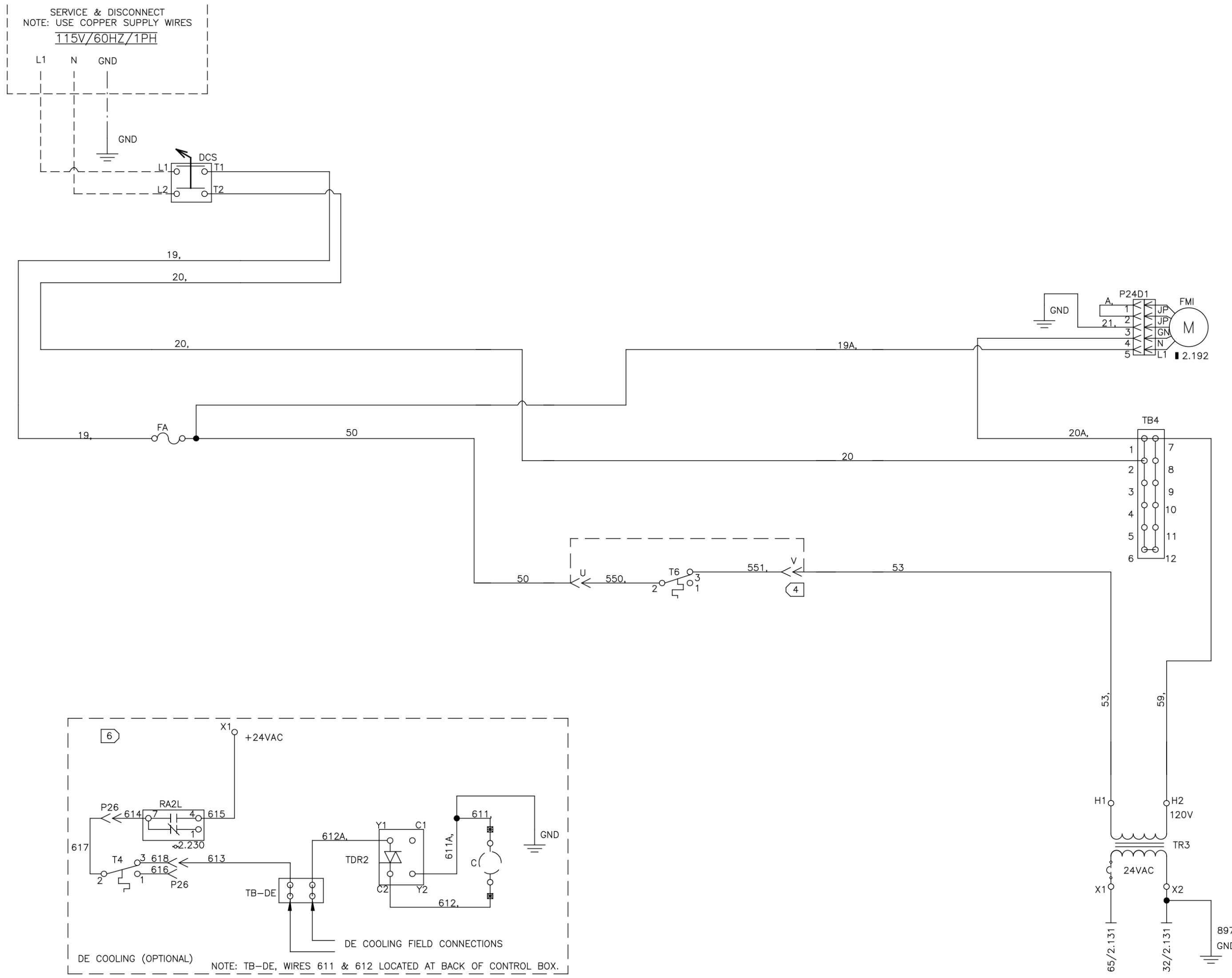


Figure 95: Variable Airflow 115 V/60 Hz/1 Ph – Motor Switchbox, Non-Electric Heat Units

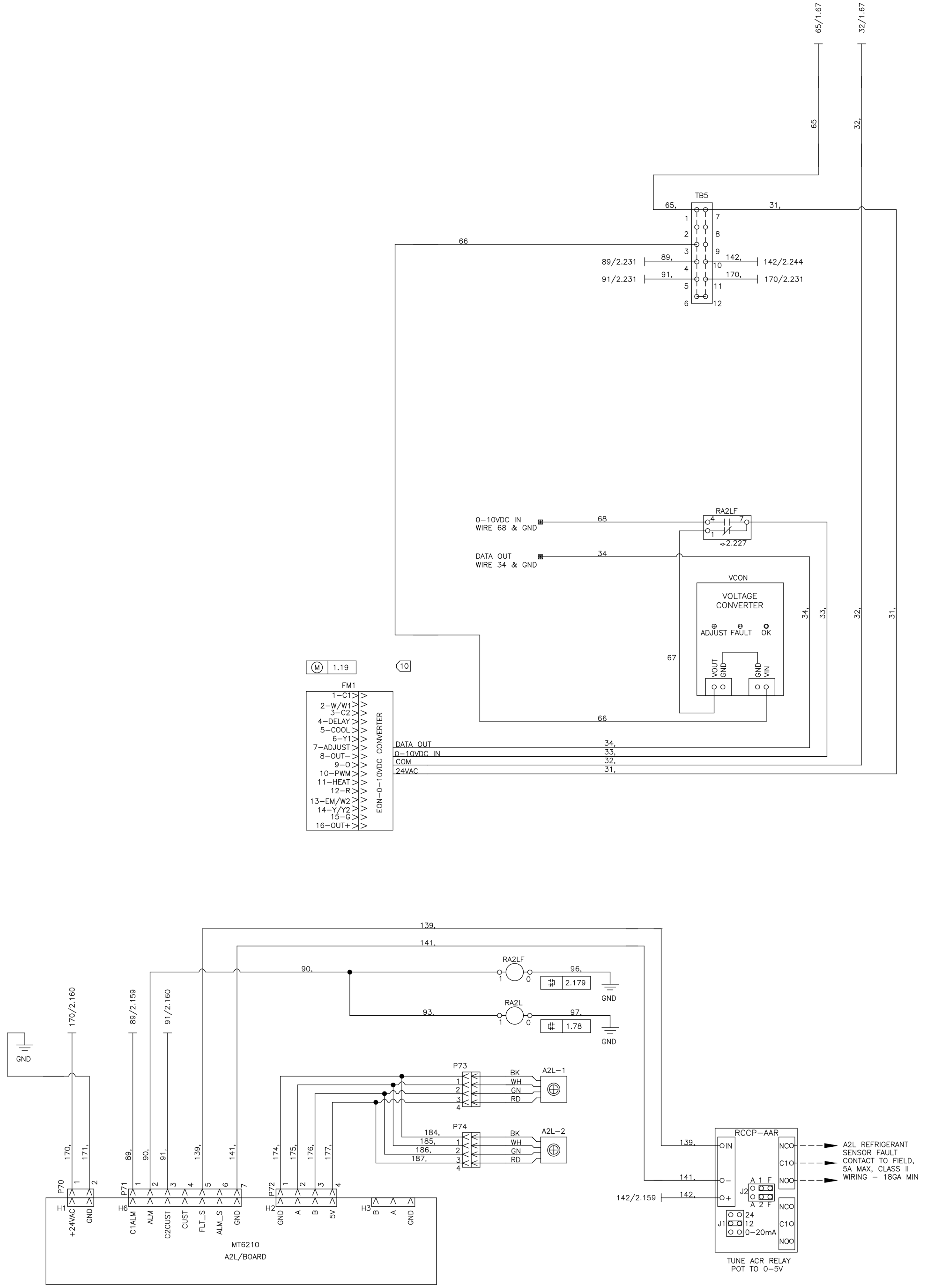


Figure 96: Variable Airflow 265 V/60 Hz/1 Ph – Motor Switchbox, Non-Electric Heat Units

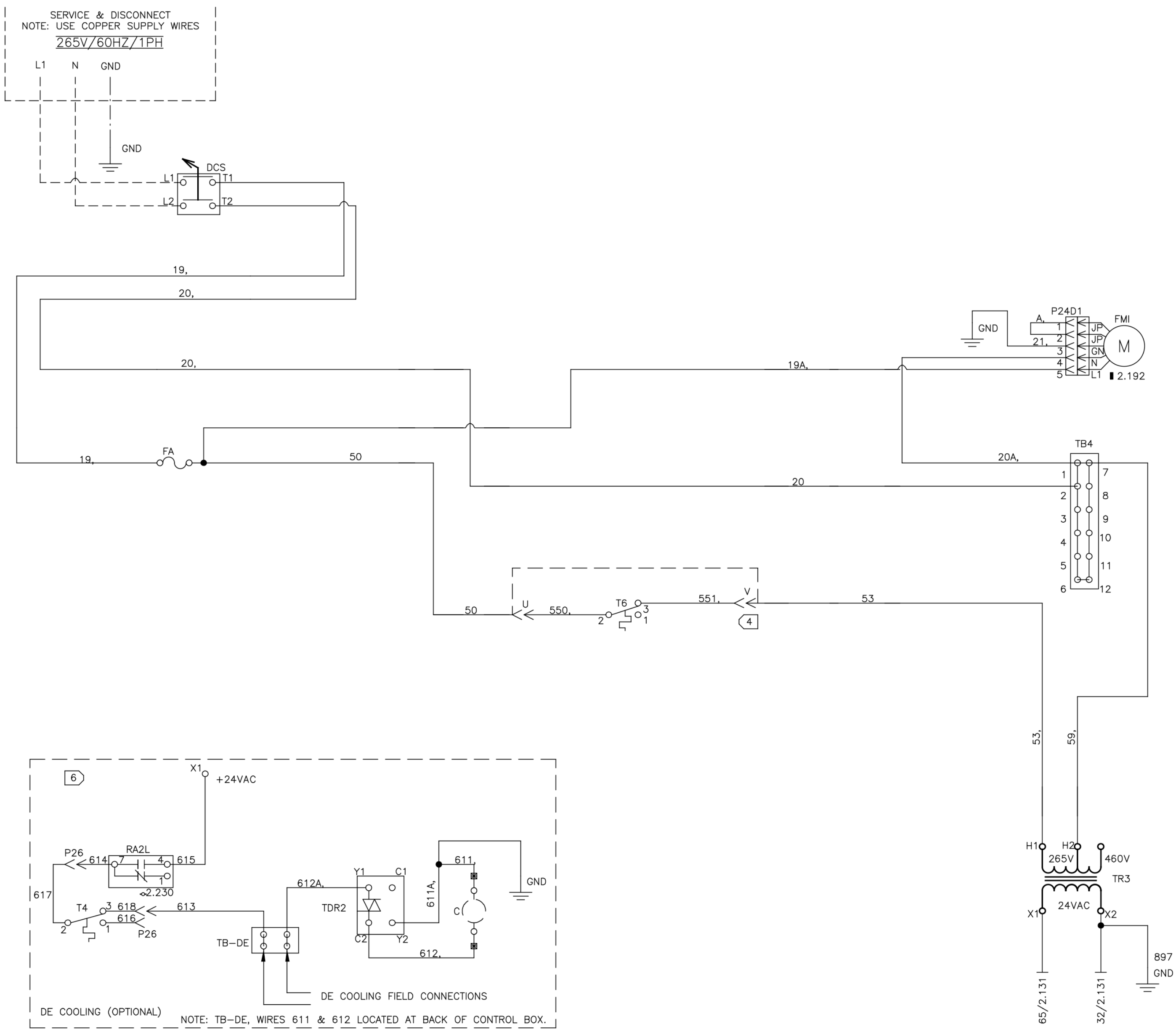
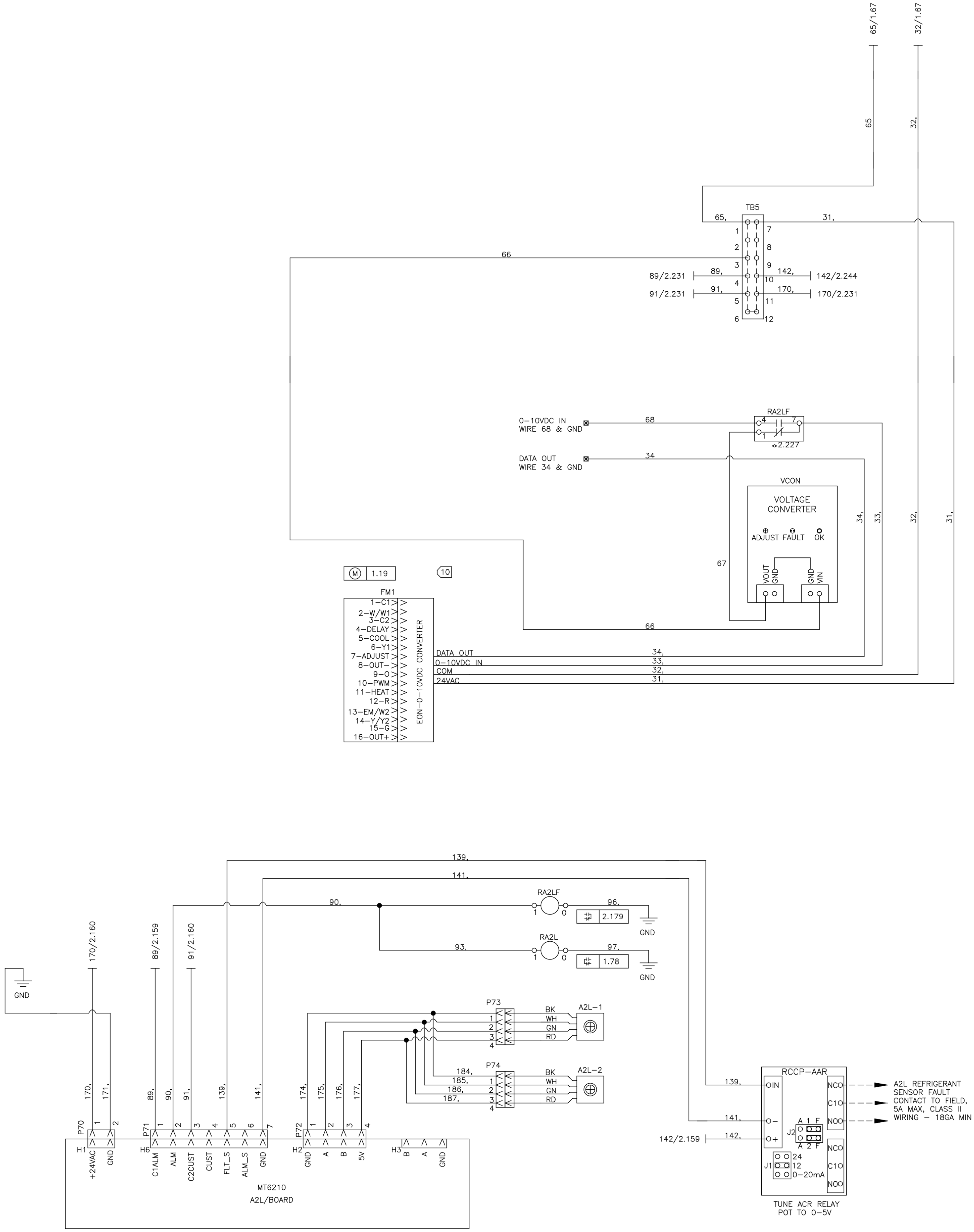


Figure 97: Variable Airflow 265 V/60 Hz/1 Ph – Motor Switchbox, Non-Electric Heat Units



Wiring Schematics Legend for "Typical Controls by Others – Units with Optional EC Motor with Variable Airflow"

Legend					
A1	Actuator (Optional)	**R3B**	Relay – Defrost/EH Coil (24 VAC)	**T5**	Thermostat Defrost
A2LB	A2L Mitigation Board	**R4**	Relay – Fan Coil (24 VAC)	**T6**	Thermostat - Freeze Stat
A2L-1	A2L Sensor	**R7**	Relay – Compressor Lockout	**T7**	Thermostat- Changeover 60°
C1	Compressor Contactor	**R8-9**	Relay – Emergency Heat	**T8**	Thermostat - Cooling Lockout 59C F
CAP1	Capacitor Run	**R10-12**	Relay – Electric Heat	**TB1**	Terminal Board Control
CEH1-3	Electric Heat Contactor	**R11A**	Relay - Defrost	**TB2**	Terminal Board Control
CO2	Sensor – Indoor Air CO_2	**RA1**	Relay - Actuator/Valve	**TB3**	Terminal Board Control
CP1	Motor Compressor 2-Stage	**RA2L**	A2L Actuator	**TB4**	Terminal Board
CS	Current Sensor (Hawkeye 800)	**RA2LF**	A2L Actuator	**TB5**	Terminal Board
DCS	Switch – Unit Power	**RAT**	Sensor - Room Air Temperature	**TB-DE**	Terminal Board for DE Contactor
DF	Dead Front Switch	**RCCP**	Transducer AAR	**TBE**	Terminal Block - Electric Heat
EH1-6	Heater – Electric	**REH**	Relay – H1 Fan 3rd STG EH	**TDR1**	Time Delay Low Voltage 5 Min
EH10	Heater – Outdoor Drain Pan	**RT6**	Relay – Freeze Stat	**TDR2**	Protector Low Voltage 5 Min
F1A/F1B	Fuse – Compressor	**RV**	Reversing Valve	**TR1**	Transformer - Motor Speed
F2A/F3B	Fuse – Electric Heat	**S2**	Sensor - DA (TAC 01-2085-001)	**TR3**	Transformer - 24 V, 75 VA
FA/FB	Fuse – Control, Load	**SW1**	Switch – Disconnect	**TR4**	Transformer - 460 V–230 V
FC/FD	Fuse – Control, Transformer	**SW2**	Switch – On - Off and Fan Speed	**TR5**	Transformer - 24 V
FMI	Motor – Room Fan	**SW5**	Switch – Emergency Heat	**TS**	Terminal Strip for EH
FMO	Motor Outdoor Air	**SW6**	Switch Rocker SPDT	**V1**	Valve - Heat EOC (Accessory)
R1-R3	Relay Electric Heat (Back Up)	**T2**	Thermostat EH Relay - 0A Temp>20°	**V2**	Valve - Cool EOC (Accessory)
R2S	Relay – High (2nd) Stage Compr	**T4**	Thermostat Low Temp 28°	**VCON**	Converter Cable 0-10 VDC

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 #)

Motor Size	SW2 Term	TR1 Speed Settings			
		750	1000	1250	1500
1/4 HP 0.00-0.20 ESP	High	PK	YE	WH/GN	GN
	Med	GY	GY	PK	YE
	Low	GY/BK	GY/BK	GY	PK

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

NOTE 2: Cap all unused transformer leads.

NOTE 3: Fuse FB, SW2, and wire 56 furnished on 208/230 volt units only. Fuse FB, SW2, wire 510 and 507 furnished on 208/230 volt units only.

NOTE 4: T6 and wires 550 and wire 551 furnished only on units with hot water or chilled water. All others connect transformer wire to wire 50.

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

NOTE 6: Automatic temperature control can be wired to TB-DE for de-cooling operation. Typical operation is to wire from the TB-DE to a Normally Open relay, with the relay closing on control call for cooling. For additional information, contact Daikin Applied.

NOTE 7: Motors are factory programmed for specified airflow. Contact Daikin Applied for replacement.

NOTE 8: For 230V operation, switch wire 56 to 240V terminal in the transformer.

NOTE 9: Devices in legend may or may not be on unit.

Typical Controls by Others – Field Installed

Figure 98: Controls by Others – Field Installed - 208-230 V/60 Hz/1 Ph

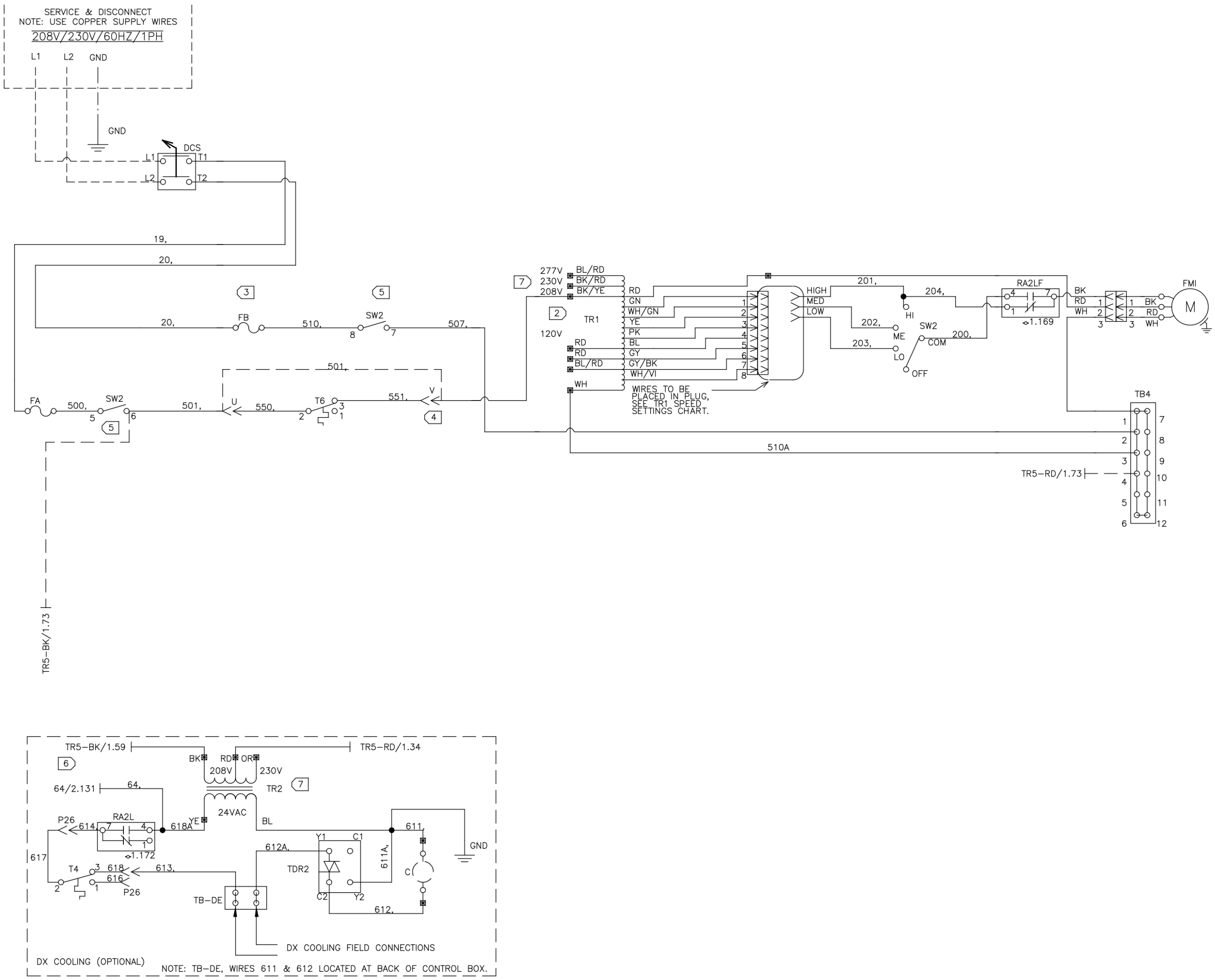


Figure 99: Controls by Others – Field Installed - 120 V/60 Hz/1 Ph

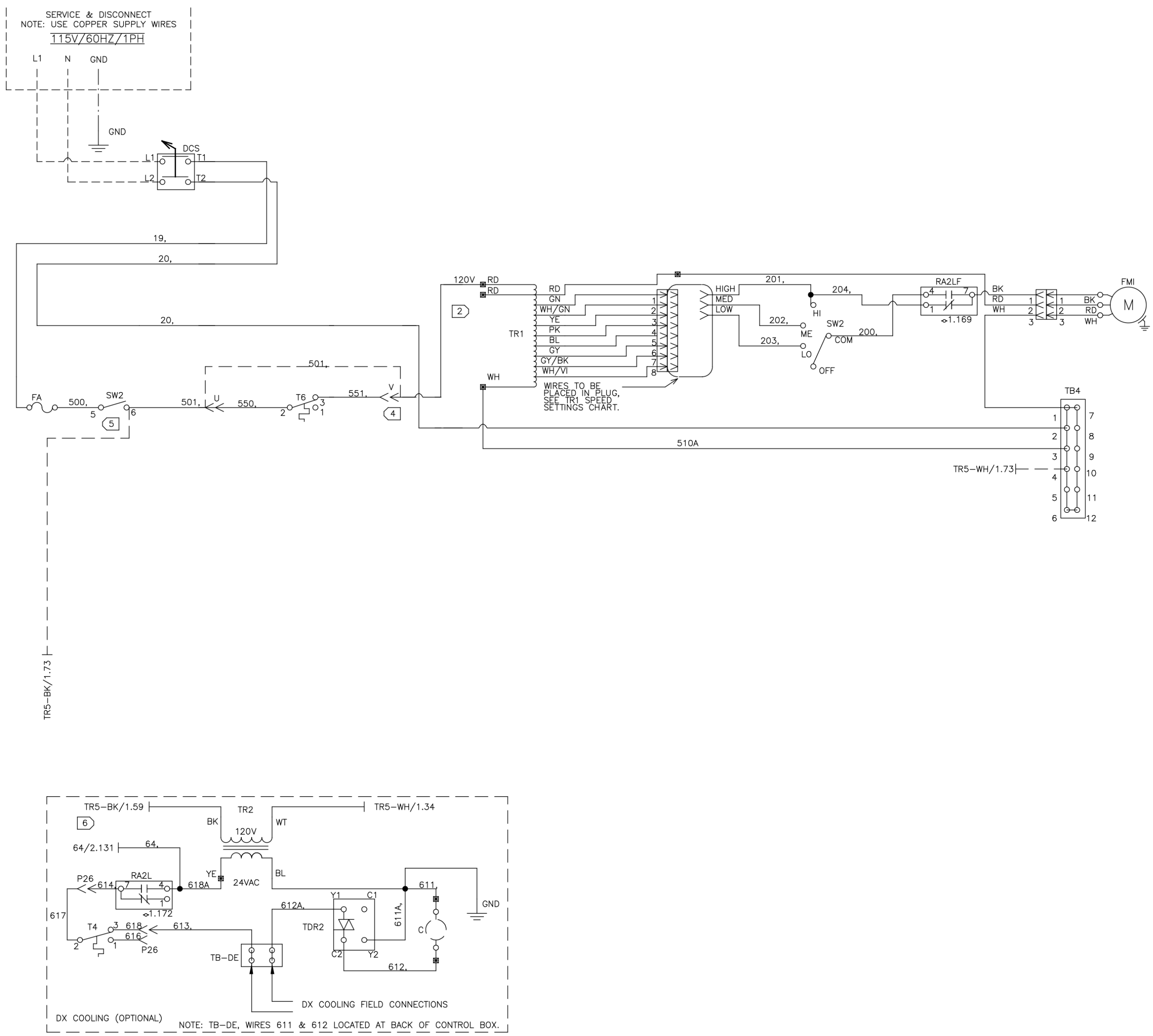


Figure 100: Controls by Others – Field Installed - 120 V/60 Hz/1 Ph

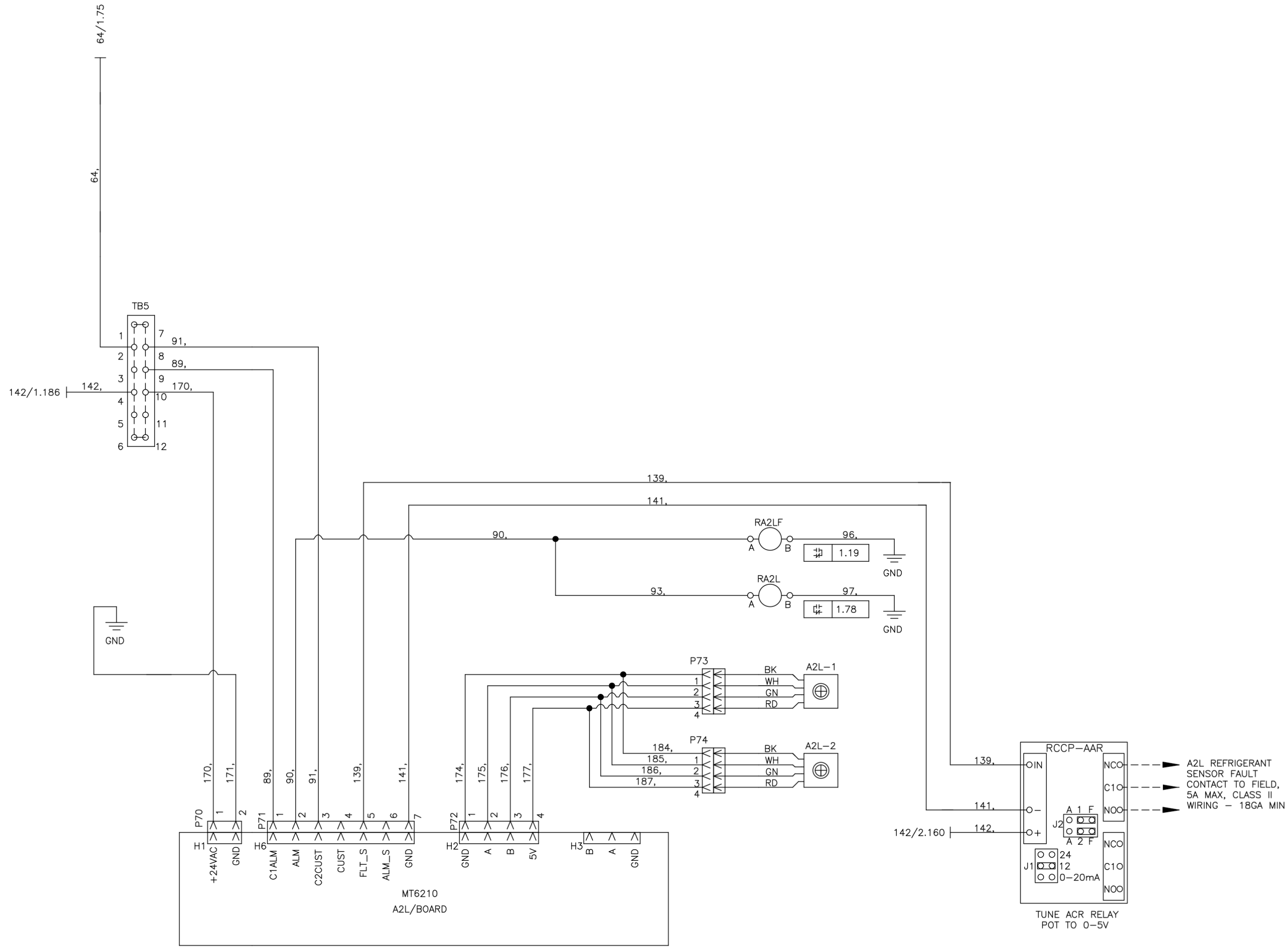


Figure 101: Controls by Others – Field Installed - 265 V/60 Hz/1 Ph

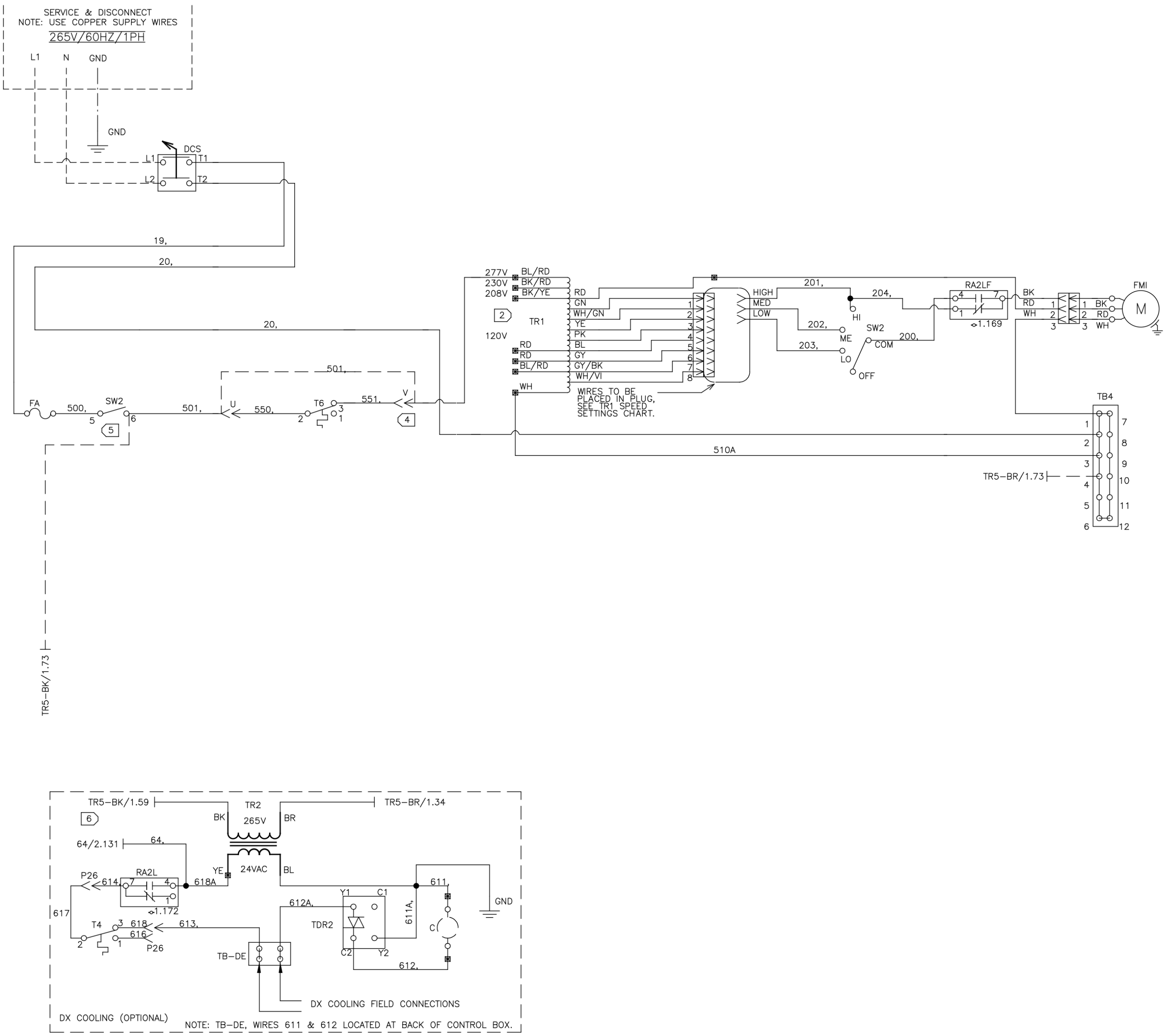
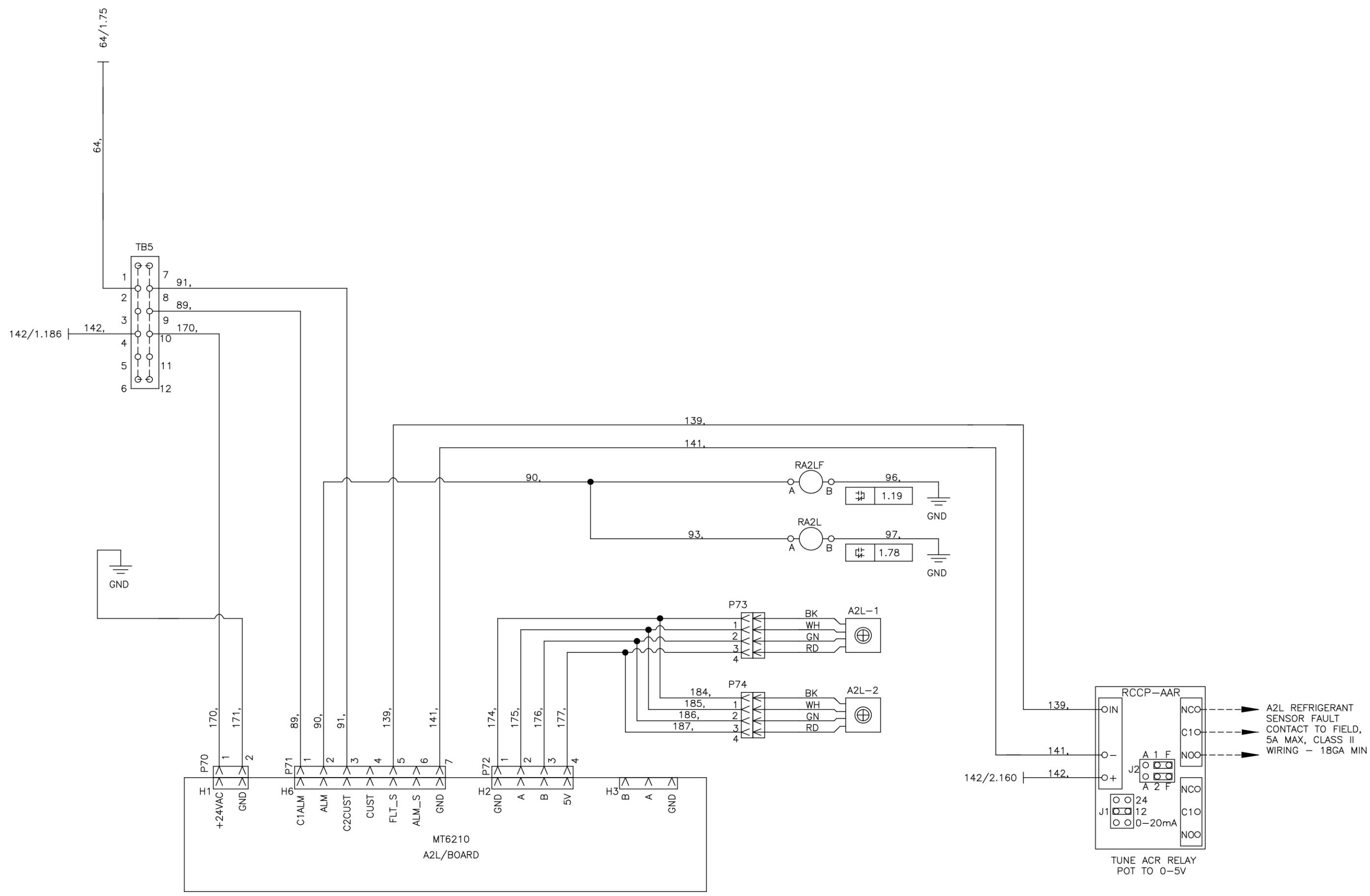


Figure 102: Controls by Others – Field Installed - 265 V/60 Hz/1 Ph



Wiring Schematics Legend for "Typical Controls by Others – Field Installed"

Legend					
A1	Actuator (Optional)	**R1-R3**	Relay Electric Heat (Back Up)	**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
C1	Compressor Contactor	**R4**	Relay – Fan Coil (24 VAC)	**T6**	Thermostat - Freeze Stat
CAP1	Capacitor Run	**R7**	Relay – Compressor Lockout	**T7**	Thermostat- Changeover 60°
CEH1-3	Electric Heat Contactor	**R8-9**	Relay – Emergency Heat	**T8**	Thermostat - Cooling Lockout 59C F
CO2	Sensor – Indoor Air CO_2	**R10-12**	Relay – Electric Heat	**TB1**	Terminal Board Control
CP1	Motor Compressor 2-Stage	**R11A**	Relay - Defrost	**TB2**	Terminal Board Control
CS	Current Sensor (Hawkeye 800)	**RA1**	Relay - Actuator/Valve	**TB3**	Terminal Board Control
DCS	Switch – Unit Power	**RA2L**	A2L Actuator	**TB4**	Terminal Board
DF	Dead Front Switch	**RA2LF**	A2L Actuator	**TB5**	Terminal Board
EH1-6	Heater – Electric	**RAT**	Sensor - Room Air Temperature	**TB-DE**	Terminal Board for DE Contactor
EH10	Heater – Outdoor Drain Pan	**RCCP**	Transducer AAR	**TBE**	Terminal Block - Electric Heat
F1A/F1B	Fuse – Compressor	**REH**	Relay – H1 Fan 3rd STG EH	**TDR1**	Time Delay Low Voltage 5 Min
F2A/F3B	Fuse – Electric Heat	**RT4**	Relay - 24 VAC	**TDR2**	Protector Low Voltage 5 Min
FA/FB	Fuse – Control, Load	**RT6**	Relay – Freeze Stat	**TR1**	Transformer - Motor Speed
FC/FD	Fuse – Control, Transformer	**RV**	Reversing Valve	**TR3**	Transformer - 24 V, 75 VA
FMI	Motor – Room Fan	**S2**	Sensor - DA (TAC 01-2085-001)	**TR4**	Transformer - 460 V–230 V
FMO	Motor Outdoor Air	**SW1**	Switch – Disconnect	**TR5**	Transformer - 24 V
OH1	Thermostat - Overheat	**SW2**	Switch – On - Off and Fan Speed	**TS**	Terminal Strip for EH
OH2	Thermostat - Overheat	**SW5**	Switch – Emergency Heat	**V1**	Valve - Heat EOC (Accessory)
OHM	EH Man Reset Overheat Stat	**SW6**	Switch Rocker SPDT	**V2**	Valve - Cool EOC (Accessory)

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 #)

Motor Size	SW2 Term	TR1 Speed Settings			
		750	1000	1250	1500
1/4 HP 0.00-0.20 ESP	High	PK	YE	WH/GN	GN
	Med	GY	GY	PK	YE
	Low	GY/BK	GY/BK	GY	PK

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

NOTE 2: Cap all unused transformer leads.

NOTE 3: Fuse FB, SW2, wire 510, and wire 507 furnished on 208/230 volt units only.

NOTE 4: T6 and wires 550 & 551 furnished only on units with hot water or chilled water. All others connect transformer wire to wire 501.

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

NOTE 6: Automatic temperature control can be wired to TB-DE for de-cooling operation. Typical operation is to wire from the TB-DB to a Normally Open relay, with the relay closing on control call for cooling. For additional information, contact Daikin Applied.

NOTE 7: For 230V operation, switch wire 501 to "240V" terminal in the transformer.

NOTE 8: Devices in legend may or may not be on unit.

Typical Electric Heat Wiring Diagram

Figure 103: Electric Heat Wiring Diagram – Typical 460 V/60 Hz/3 Ph

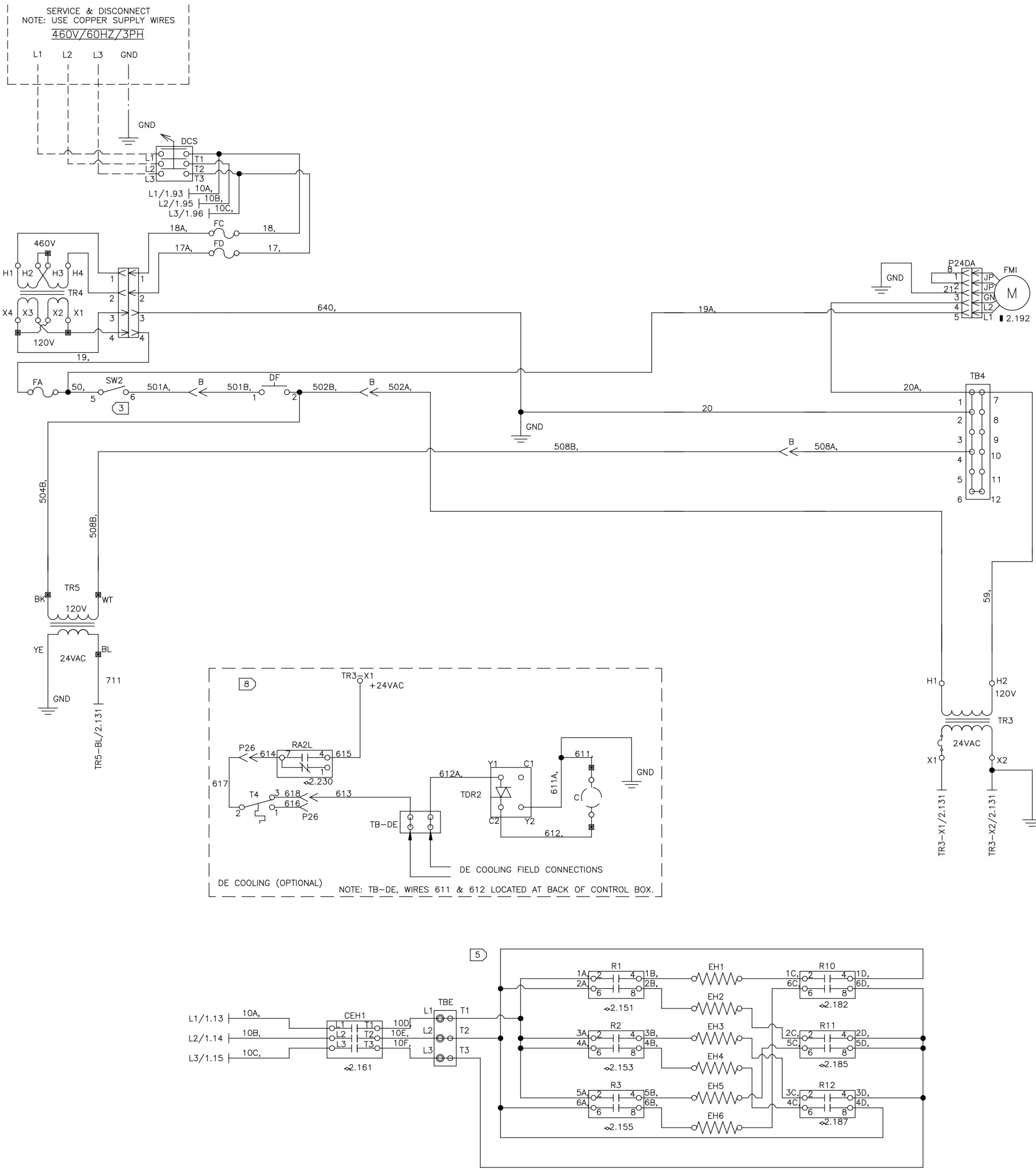
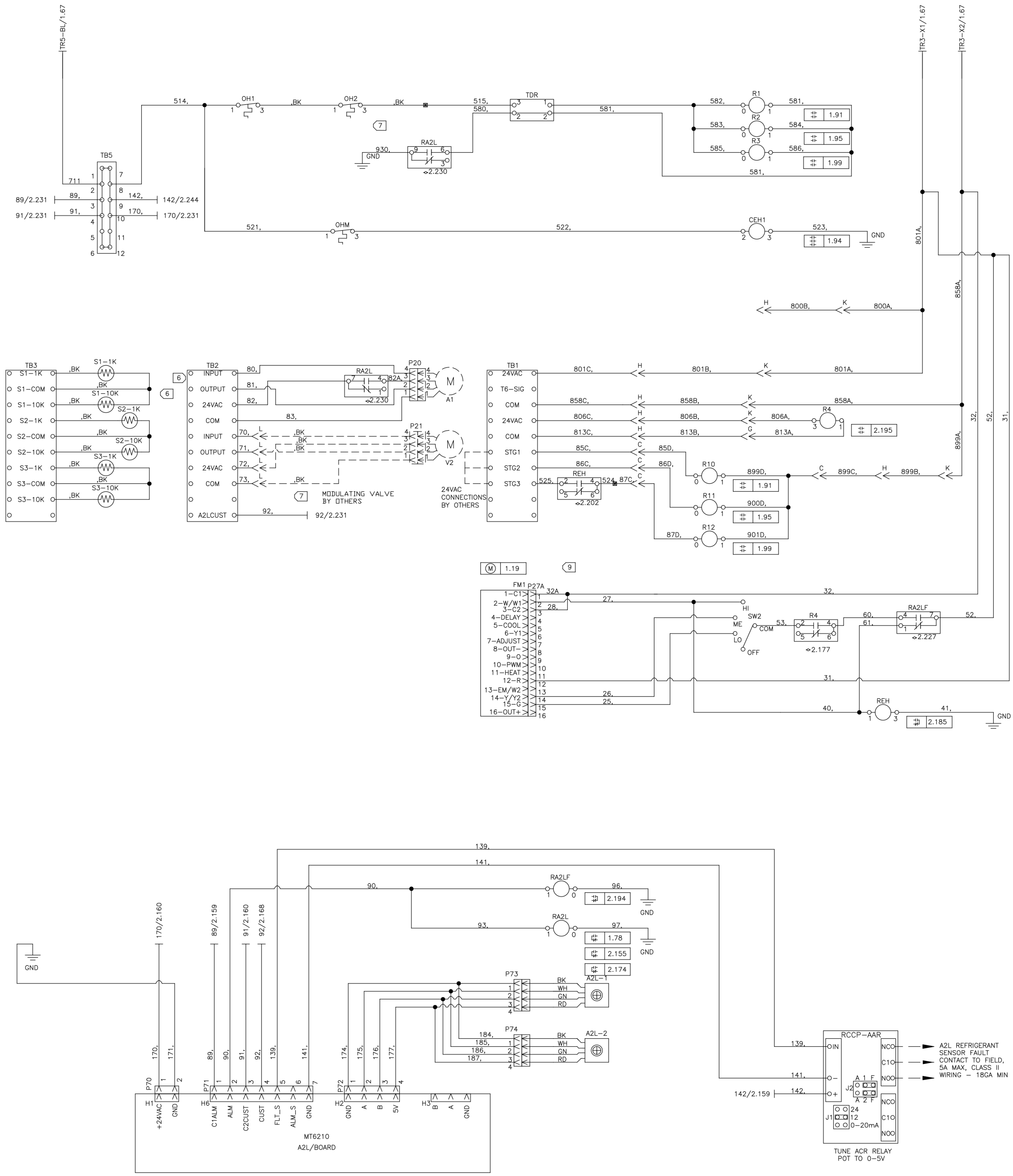


Figure 104: Electric Heat Wiring Diagram – Typical 460 V/60 Hz/3 Ph



Wiring Schematics Legend for "Typical Electric Heat Wiring Diagram"

Legend					
A1	Actuator (Optional)	**OH2**	Thermostat - Overheat	**SW2**	Switch – On - Off and Fan Speed
A2LB	A2L Mitigation Board	**OHM**	EH Man Reset Overheat Stat	**SW5**	Switch – Emergency Heat
A2L-1	A2L Sensor	**R1-R3**	Relay Electric Heat (Back Up)	**SW6**	Switch Rocker SPDT
BPT	Sensor - Braze Plate DX Coil Refrigerant Temperature	**R2S**	Relay – High (2nd) Stage Compr	**T2**	Thermostat EH Relay - 0A Temp>20°
		R4	Relay – Fan Coil (24 VAC)	**T4**	Thermostat Low Temp 28°
CAP1	Capacitor Run	**R4H**	Relay – Hi Fan Speed Coil (24 VAC)	**T5**	Thermostat Defrost
CEH1-3	Electric Heat Contactor	**R4L**	Relay – Low Fan Speed Coil (24 VAC)	**T6**	Thermostat - Freeze Stat
CO2	Sensor – Indoor Air CO_2	**R4M**	Relay – Med Fan Speed Coil (24 VAC)	**T7**	Thermostat- Changeover 60°
CP1	Motor Compressor 2-Stage	**R7**	Relay – Compressor Lockout	**T8**	Thermostat - Cooling Lockout 59C F
CS	Current Sensor (Hawkeye 800)	**R8-9**	Relay – Emergency Heat	**TB1**	Terminal Board Control
DCS	Switch – Unit Power	**R10-12**	Relay – Electric Heat	**TB3 (A,B)**	Terminal Block - Main Power
DF	Dead Front Switch	**R11A**	Relay - Defrost	**TB4**	Terminal Block 24 VAC
EH1-6	Heater – Electric	**RA1**	Relay - Actuator/Valve	**TB-DE**	Terminal Board for DE Contactor
EH10	Heater – Outdoor Drain Pan	**RA2L**	A2L Actuator	**TBE**	Terminal Block - Electric Heat
F1A/F1B	Fuse – Compressor	**RA2LF**	A2L Actuator	**TDR**	Time Delay Low Voltage 5 Min
F2A/F3B	Fuse – Electric Heat	**RAT**	Sensor - Room Air Temperature	**TDR2**	Protector Low Voltage 5 Min
FA/FB	Fuse – Control, Load	**RCCP**	Transducer AAR	**TR1**	Transformer - Motor Speed
FC/FD	Fuse – Control, Transformer	**REH**	Relay – H1 Fan 3rd STG EH	**TR3**	Transformer - 24 V, 75 VA
FMI	Motor – Room Fan	**RT4**	Relay - 24 VAC	**TR4**	Transformer - 460 V–230 V
FMO	Motor Outdoor Air	**RT6**	Relay – Freeze Stat	**TR5**	Transformer - 24 V
M	Motor (ECM) - Fan ⅓ HP (750/1500)	**S2**	Sensor - DA (TAC 01-2085-001)	**V1**	Valve - Heat EOC (Accessory)
OH1	Thermostat - Overheat	**SW1**	Switch – Disconnect	**V2**	Valve - Cool EOC (Accessory)

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 #)

Motor Size	SW2 Term	TR1 Speed Settings			
		750	1000	1250	1500
1/4 HP 0.00-0.20 ESP	High	PK	YE	WH/GN	GN
	Med	GY	GY	PK	YE
	Low	GY/BK	GY/BK	GY	PK

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. Stage 3 energized only when fans are in high.

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: Automatic temperature control supplier is responsible to ensure controls operate correctly and protect the unit.

NOTE 3: SW2 contacts 5, 6 and 7, 8 open only when SW2 is in OFF position.

NOTE 4: T6 only on units with chilled water.

NOTE 5: TYP 6 ELM on 750 & 1000 CFM units only terminal block furnished when total heating load is less than 48 amps.

NOTE 6: 1K thermistor is positive temperature coefficient. 10K thermistor is negative temperature coefficient.

NOTE 7: OH2 supplied on ceiling units, connect wire 515 to OH1 on AV (floor) units.

NOTE 8: Automatic temperature control can be wired to TB-DE for the de-cooling operation. Typical operation is to wire from the TB-DE to a normally open relay with the relay closing on the control call for cooling. For additional information, contact Daikin Applied.

NOTE 9: Motors are factory programmed for specified airflow. Contact Daikin Applied for replacement.

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

MicroTech 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 24VAC signal. Input signal choices are described below. 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 88.

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 24VAC.

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 Normally Open (NO) (reversible through keypad/software) 24VAC 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 Normally Open (NO) (reversible through keypad/software) 24VAC 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 Normally Open (NO) (reversible through keypad/software) 24VAC 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 modulating chilled-water valve opens fully 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.

Passive Dehumidification Control

On units with face and bypass damper control, a chilled-water coil and MicroTech part-load variable air control, passive dehumidification can be used under high humidity conditions to keep classrooms comfortable. A unit-mounted humidity sensor and a low fan speed are utilized to improve latent cooling by keeping the air in closer contact with the cold coil for passive dehumidification.

This only occurs in the unoccupied mode as the unit operates to satisfy the humidity set point with the outside damper closed. The face and bypass damper is placed in a minimum face position to promote high latent cooling. The unit fan continues to operate on low speed until the load is satisfied. This is very helpful in high humidity areas where high night time humidity can be absorbed in the building during off hours.

DX Split System Control

On unit ventilators equipped with direct-expansion (DX) coils, 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:

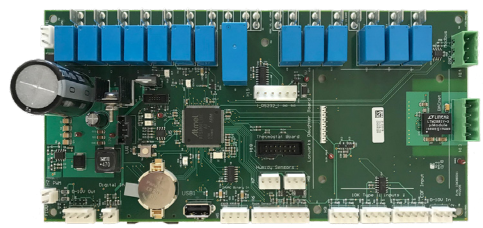
- A Unit Ventilator Controller (UVC) with on-board BACnet MS/TP communications
- Optional Local User Interface (LUI)
- Optional LonWorks plug-in network communication module

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 105: MicroTech Control Board



Local User Interface (Optional)

An optional 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 106: User Interface Touch Pad

The User Interface has individual touch-sensitive printed circuit board mounted buttons, and comes with a built-in menu structure (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.

Table 43: Ranges For 3-Speed Adjustable ECM Fan

Fan Speed	Operating Range
PWM low fixed-speed	50% - 80%
PWM medium fixed-speed	70% - 90%
PWM high fixed-speed	80% - 100%

Note: Low speed ≤ medium speed ≤ high speed.

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.

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.

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 107).

Figure 107: CO_2 Sensor For Demand Control Ventilation

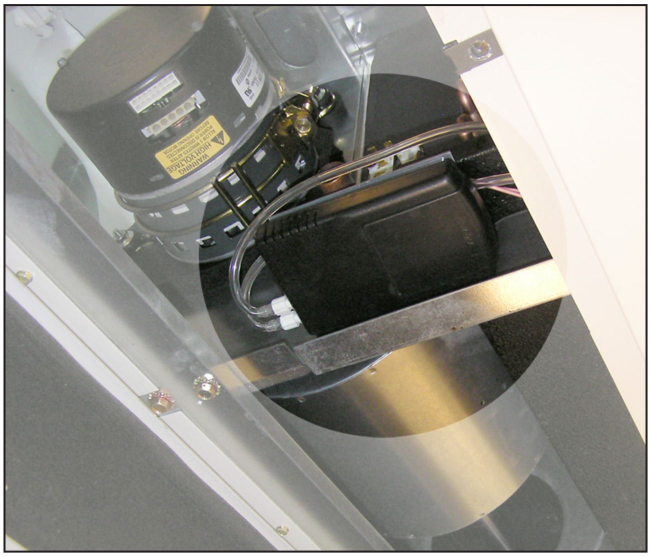
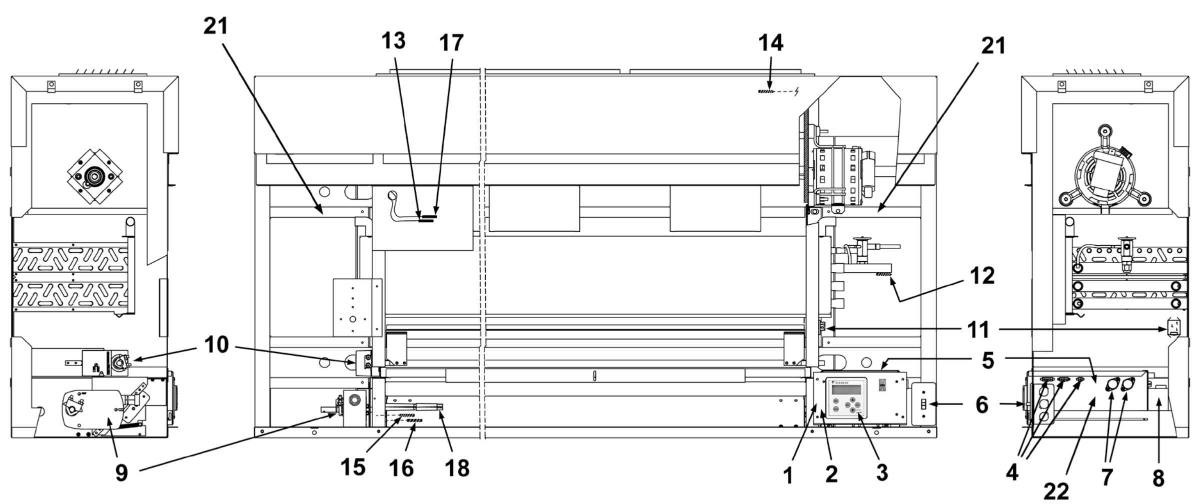


Figure 108: MicroTech Sensor and Component Locations



1. MicroTech Unit Ventilator Controller
2. Communication Module (Optional)
3. Local User Interface (LUI)
4. External Signal Connection Plugs
5. Electric Connection Box
6. Unit Main Power "On-Off" Switch
7. Fuse(s)
8. Control Transformer
9. Outdoor Air/Return Air Damper Actuator - (A1)
10. Face and Bypass Damper Actuator - (A2)
11. Hydronic Coil Low Air Temperature Limit (T6 freezestat)
12. Low Refrigerant Temperature Sensor (S4)
13. Room Temperature Sensor
14. Discharge Air Temperature Sensor
15. Outdoor Air Temperature Sensor
16. Outdoor Air Humidity Sensor (S8) (Optional)
17. Room Humidity Sensor (S6) (Optional)
18. CO_2 Sensor (S7) (Optional)
19. Control Valve(s) (Not Shown)
20. Water In Temperature Sensor (S5)(Not Shown)
21. A2L Sensor (A2L1-2)
22. MT6210 A2L Mitigation Controller

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 109: Face and Bypass 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 110: 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 111). 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 111: 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 112).

Figure 112: Modulating Valve Actuators

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

Spring return actuators are used for all modulating valves. All wet heat and heat/ cool valves are normally open, all cooling valves are normally closed.

To determine modulating valve position the UVC uses a separate factory preset, configurable setting for each actuator's stroke time. For accuracy of actuator positioning, 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.

Table 44: 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 and 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	●	●	●	●

Table 45: 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 and 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.

A Wide Variety of Input, Output and 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 45 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 (32GB max size), 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.

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

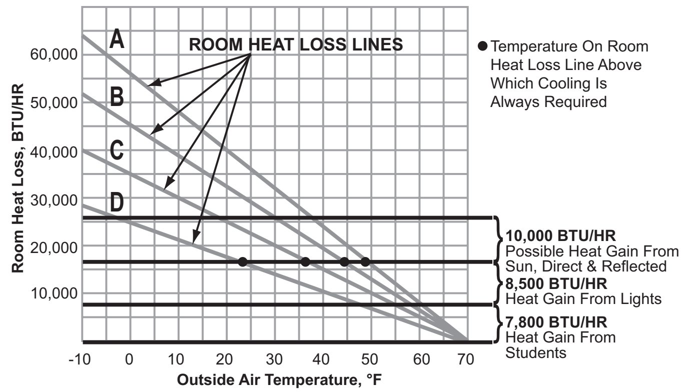
Schools have unique heating and ventilating needs, in large part because of their variable occupancy and usage patterns. Fewer cubic feet of space is provided per student in a school building than in any other type of commercial or public building. School classrooms are typically occupied only six hours 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 midwestern 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 BTUs per hour.

As the outside temperature changes, so does the amount of heat that the room loses. This is represented in Figure 113 by Room Heat Loss Line A, which ranges from 55,000 BTUs per hour at 0°F outside air temperature to zero BTUs 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 113: Heat Gain Vs. Heat Loss In Occupied Classrooms



As Figure 113 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 BTUs per hour per pupil. Multiply this by 30 and you get a total of 7,800 BTUs per hour added to the room by the students alone. This excess heat is noted in Figure 113 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 113 as "Heat Gain from Lights."

Add the heat gain from lighting to the 7,800 BTUs 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 113 on page 97 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 113 on page 97 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 113 on page 97).

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.

Daikin Applied Unit Ventilators and VentiMatic Shutters Solve The IAQ Problem

Daikin Applied unit ventilators do a thorough job of maintaining a healthful and productive classroom environment through the introduction of plenty of filtered fresh air directly into the classroom. This feature, which has always been a significant factor in reducing energy costs, is now more important than ever in the promotion of a healthful environment for learning.

It should be kept in mind that a properly designed exhaust system is essential for avoiding indoor air quality problems. Simply put, if room air is not being exhausted in a prescribed fashion, fresh outside air cannot be introduced into the room. Likewise, an excessive amount of outside air will be admitted, wasting energy.

The Daikin Applied VentiMatic shutter, a gravity-actuated room exhaust vent, can solve both these problems. The VentiMatic shutter allows the correct amount of outdoor air to be brought into the room while maintaining a slight positive pressure in the room. This slight positive pressure, maintained during normal operation, can also help prevent the infiltration of undesirable gases into the classroom. See "VentiMatic Shutter – Room Exhaust Ventilation" on page 26.

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 "ASHRAE Cycle II Operation" on page 110.)

Under ASHRAE Cycle II, the outdoor air damper is closed during warmup 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, hot water or chilled 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.

Note: *When unit ventilators containing electric heat are ordered without controls (controls by others) the contactors and relays used for staging the electric heat are not provided. This is because the number of stages varies based on the type and manufacturer of the control devices. It is not possible to pre-engineer contactors and relays for all of these variables. The control contractor is responsible for making certain that the controls correctly control the unit's functions.*

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.

Meeting AHRI 840 Requirements

The ventilation rate of Daikin Applied unit ventilators is certified and tested per Air Conditioning, Heating and Refrigeration Institute (AHRI) Standard 840. Per this standard, unit ventilators with outside air ventilation and return air dampers must provide ventilation air at a rate of minimum of 80% rated standard air flow. They must also be capable of providing any combination of humidity control, circulation, heating or cooling, and filtering of air.

Face and Bypass Temperature Control

Unit ventilators with face and bypass damper control are available for 2-pipe or 4-pipe applications. Two-pipe chilled/hot water installations require a system changeover from heating to cooling whenever the outdoor air temperature rises to a point that ventilation cooling can no longer offset the heat gains in the space. The reverse happens whenever heating is required. Four-pipe systems have both heating and cooling available whenever needed. With 4-pipe systems, each unit will automatically change over to heating or cooling as the room temperature demands.

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.

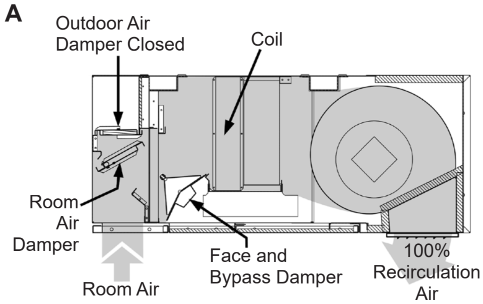
The superior ability of the face and bypass damper to control temperature and humidity during cooling operation is well established. Constant chilled water flow maintains the coil surface temperature at or below dew point, providing maximum dehumidification.

Figure 114: Face and 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

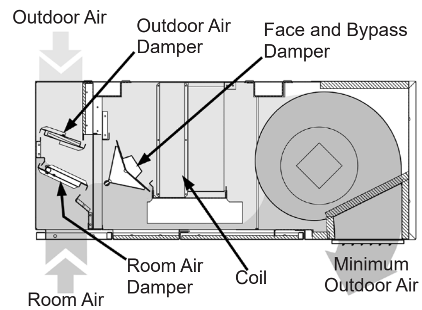


Maximum Heat or Cool, Minimum Outdoor Air

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.

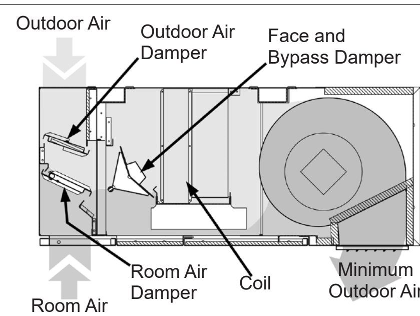
B



Minimum Outdoor Air, Face and 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

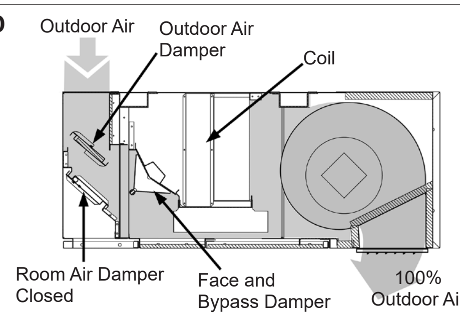


Full Outdoor Air (Free Cooling)

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



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.

Improved Boiler Economics

In a 2-pipe system, the coil is usually selected for cooling and, during the heating season, extra coil heat transfer is available. Since the water is always being pumped with face and bypass, boiler water temperature can be modulated rather than fixed, reducing the hot water temperature to better match the heating load. This is an opportunity to reduce operating costs. By resetting the boiler hot water to 90°F and modulating upward to 140-160°F for design conditions, boiler economy results in savings. Better room temperature control is available at low heating loads and the system can be quickly and easily changed over from heating to cooling or vice versa.

Since conditions of full heating or full cooling are achieved only 1-2% of the time, savings are available with today's chillers. Load rates at changeover from heating to cooling of 100°F plus are limited and the chiller protected. Daikin Applied chillers have this state-of-the-art system. Considerable savings can be realized when you couple this cooling with today's high-efficiency condensing boilers (which can accept 45°F entering water without damage) and with the elimination of boiler circulating pumps, mixing valves and isolation valves.

Easy Maintenance

A Daikin Applied unit ventilator with face and bypass damper control is easier to maintain. It has fewer moving parts: one pump, one motorized valve, two or three small modular condensing boilers, one or two air-cooled chillers, and, in each classroom, one outdoor air damper actuator, one face and bypass damper, and one fan. The system can deliver the lowest utility cost. And with their long, durable life, replacement/maintenance costs can be deferred. These low costs are desirable to taxpayers and school officials, so limited resources can be used to support teaching.

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.

Hot Water Reset

Automatic reset should be used to reduce the temperature of the hot water being recirculated as the outdoor air temperature rises. This should be reversed as the outdoor temperature drops. Such adjustments help prevent overheating and reduce fuel costs.

Modulating Valve Temperature Control

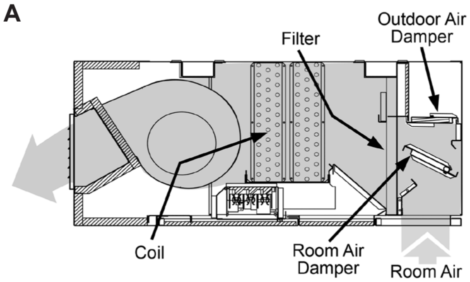
Modulating valve-controlled unit ventilators are an alternative to face and bypass control. All air handled by the fans passes through the coil at all times. A valve-controlled unit ventilator is a constant-volume, variable-temperature device that delivers constant air while modulating water flow through a chilled-water coil to maintain the dry bulb (sensible) temperature in the classroom. With water flow through the coil being modulated, the surface temperature of the coil increases and reduces the coil's ability to remove moisture or dehumidify. The moisture brought from outdoor air, along with the internally generated moisture from students, can result in unacceptable indoor humidity levels. Face and bypass is the preferred method to maintain indoor humidity levels and reduce damaging freezing.

Figure 115: 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

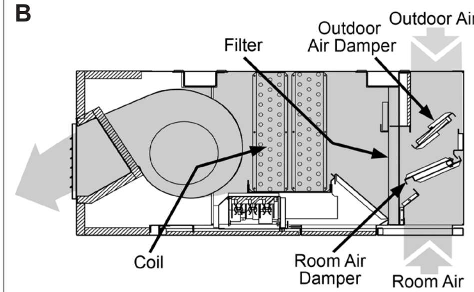


Minimum Heating

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.

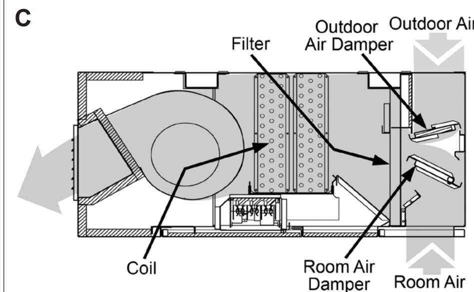
B



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.

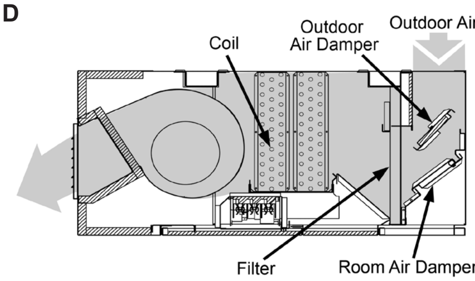
C



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 "Increased Coil Freeze Protection" on page 9.)

D



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 or cooling 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.

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 un-shared 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 de-coupling 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. Coils and units are AHRI capacity rated.

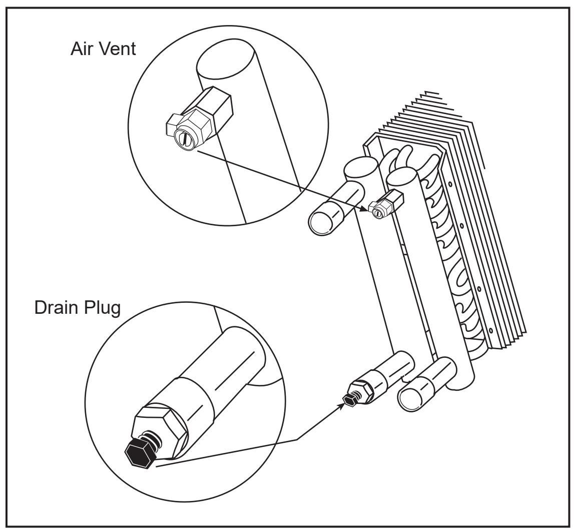
High-Quality Water Coils

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

A manual air vent is located on the top of the coil header of all floor hydronic coils. (Figure 116). This allows air to be purged from the coil during field start-up or for maintenance.

A manual drain plug (Figure 116) is provided at the bottom of the coil header for coil drainage. Some competitors may not provide for drainage of coils.

Figure 116: Manual Air Vent and 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.

DX Split Systems

Daikin Applied unit ventilators are available with direct expansion (DX) cooling coils that are equipped with thermal expansion valves. Unit ventilators with DX coils operate as a system with most properly sized R-32 condensing units. In most classroom applications, if the unit ventilator and the condensing unit are sized properly, the application should fulfill its design expectations.

The proper selection of a DX split system unit ventilator for a classroom requires special considerations. This is due to the high amount of outdoor air ventilation required and to the occupied and unoccupied cooling requirements. Because of the high number of occupants in classrooms, cooling is required even when the outside air temperature is very mild. With mild ambient conditions, down to 55°F, the system can create colder discharge air temperatures than desired and can even trip the DX low temperature limit on the unit.

DX for Heat Pump Operation

The DX coil will have a TXV bypass installed to allow for split-system pairing with a heat pump condensing unit, to allow for field-supplied refrigerant heating. This option is only selectable on units with Digital Ready or Control by Others.

Condensing Unit Selection

Proper sizing of the field-supplied condensing units is important for trouble-free operation. An oversized condensing unit can reduce performance and cause operational problems, such as:

- Rapid temperature pull down, causing short cycling and potential compressor damage.
- Poor temperature and humidity control.
- Low saturated evaporator coil conditions.
- Low discharge air temperatures.

If the DX system is oversized for the room loads the compressor will have short run times. When rooms are occupied, unit ventilators provide outdoor air to the space continuously. In humid areas, the outdoor air is laden with moisture. The room thermostat responds to the room sensible temperature. With short compressor run times (oversized condition) the system is unable to extract the moisture and the humidity level builds, sometimes exceeding 60 percent.

To properly size the unit ventilator, determine the cooling load based on May and September conditions at 1 pm when the classroom is occupied. Do not select units for July or August, after 3 pm, or when the classroom is unoccupied. Select a properly sized unit based on the calculated cooling load, ambient air temperature and enter air temperature to the coil. If the calculated cooling load falls between two unit sizes, select the smaller of the two units to minimize the potential problems seen with oversized units.

A general rule for DX unit sizing is 400 cfm per ton of cooling capacity. If the 400 cfm per ton criteria is followed, most problems can be avoided. Review the design selection for the system and a typical low ambient condition to determine if the suction temperatures are below an acceptable level.

Table 46 shows the recommended condensing unit size, based on nominal tons, for each size unit ventilator. The Table is based on 400 plus cfm per ton for high-speed operation, at design conditions. If you anticipate a lower-speed DX cooling operation, additional static pressure, or lower outdoor ambient temperature operation, a smaller condensing unit should be considered.

Table 46: Condensing Unit Size Selection

Unit Vent Model	Unit Vent CFM Nominal	Condensing Unit Size Tons Nominal
H07, V07	750	1-1/2
H10, V10	1000	2-1/2
H13, V13	1250	3
H15, V15	1500	3-1/2
H20, V20	2000	4

Control Considerations

Most unit ventilators for classroom applications require compressorized cooling below 75-80°F outdoor ambient due to internal student, equipment and solar loads. For effective system operation and correct thermal expansion valve operation at these conditions, condensing unit head pressure control is required. A hot gas bypass system or an evaporator minimum pressure regulator may also be required to maintain suction pressure.

The unit ventilator incorporates provisions for wiring to the contactor in the condensing unit. A 5-minute delay relay is included to reduce compressor cycling. On Digital Ready and Controls By Others units, a DX low limit is included to help protect against abnormally low evaporator coil temperatures caused by unit ventilator motor failure, blocked air filters, or other restrictions to airflow.

When MicroTech unit ventilator controls are provided, the controller operates the condensing unit contactor, as needed, to provide cooling when required.

When controls are not provided by Daikin Applied, the normally closed contacts of the DX low limit should be electrically connected (following all appropriate codes) to disable the compressor when contacts open. Controls must be designed to keep the unit ventilator fan running when the compressor is on, so that the face and bypass damper is full face for compressorized cooling operation and other system safeties are provided and integrated into the system controls correctly.

When a DX coil is used for the main source of cooling, the outdoor condensing unit will be cycled on and off as required to maintain the room temperature.

A low temperature thermostat control is inserted into the DX coil to prevent frosting. When tripped, the outdoor condensing unit is locked out and the indoor unit ventilator fan continues to run. When the DX coil temperature rises above the trip set point, the outdoor condensing unit will be allowed to operate.

The outdoor condensing unit is also locked out based on outside air temperature. If the outside air is below the DX outside air low limit the outdoor condensing unit is locked out and cooling is provided by the economizer of the unit ventilator.

Condensing Unit Installation

The condensing unit must not be located more than 30 feet above the unit ventilator and should be located at least 24 inches from a wall or other obstruction to provide unrestricted airflow and to allow for service access. Since condenser discharge air is vertically directed, do not allow any obstruction within 6 feet (measured vertically) from the top of the condensing unit.

Control circuit power, located in the unit ventilator right end compartment, is obtained from a 24-volt transformer furnished by Daikin Applied. The transformer is wired to the fan control switch to de-energize the 24-volt circuit when the switch is in the off position. The condensing unit must be controlled by the same room sensor that controls the unit ventilator.

The temperature control contractor must field supply a low-ambient thermostat in the 24-volt circuit to prevent operation of the condensing unit when the outdoor air temperature is below 60°F. Wire this device into the temperature controls in such a manner that, when the low ambient thermostat opens at 60°F, the unit ventilator is returned to the heating-only mode with full ventilation cooling capabilities.

Typical System Wiring And Piping

General system wiring and piping for a DX system are shown in Figure 117 and Figure 118. For additional information, see Daikin Applied Unit Ventilator Installation Manual IM 1399.

Figure 117: Typical DX System Wiring

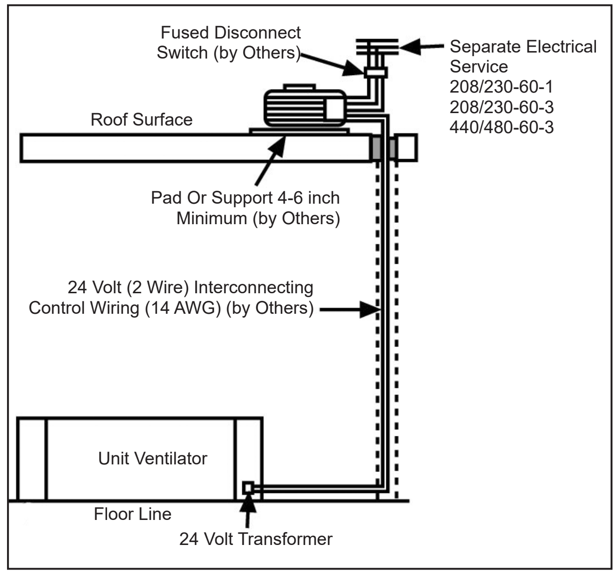
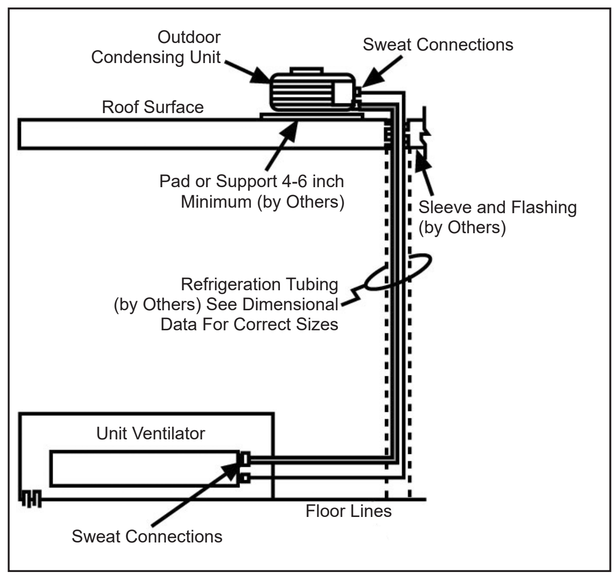


Figure 118: Typical DX System Piping



Nominal cooling capacities are based on 20 feet (one way) of refrigerant tubing between the unit ventilator and the condensing unit. Cooling capacities will be reduced by 20 BTU for each foot in excess of 20 feet. Refrigerant tubing must not exceed 90 feet.

Systems using refrigerant lines longer than 20 feet between the unit ventilator and condensing unit may experience a slight capacity reduction and require crankcase heaters, additional refrigerant oil and refrigerant, and special piping considerations. Clean, refrigerant grade tubing must be used and precautions taken to prevent oxidation and scale formation inside the tubing during brazing. Adequate system isolation valves are required. A filter drier and sight glass are recommended. For specific recommendations on suction and liquid line sizes, routing and length limits, follow the condensing unit manufacturer's recommendations and the ASHRAE Guide.

Most condensing units are pre-charged with refrigerant (R-32) for a nominal length of tubing. It may be necessary to add additional charge. The system, including the unit ventilator coil, must be leak tested and evacuated before charging.

Proper refrigerant charge is critical for optimum system operation. Refer to the condensing unit manufacturer's start-up documents to determine the proper system charge.

Digital Ready Systems

For unit ventilator applications where controls are to be supplied by others, specifying a Digital Ready system can greatly simplify control installation.

Digital Ready systems come with a factory-installed, pre-wired package of selected Direct Digital Control (DDC) components. This greatly facilitates the field hook up of a DDC unit ventilator controller that is compatible with these components and that is capable of providing the standard ASHRAE II cycle (see "ASHRAE Cycle II Operation" on page 110).

Note: *It is the responsibility of the control supplier to ensure the controls operate correctly and protect the unit.*

Digital Ready systems include the following components, which are factory wired and powered:

1. A non-fused power interrupt switch.
2. Hot line(s) for the fan motor and controls protected by factory-installed cartridge type fuse(s).
3. Three-speed HIGH-MEDIUM-LOW-OFF motor fan speed switch (SW2) on units with 3-speed EC motor. (Units with variable airflow EC motor will not have a speed switch.)
4. A 75 VA, 24-volt NEC Class 2 transformer for the 24-volt power supply.
5. Three 10-pole, Europa-type, 16 awg terminal strips rated for 10 amps at 300 volts with nickel-plated connectors and zinc-plated clamping screws.
6. Approximately 8" x 21" (203 mm x 533 mm) of space provided in the unit ventilator's left end compartment for unit ventilator controller mounting (by others).
7. Interface to the fan motor start/stop relay (R4).
8. Interface to a factory-installed low-air-temperature limit freezestat (T6). The freezestat cuts out below 38±2°F and automatically resets above 45±2 °F. It responds when any 15% of the capillary length senses these temperatures. And, it is wired so that upon T6 cut out, the outside air damper closes, the hot water valve opens and the 24 volt power supply to the terminal strip (T6 Sig) is interrupted.
9. Discharge air temperature sensors: 10 kΩ NTC (Negative Temperature Coefficient) and 1 kΩ PTC (Positive Temperature Coefficient) located on the second fan housing from the right side of the unit.
10. Room temperature sensors: 10 kΩ (NTC) and 1 kΩ (PTC).
11. Outdoor air temperature sensors: 10 kΩ (NTC) and 1 kΩ (PTC).
12. A direct-coupled, proportional-control (0 to 10 VDC) outdoor air/return air damper actuator with spring return.
13. A direct-coupled, proportional-control (0 to 10 VDC) face and bypass damper actuator without spring return.
14. Interface from the terminal board with one or two end-of-cycle DDC valves with spring return actuators (by others) providing 24-volt power. Open/shut signal from unit ventilator controller (by others).
15. A 24-volt power wiring harness from the right to left-hand end compartment of the unit, through the built-in metal wire raceway, and terminating at three terminal blocks.
16. DX low-limit designed to protect against abnormally low evaporator coil temperatures (DX units only).

Note: *See "Required Control Sequences" on page 109 for control sequences that should be incorporated for equipment protection and occupant comfort.*

Field-Installed Controls By Others and Digital Ready Controls

There are many advantages to having the basic temperature controls in Daikin Applied units be MicroTech and factory-installed in the unit ventilator prior to shipment (see "MicroTech Controls (Optional)" on page 23). However, factory installation of controls cannot always be achieved. For example, sometimes the specified controls are nonstandard and as such deviate from the pre-engineered DDC control packages available.

A particular school system may have a preferred temperature control supplier that is unable to interface with standard unit ventilator controls or may decide to field-install them. In such cases, we will ship the unit without any temperature controls. It is the responsibility of the automatic temperature control supplier to provide a control package specifically for installation in the Daikin Applied unit ventilator.

The responsibility for proper control operation and application always rests with the Automatic Temperature Control (ATC) contractor regardless of whether the controls are factory installed or field installed.

The effect of misapplied or improperly installed controls can go beyond unacceptable or poor temperature control: unit ventilator components may be damaged by control misapplication. Brief examples of this include:

- Frozen hydronic coils due to improper or lack of freeze protection and/or incorrect control cycle (failure to close outdoor air damper and open the hot water temperature control valve during night cycle, full shutoff of water through a coil exposed to freezing air, etc.)
- Compressor failures where condensing units are permitted to operate at low ambient conditions or without room air fan operation for prolonged periods.
- Failure of Daikin Applied furnished protective devices due to excessive recycling caused by improper control cycle.

Daikin Applied disclaims all responsibility for any unit component failure that may occur due to improper temperature control application or installation.

The following presents information on specific factory-provided equipment protective devices and their suggested use by others in non-MicroTech control sequences. The Automatic Temperature Control supplier is responsible for correct operation and unit protection.

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. See "ASHRAE Cycle II Operation" on page 110.

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.

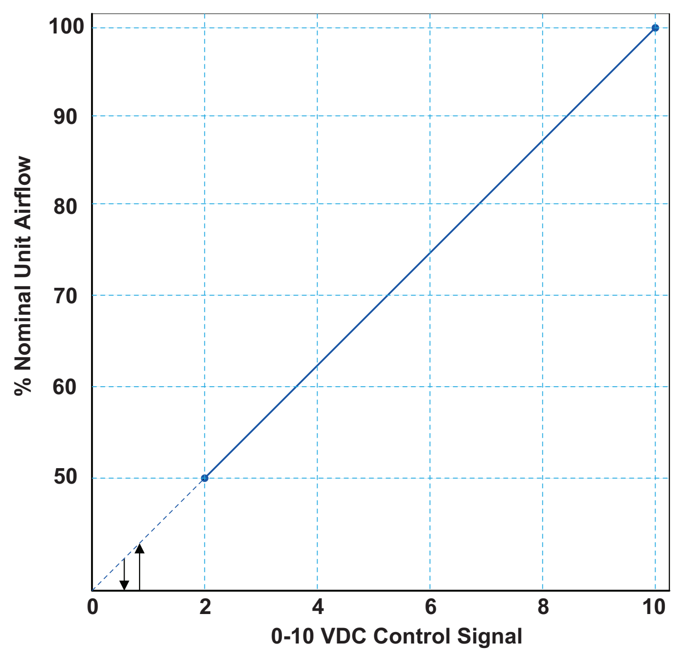
When the discharge air temperature drops below 55°F, the discharge-air low-limit function will disable cooling (if enabled) and modulate the unit's heating capability as needed to maintain the 55°F discharge-air setpoint regardless of room temperature.

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.

Variable Airflow

An EC motor with optional "variable fan speed control" allows for MicroTech controls or a field-provided DDC controller to modulate the unit airflow between 50% and 100% of nominal unit airflow in a single zone variable air volume sequence. In continuous fan mode the benefits of Single Zone VAV include sound reduction, energy savings, and consistent and precise temperature control for improved comfort with better air mixing and less stratification. In humid climates, the ability to deliver a wide range of fan speeds is particularly effective for de-humidification.

Figure 119: 0-10VDC Motor Operation



Required Control Sequences

When using controls by others or digital-ready units, the following control sequences should be incorporated for equipment protection, and occupant comfort. Not including them may void the unit warranty. It is the responsibility of the Automatic Temperature Control supplier to ensure the controls operate correctly and protect the unit.

DX Low Temperature Limit Sequence

Each of the following units comes with a factory-installed DX Low Temperature Limit switch:

- DX Cooling With Electric Heat
- DX Cooling Only
- DX Cooling With Steam Or Hot Water Heat Using Valve Control
- DX Cooling With Steam Or Hot Water Heat Using Face And Bypass Damper Control

Its function is to temporarily de-energize the DX system when the DX coil becomes too cold. This switch has a cut-out setting of no less than 28±3°F and a cut-in temperature setting of approximately 48±3°F. When the switch cuts out due to low temperatures the compressor (condensing unit) must be de-energized until the switch cuts in (coil has warmed up).

The condensing unit should have its own high-pressure safety sequence or head pressure control and a Low Ambient Temperature Lockout feature which prevents DX cooling operation when the outside air temperature drops below 60°F. Cooling should be provided via an outdoor air damper economizer function when the outside air temperature drops below 60°F.

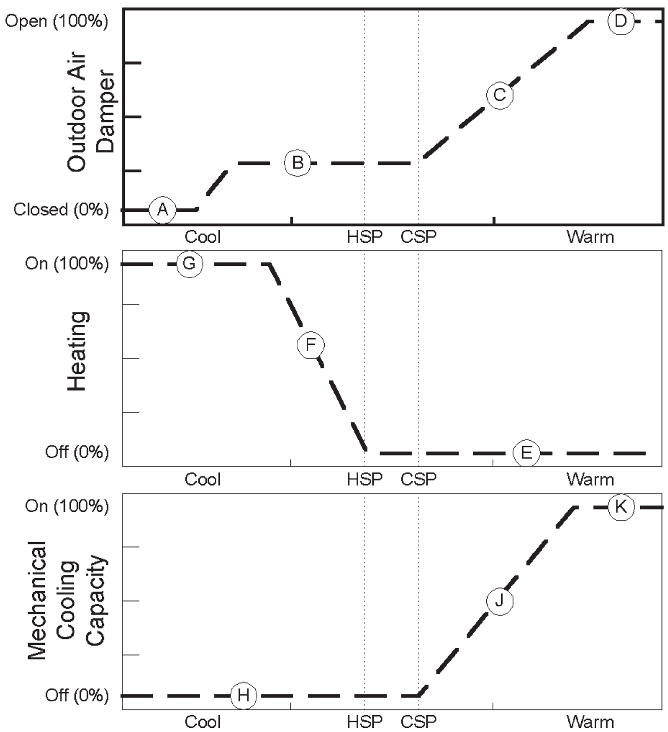
DX Cooling Sequence with Steam or Hot Water Heat and face and bypass Damper Control

For this configuration, a heating End-Of-Cycle valve must be used so that hydronic heat can be switched off when DX cooling is required. Improper system operation will result if this valve is not provided. When cooling is required, the controls must force the face and bypass damper to a full-face position prior to starting DX cooling. See "DX Split Systems" on page 105 for additional controls required for DX operation.

Chilled-Water Cooling Sequence with face and bypass Damper Control and Electric Heat

When heating is required, the controls must force the face and bypass damper to a full-face position prior to energizing the electric heaters.

Figure 120: 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 or over-cooling which can occur when the face and bypass damper is in the full bypass position (i.e., no heating or cooling required).

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.

Heat/Cool EOC Valve (2-pipe)

For units with chilled-water cooling and hot-water heating (2 pipe) and face and bypass damper control:

- The heat/cool EOC valve should be a normally open, spring return (open), two position valve.
- A water-in temperature sensor should be used to determine whether the supply water temperature is appropriate for heating or cooling. The sensor should be located on the water supply in an area where there is continuous water flow. A 3-way EOC valve is recommended.

In addition:

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

Heating EOC Valve

For steam or hot water heat only with face and bypass damper control; chilled water cooling with steam or hot water heating (4 pipe) 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.

Cooling EOC Valve

For chilled water cooling with steam or hot water heating (4 pipe) with face and bypass damper control; chilled water cooling only with face and bypass damper control; chilled water cooling with face and bypass damper control coupled electric heat:

The cooling EOC valve should be a normally closed, spring return (closed), two position valve.

1. **Cooling Operation:** When room temperature is 2°F or more above the cooling setpoint, the EOC valve should open and remain open until the room temperature becomes equal to the cooling setpoint or less.
2. **Operation Due To Outside Air Temperature:** If the outside air temperature is equal to or less than 35°F, and the face and bypass damper is in the full bypass position, the EOC valve should open. The valve should remain open until the outdoor air temperature reaches 37°F or higher or if the face and bypass damper is not in the full bypass position.

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:

Face And Bypass Damper Control Applications

Hot Water Heat Only or Chilled Water Cooling And Hot Water Heating (2 Pipe): The length of the freezestat is secured to the leaving air face of the heating coil. When the freezestat cuts out due to low temperatures the following should occur:

- 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.

Chilled Water Cooling With Hot Water Heating (4 Pipe):

If the cooling coil is in the first position and the heating coil in the second position, the freezestat is secured to the leaving air face of the first position coil (cooling coil).

Note: *The freezestat is placed between the first and second coils. If you use glycol in the first coil, then you may move the freezestat to the leaving air side of the second coil. If you do not use glycol in the first coil, leave the freezestat where it is.*

If the cooling coil is in the second position, the heating coil is in the first position and the heating coil is hot water, the freezestat is secured to the leaving air face of the first position coil (heating coil).

When the freezestat cuts out due to low temperatures, the following should occur:

- The outdoor air damper is closed.
- The cooling and heating EOC valves are forced to full open.
- If heating is required, the face and bypass damper modulates normally to maintain room temperature.

When the freezestat cuts in after cut-out, normal operation may return.

Chilled Water Cooling Only: The freezestat is secured to the leaving air face of the cooling coil. When the freezestat cuts out due to low temperatures, the following should occur:

- The outdoor air damper is closed.
- The cooling EOC valve is forced to full open.
- If cooling is required, the face and bypass damper modulates as needed to maintain space temperature.

When the freezestat cuts in after cut-out, normal operation may return.

Chilled Water Cooling With Electric Heat: The freezestat is secured to the leaving air face of the cooling coil. When the freezestat cuts out due to low temperatures the following should occur:

- The outdoor air damper is closed.
- The cooling EOC valve is forced to full open.
- If cooling is required, the face and bypass damper modulates as needed to maintain room temperature.
- If heating is required, the face and bypass damper goes to full face and electric heat is used as needed to maintain space temperature.

When the freezestat cuts in after cut-out, normal operation may return.

DX Cooling With Hot Water Heat and 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 (condensing unit) 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 or cooling 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.

Hot Water Heat Only or Chilled Water Cooling And Hot Water Heating (2 Pipe): 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 outside 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.

Chilled Water Cooling With Hot Water Heating (4 Pipe): If the cooling coil is in first position and the heating coil is in second position, the freezestat is secured to the leaving air face of the first position coil (cooling coil).

Note: *The freezestat is placed between the first and second coils. If you use glycol in the first coil, then you may move the freeze stat to the leaving air side of the second coil. If you do not use glycol in the first coil, leave the freezestat where it is.*

If the cooling coil is in the second position, the heating coil is in the first position, and the heating coil is hot water, the freezestat is secured to the leaving air face of the first position coil (heating coil).

When the freezestat cuts out due to low temperatures, the following should occur:

- 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.

Chilled Water Cooling Only: The freezestat is secured to the leaving air face of the cooling coil. When the freezestat cuts out due to low temperatures, the following should occur:

- The outdoor air damper is closed.
- The cooling valve is forced to full open.

When the freezestat cuts in after cut-out, normal operation may return.

Chilled Water Cooling Coupled With Electric Heat: The freezestat is secured to the leaving air face of the cooling coil. When the freezestat cuts out due to low temperatures, the following should occur:

- The outdoor air damper is closed.
- The cooling valve is forced to full open.
- Electric heat is used as needed to maintain space temperature.

When the freezestat cuts in after cut-out, normal operation may return.

DX Cooling With Hot Water Heat and 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

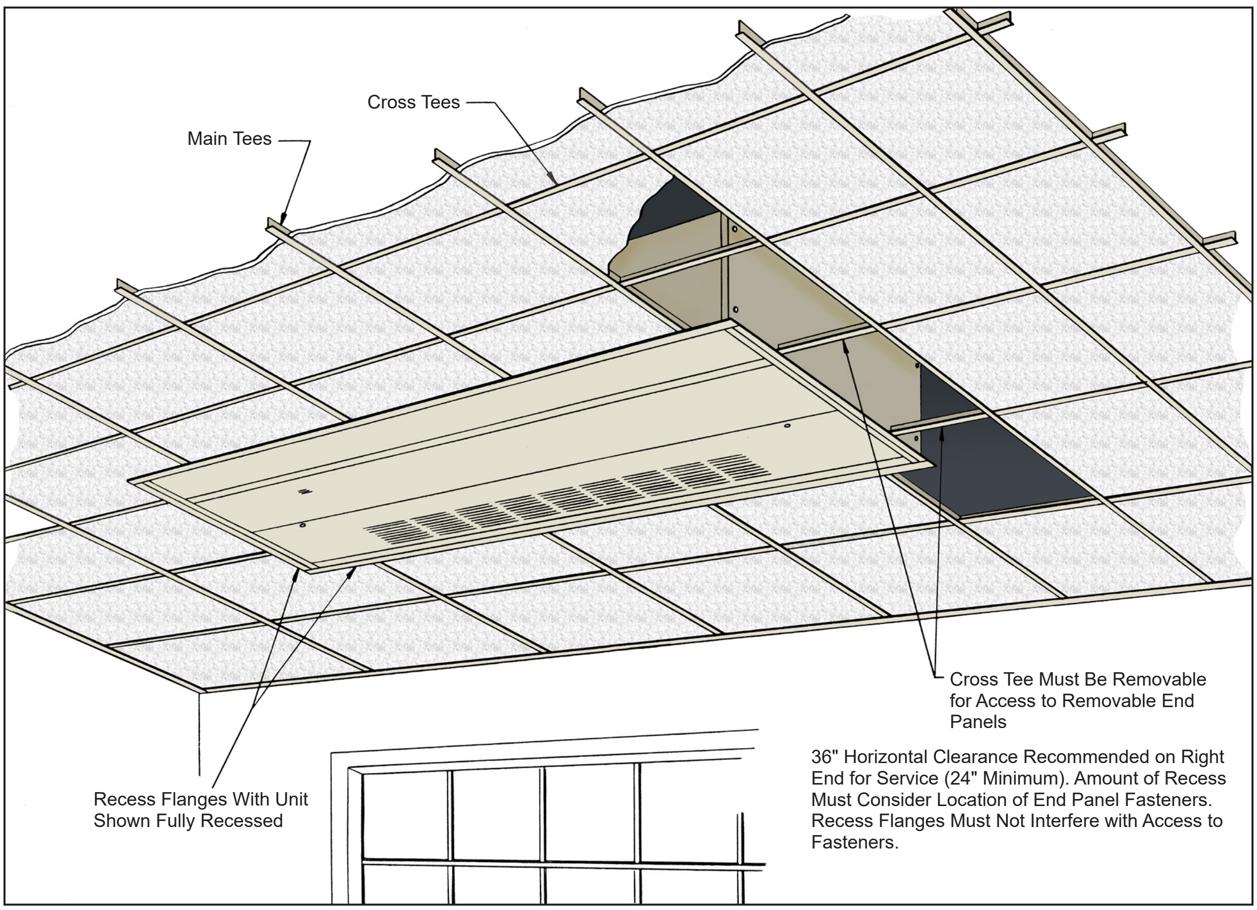
Ceiling unit ventilators are typically applied to bring outdoor air directly to classrooms, interior rooms or spaces of a school such as a computer teaching room, auditorium, gymnasium or library. Units, when correctly applied, are capable of operating in a free blow application or against external statics of up to 0.45 inches w.g. See "Unit Arrangements" on page 115.

The unit can be mounted in an exposed position, in a soffit, partially recessed, fully recessed or concealed. See Figure 11 on page 10. Wall guard flanges are a standard accessory for partially and fully recessed units, to provide a finished appearance at the ceiling.

Accessibility to fully recessed units should be considered. See Figure 121. When hanging, the unit should be level both front to back and side to side. This aids in condensate removal from the drain pan.

The unit is equipped with several inlet and discharge arrangements to satisfy numerous application needs. One-inch, field-installed duct collars are provided for field attachment to the supply-air outlet. Locate the unit ventilator as close as practical to the outdoor air intake opening. Insulate the outdoor air duct to reduce sweating and temperature rise.

Figure 121: Accessibility to Fully Recessed Units



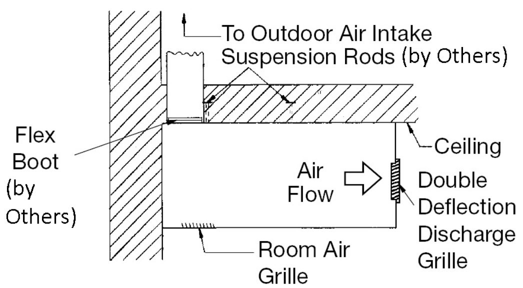
Unit Arrangements

Ceiling unit ventilation is typically applied to bring outside air directly to interior rooms or spaces of a school such as a computer teaching room, auditorium, gymnasium or library. The ceiling unit can be applied in a variety of applications; in a soffit, partially recessed, fully recessed and concealed. Units when correctly applied are capable of operating against external statics up to 0.45 inches w.g. Flexible boots and ceiling are by others.

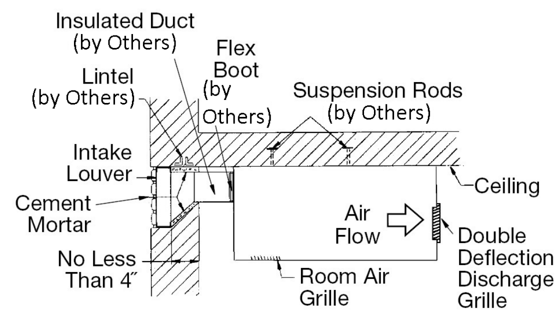
> ⚠ **CAUTION**
>
> Avoid a rear outdoor return air arrangement, where strong prevailing winds have a direct path into the unit ventilator outdoor air opening. Strong air turbulence can cause undesirable sound levels, unit operating issues, and property damage.

Completely Exposed Arrangements

Figure 122: 36" Units

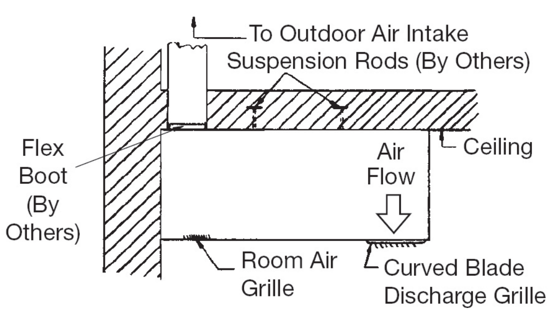


Room Air from Bottom Grille, Outdoor Air from Top Duct Collar (Arrangement 26), Discharge Air from Front Double- Deflection Grille (Arrangement AT)

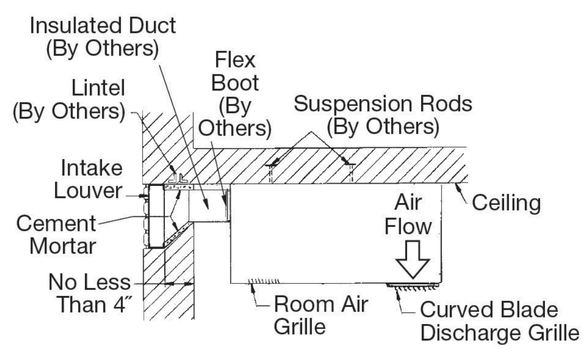


Room Air from Bottom Grille, Outdoor Air from Rear Duct Collar (Arrangement 27), Discharge Air from Front Double-Deflection Grille (Arrangement AT)

Figure 123: 40" Units



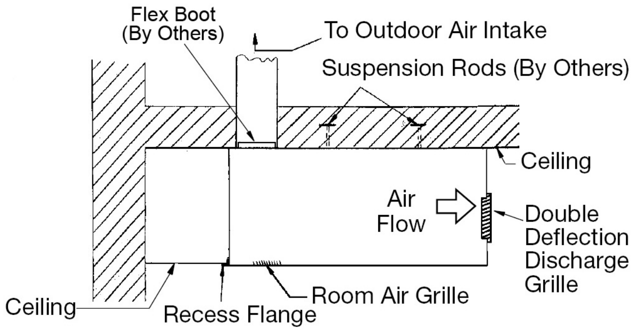
Room Air from Bottom Grille, Outdoor Air from Top Duct Collar (Arrangement 26), Discharge Air from Bottom Double-Deflection Grille (Arrangement BD)



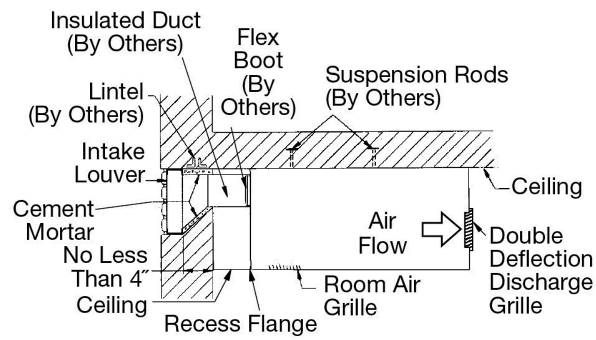
Room Air from Bottom Grille, Outdoor Air from Rear Duct Collar (Arrangement 27), Discharge Air from Bottom Double-Deflection Grille (Arrangement BD)

Partially Exposed (Soffit) Arrangements

Figure 124: 36" Units

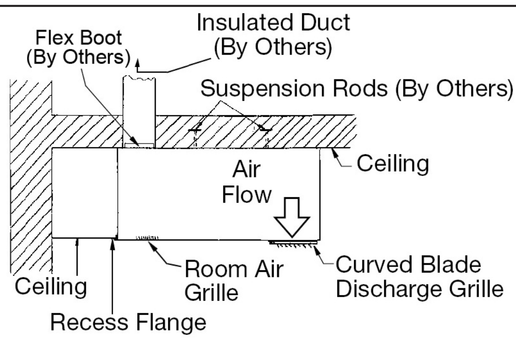


Room Air from Bottom Grille, Outdoor Air from Top Duct Collar (Arrangement 26), Discharge Air from Front Double-Deflection Grille (Arrangement AT)

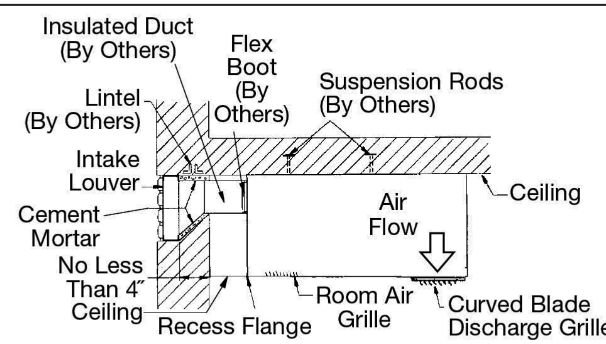


Room Air from Bottom Grille, Outdoor Air from Rear Duct Collar (Arrangement 27), Discharge Air from Front Double-Deflection Grille (Arrangement AT)

Figure 125: 40" Units



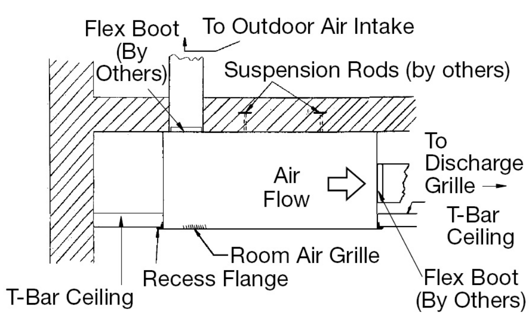
Room Air from Bottom Grille, Outdoor Air from Top Duct Collar (Arrangement 26), Discharge Air from Bottom Double-Deflection Grille (Arrangement BD)



Room Air from Bottom Grille, Outdoor Air from Rear Duct Collar (Arrangement 27), Discharge Air from Bottom Double-Deflection Grille (Arrangement BD)

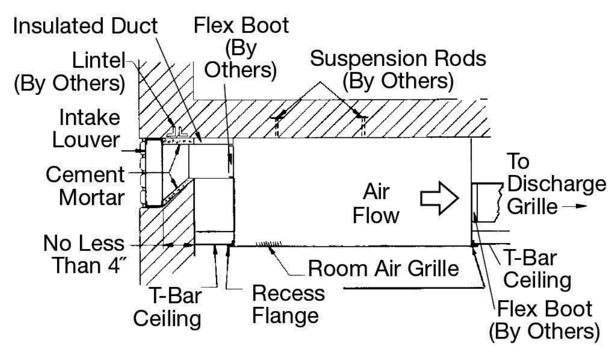
Fully Recessed Arrangement

Figure 126: 36" Units



Room Air from Bottom Grille, Outdoor Air from Top Duct Collar (Arrangement 26), Front Discharge (Arrangement AH) Four-Sided Recess Flange (Accessory)

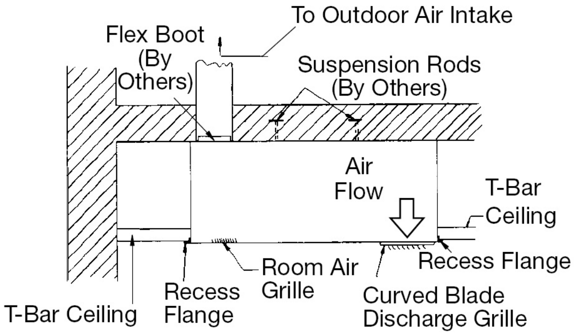
Note: *Consider Ceiling Lighting*



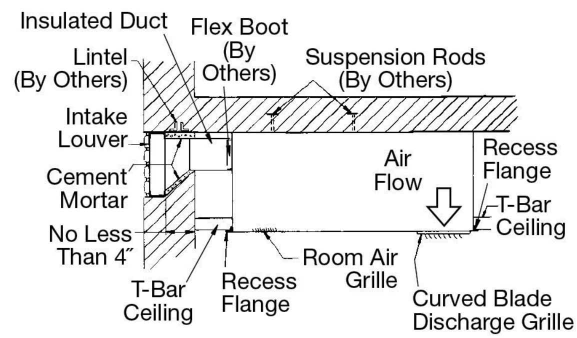
Room Air from Bottom Grille, Outdoor Air from Rear Duct Collar (Arrangement 27), Front Discharge Duct Collar (Arrangement AH) Four-Sided Recess Flange (Accessory)

Note: *Consider Ceiling Lighting*

Figure 127: 40" Units



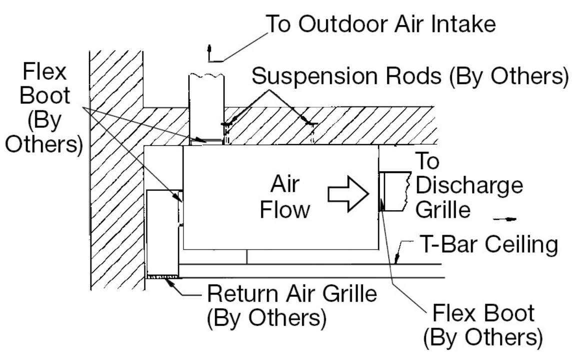
Room Air from Bottom Grille, Outdoor Air from Top Duct Collar (Arrangement 26), Discharge Air from Bottom Double-Deflection Grille (Arrangement BD), Four-Sided Recess Flange (Accessory)



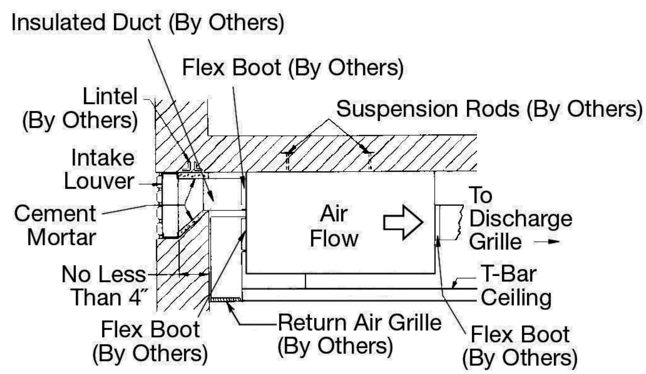
Room Air from Bottom Grille, Outdoor Air from Rear Duct Collar (Arrangement 27), Discharge Air from Bottom Double-Deflection Grille (Arrangement BD), Four-Sided Recess Flange (Accessory)

Concealed Arrangements

Figure 128: 36" Units

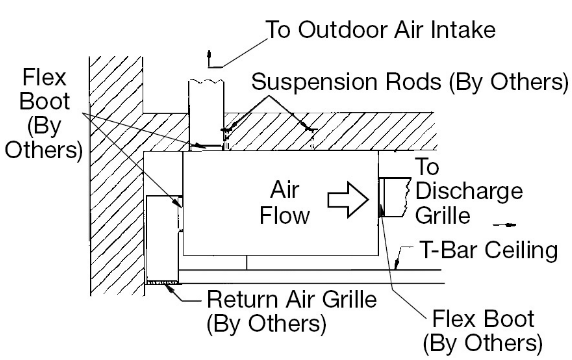


Room Air from Rear Duct Collar, Outdoor Air from Top Duct Collar (Arrangement 29), Discharge Air from Front Duct Collar (Arrangement AH)

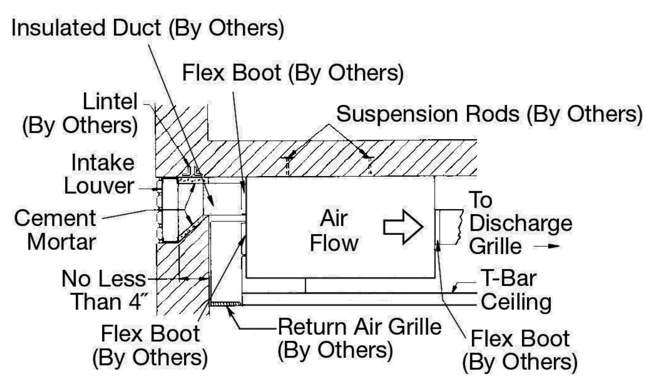


Room Air from Rear Duct Collar, Outdoor Air from Rear Duct Collar (Arrangement 29), Discharge Air from Front Duct Collar (Arrangement AJ)

Figure 129: 40" Units



Room Air from Rear Duct Collar, Outdoor Air from Top Duct Collar (Arrangement 29), Discharge Air from Front Duct Collar (Arrangement FD)



Room Air from Rear Duct Collar, Outdoor Air from Rear Duct Collar (Arrangement 29), Discharge Air from Front Duct Collar (Arrangement FD)

Duct System Applications

Duct work can be used with this unit for outdoor, return and discharge air, singly or in combination. It is designed to operate against external static pressures (ESP) through 0.45". ESP is determined by adding the discharge air static pressure, if any, to the greater of the outdoor or return air static pressure.

Duct System Design

Good duct design makes for a quiet installation that can positively impact a school for years. Flexible connections between the unit discharge, the unit return/outdoor air and any duct work should be provided using uniform straight flow conditions at the unit outlet and inlet. Accurate determination of resistance losses for the ductwork system is also necessary for satisfactory fan performance.

The following general suggestions are offered only to stress their importance; however, additional important factors must be considered. Assistance in the design of ductwork can be found in the ASHRAE Handbook and SMACNA publications, as well as other recognized authorities.

Duct Design For Noise Control

Proper acoustics are often a design requirement for schools. Most problems associated with HVAC generated sound can be avoided by properly selecting and locating system components. Figure 130, Figure 130 and Figure 130 on page 118 show suggested supply and return air duct considerations per SMACNA and ASHRAE. Here are some general do's and don'ts that should be observed to reduce the amount of sound that reaches the occupied room:

- Use flexible duct connections.
- Make the discharge duct the same size as the unit discharge opening for the first five feet.
- Line the first five feet of the supply and return ducts.
- Make two 90-degree turns in the supply and return air ducts.
- Keep duct velocity low and follow good duct design procedures.
- Mount and support the ductwork independent of the unit.
- Locate the return air intake away from the unit discharge.
- Provide multiple discharges.
- Restrict use of high-pressure-drop flexible ducting.
- Size the outdoor air and return air ducts to handle 100% of the total cfm to accommodate economizer or morning warm-up operation.

Figure 130: Suggested Supply Air Ducting per ASHRAE and SMACNA Publications

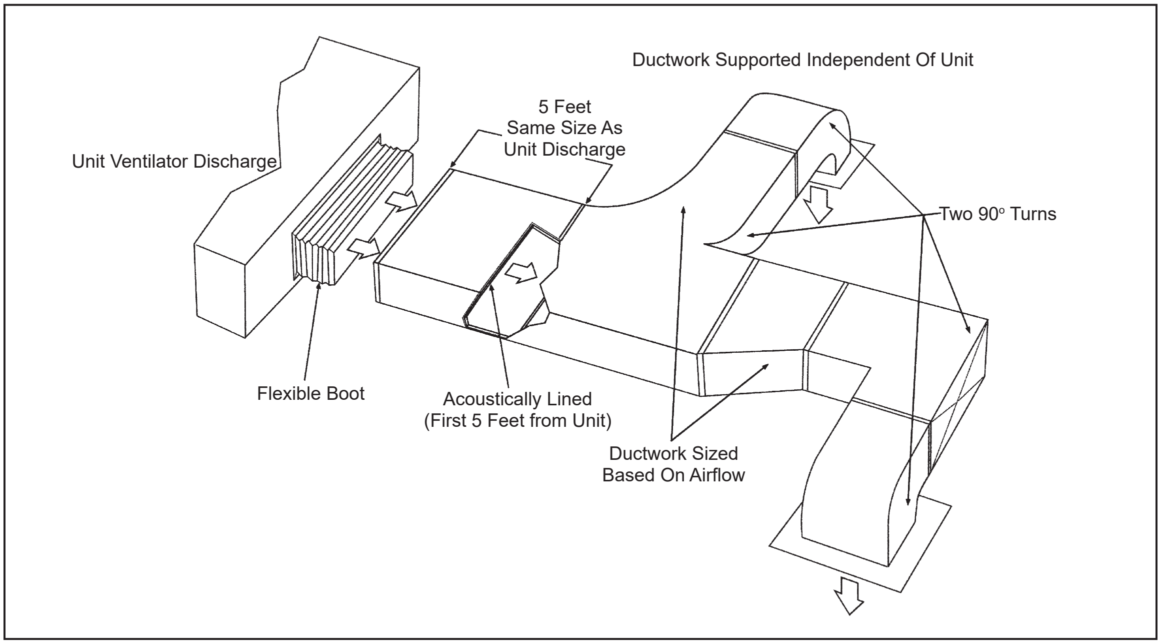


Figure 131: Suggested Return Air Ducting per ASHRAE and SMACNA Publications

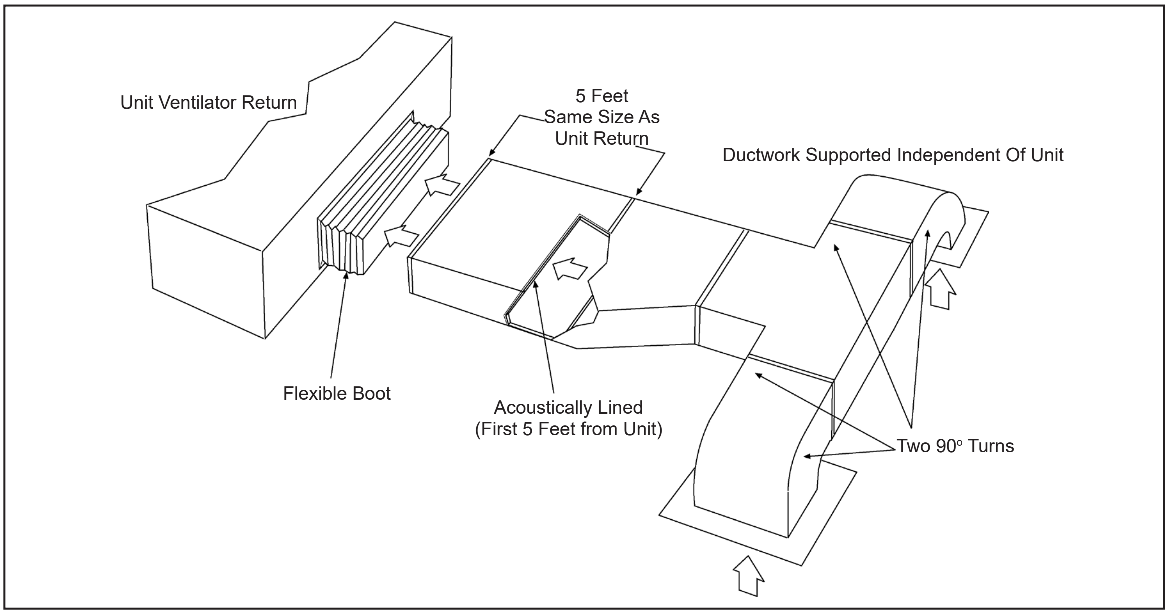
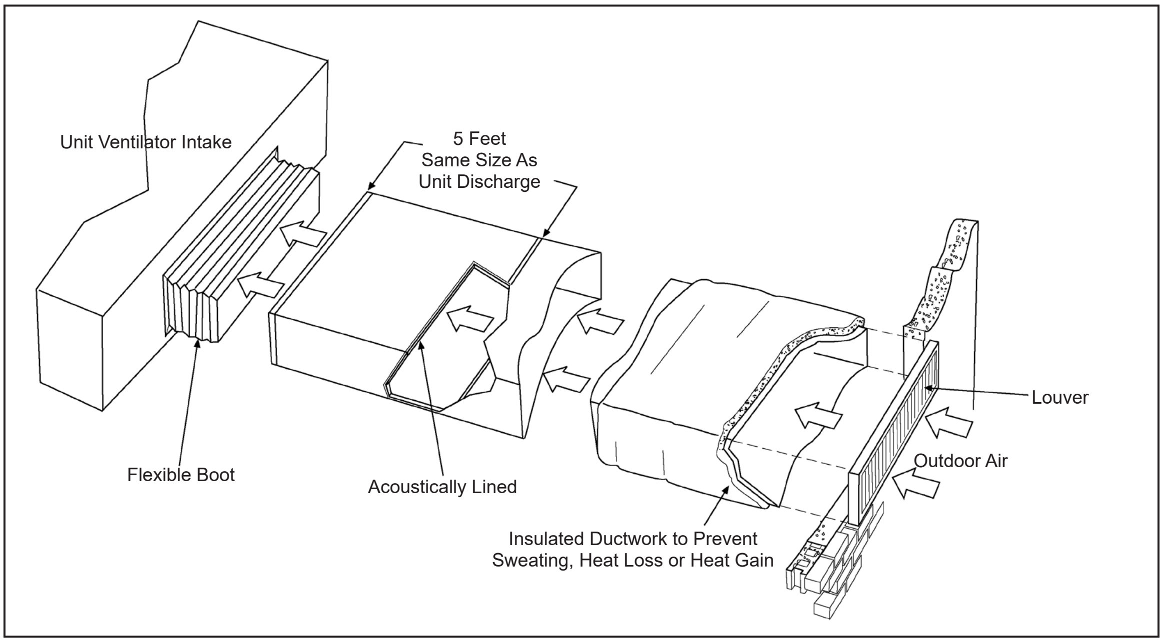


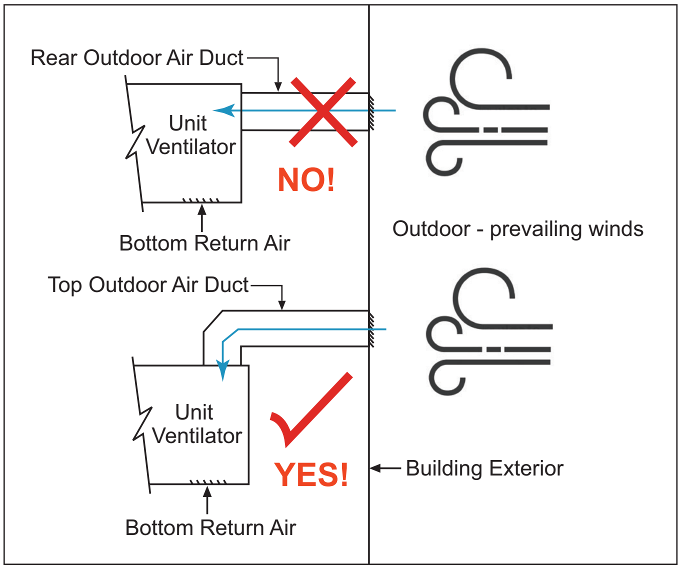
Figure 132: Suggested Outdoor Air Ducting (Insulated) per ASHRAE and SMACNA Publications



⚠ CAUTION

Avoid a rear outdoor return air arrangement, where strong prevailing winds have a direct path into the unit ventilator outdoor air opening. Strong air turbulence can cause undesirable sound levels, unit operating issues, and property damage.

Figure 133: Outdoor Air Arrangement With Prevailing Winds



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.

Recessed Wall Louvers

Set recessed wall louvers into the wall in a bed of mortar with the face of the louver frame set slightly inside the wall line. The complete wall louver frame must be level with the face plumb and the louver frame set so that the drain holes on the bottom are toward the outside of the building.

The mortar should seal the frame perimeter water-tight to help prevent leaks. Do not block drain holes in the frame with mortar (Figure 134).

Flanged Wall Louvers

Set flanged wall louvers into the wall in a bed of mortar with the face of the louver frame flush with the wall line (Figure 135). The complete wall louver and frame must be set level. Do not block drain holes in the frame with mortar.

Use appropriate fasteners to secure the louver through the flange into the adjacent wall. Caulk the entire perimeter of the flange. For panel wall construction applications, caulk and seal the top and vertical sides of the vertical blade louver. Be sure that the drainage holes are pointing outward and that a metal channel is used to drain moisture (Figure 136).

Figure 134: Recessed Wall Louver Installation Detail

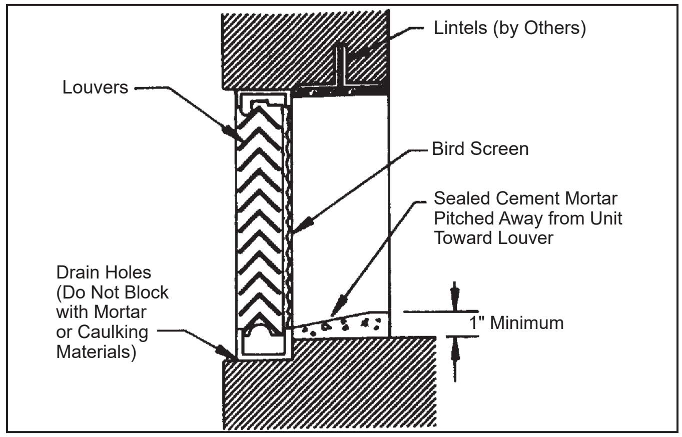


Figure 135: Flanged Wall Louver Installation Detail

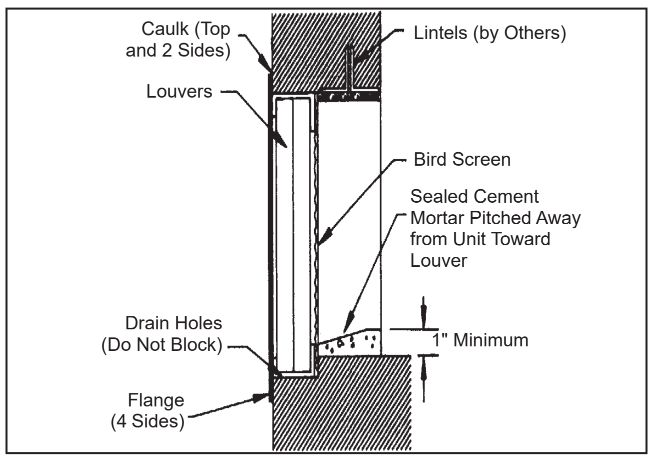
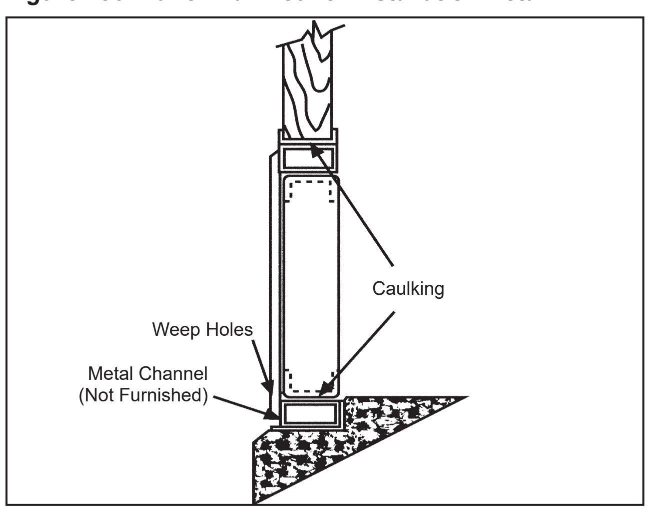


Figure 136: Panel Wall Louver Installation Detail



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. This provides a surface against which the gasket at the bottom of the unit ventilator can be placed to help prevent any leakage of outdoor air under 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.

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 26 for information on this system and its proper installation.

VentiMatic Installation

Figure 137: VentiMatic Shutter Components

Louver Ships Assembled As One Piece

The VentiMatic shutter should be mounted on the same wall as the unit ventilator. This neutralizes the effect of wind pressure forcing excess air into the room through the unit ventilator louver. That's because the wind pressure will also keep the VentiMatic shutter closed and prevent room air from escaping. Since the existing room air cannot leave, excess air from the wind gust will not enter. (In contrast, a powered exhauster would "assist" the wind's effect.) Same-wall mounting also minimizes "short circuiting" of air flow that could occur with opposite-wall mounting.

The VentiMatic shutter is generally mounted on a Daikin Applied wall louver (ordered separately) which is then used for exhaust For large unit ventilators, two VentiMatic shutters may be mounted side by side on the same wall louver to promote adequate exhaust air capacity. The size and appearance of wall louvers and grilles used for unit ventilators and for VentiMatic shutters are identical and present an architecturally coordinated and pleasing installation.

An ideal method of integrating the VentiMatic shutter with the unit ventilator is to locate the shutter behind a matching open-shelf or closed-shelf storage cabinet mounted next to the unit ventilator. For example, 48-inch length wall louver can be accommodated behind a 4-foot high storage cabinet. The cabinet should be ordered with a slotted-type kick plate to provide a concealed exhaust air path to the shutter. This combination will enable a complete, integrated, energy-efficient HVAC and room exhaust system. For dimensional information, see "VentiMatic Shutter" on page 47.

Valve Selection

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

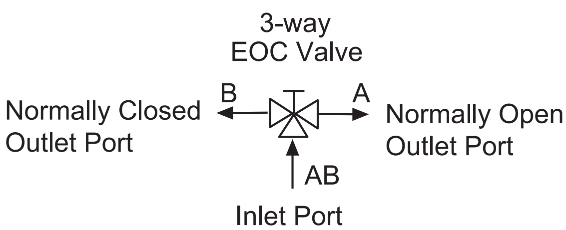
MicroTech face and bypass damper control units require an end-of-cycle (EOC) valve for each hydronic coil. Unlike modulating valves that require precise control over the variable flow rate through the valve, the EOC valves are either full-open or full-closed, and therefore a proper valve Cv selection is not important. Table 47 gives the pressure drops at various water flow rates for the available EOC valves.

Select an EOC valve based on the application and type of coil to be controlled. For hydronic systems with constant flow pumps a 3-way valve is recommended, while 2-way valves are typically used on systems with variable flow pumps. Each hydronic coil in the unit will require its own EOC valve. For hot water or 2-pipe chilled/hot water coils use a normally open valve, and for chilled water coils use a normally closed valve. The 3-way valves can be piped for normally open or normally closed duty (see Figure 138 on page 123) and it is very important that they are properly installed in the field for the MicroTech control sequence to function correctly. The Normally Open outlet port must be connected to hot water or 2-pipe chilled/hot water coils, and the Normally Closed outlet port must be connected to chilled water coils.

Table 47: Hot and Chilled 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 or Chilled 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 / 2-Way Chilled 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
2-Way Hot Water EOC Valve, FNPT, Normally Open																		
8.0	1 inch	ft H2O	0.9	1.3	1.8	2.3	2.9	3.6	4.4	5.2	6.1	7.1	8.1	9.2	10.4	11.7	13.0	14.4
		kPa	2.7	3.9	5.3	6.9	8.7	10.8	13.0	15.5	18.2	21.1	24.2	27.6	31.1	34.9	38.9	43.1

Figure 138: 3-Way Valve Piping Connections



Hot Water EOC Valve Piping

Hot water (or chilled water/hot water 2-pipe) 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 139: 2-Way Hot Water EOC Valve Piping

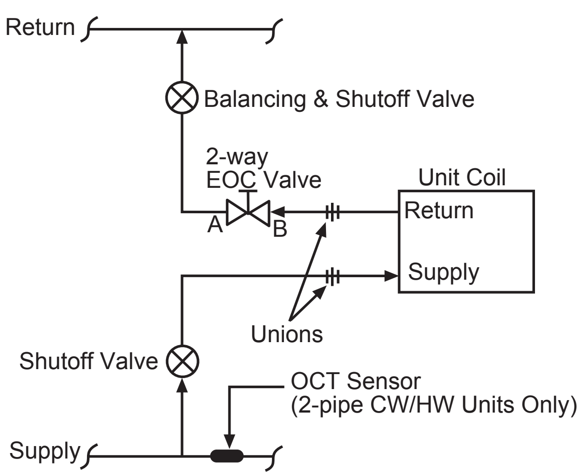
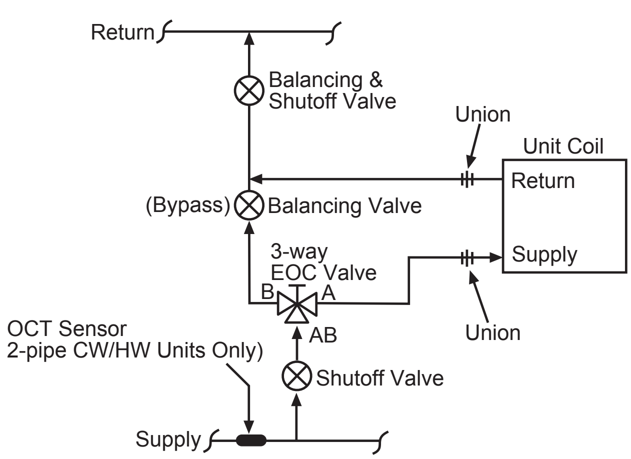


Figure 140: 3-Way Hot Water EOC Valve Piping



Chilled Water EOC Valve Piping

Chilled water EOC valves are furnished normally closed to the coil. When the valve is de-energized (off) there is no flow through the coil. Energizing the valve allows flow through the coil.

Figure 141: 2-Way Chilled Water EOC Valve Piping

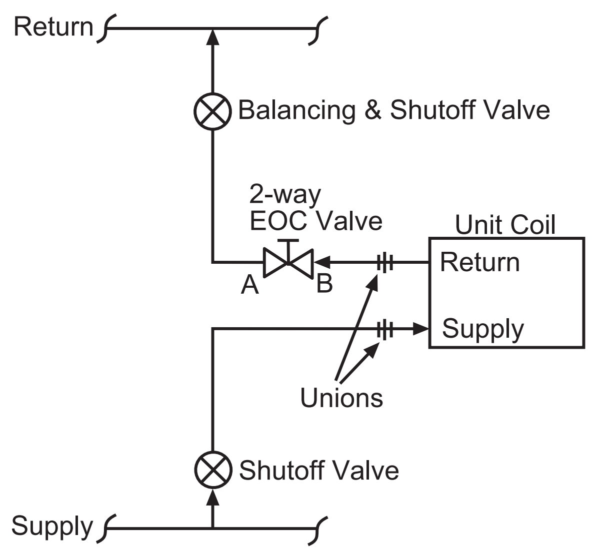
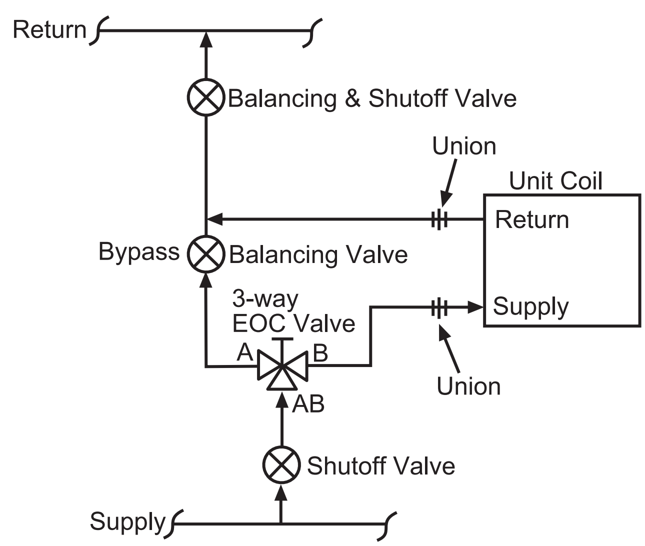


Figure 142: 3-Way Chilled Water EOC Valve Piping



Modulating Valve Sizing and 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 to 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 48 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 "Modulating Steam Valve Selection" on page 126 for application).

Table 48: 2-Way Modulating 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
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 49: Modulating 3-Way Hot Water, Chilled Water or 2-Pipe CW/HW Valve 1/2" – Pressure Drop

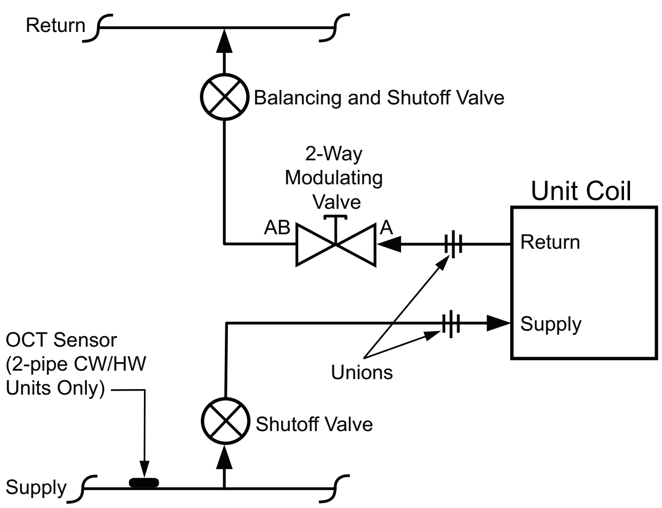
2-Way CCV Part No.	Cv Maximum Rating	Connection Size	Pressure Drop Across the Valve									
			1 PSI	2 PSI	3 PSI	4 PSI	5 PSI	6 PSI	7 PSI	8 PSI	9 PSI	10 PSI
B309(B)	0.8	1/2 inch	0.8	1.	1.4	1.6	1.8	2.0	2.	2.3	2.4	2.5
B310(B)	1.2		1.2	1.7	2.	2.4	2.8	2.9	3.2	3.4	3.6	3.8
B311(B)	1.9		1.9	2.7	3.3	3.8	4.2	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

Hot Water Modulating Valve Piping

Modulating hot water (or 2-pipe CW/HW) valve is furnished to fail open to the coil. 24VAC is required to power the valve actuator. When the actuator is powered, a controller will provide a 2-10VDC signal to the actuator. A signal of 2VDC or less will drive the valve closed; the valve will drive open as the signal increases to a maximum of 10VDC.

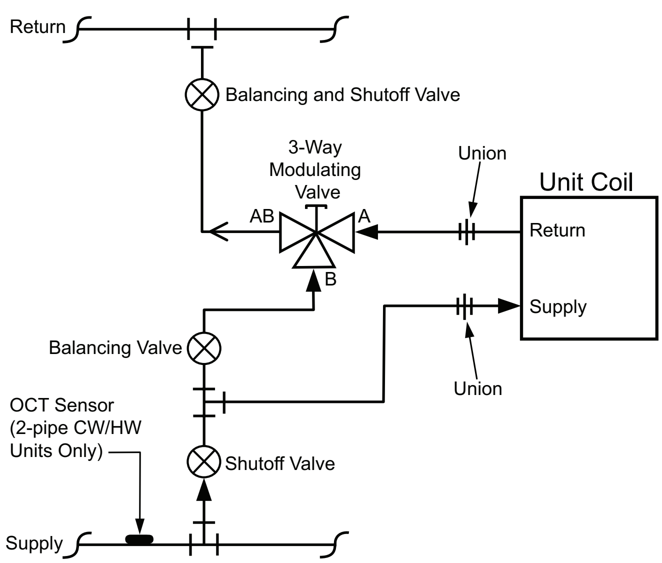
If 24VAC is lost to the actuator, valve will spring-return to its fail position (open to the coil for hot water or 2-pipe CW/HW valves).

Figure 143: 2-Way Hot Water Modulating Valve Piping



Note: *Actuator to be configured for **A** port to be normally open.*

Figure 144: 3-Way Hot Water Modulating Valve Piping



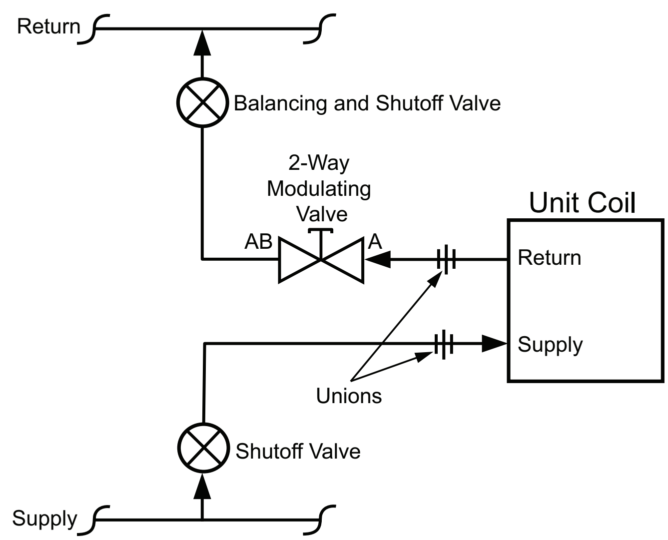
Note: *The **A** port is always piped to the coil. Actuator to be configured for **A** port to be Normally Open.*

Chilled Water Modulating Valve Piping

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

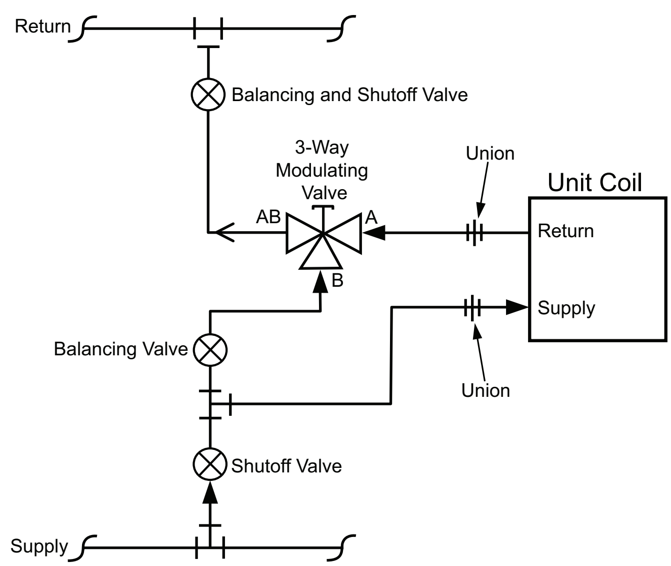
If 24VAC is lost to the actuator, valve will spring-return to its fail position (closed to the coil for chilled water valves).

Figure 145: 2-Way Chilled Water Modulating Valve Piping



Note: *Actuator to be configured for **A** port to be normally closed.*

Figure 146: 3-Way Chilled Water Modulating Valve Piping



Note: *The **A** port is always piped to the coil. Actuator to be configured for **A** port to be Normally Closed.*

Steam Valve Sizing and 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 50 gives the steam capacity based on a pressure drop equal to 10% of the inlet pressure.

Table 50: 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

NOTE: *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 51, 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 51: 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
B215HT455	4.55		54.65	85.44	100.43	114.24	174.72	228.97

Steam Valve Piping

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

If 24VAC 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.

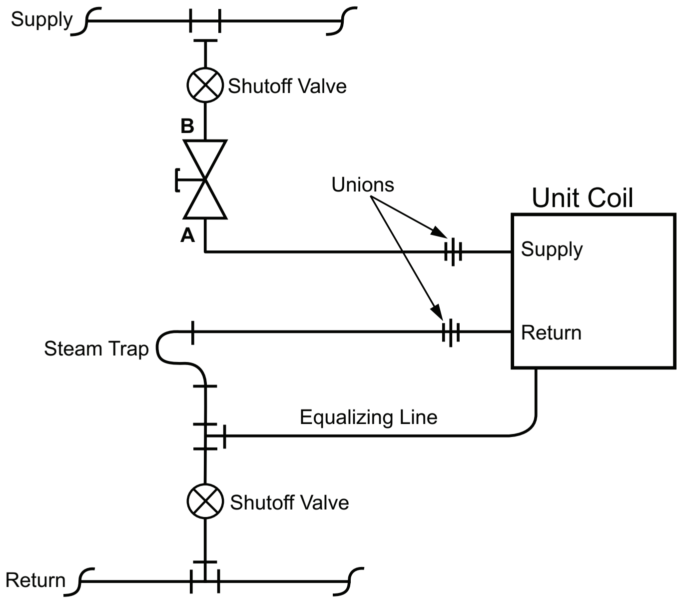
All valves are shipped loose to help prevent shipping damage and to provide the installing contractor with maximum flexibility in making the field piping connection. The valves are field piped by others. They are factory wired for field hook-up.

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.

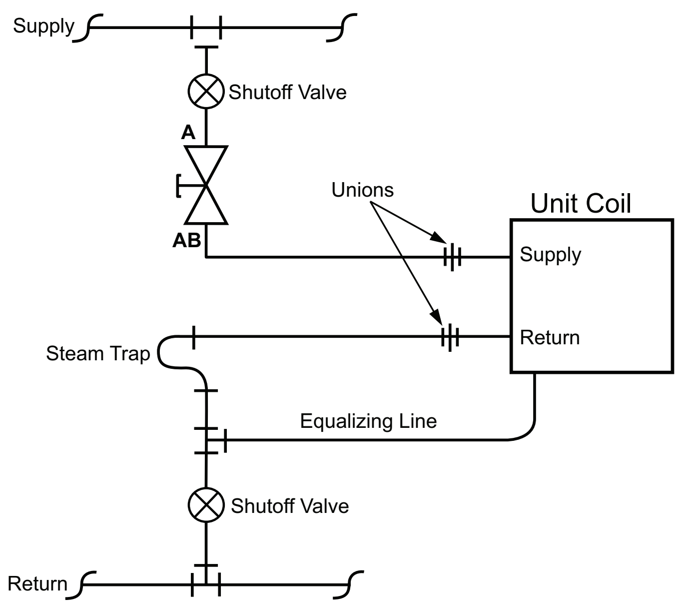
3. The control valve should be installed so that there is 2" (51 mm) minimum clearance to remove the actuator from the valve body. Provide unions for the removal of the unit coil and/or control valve. This is a future service consideration.

Figure 147: 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 148: 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 AHF, AHB, AHV, AHR

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.

PART 2--PRODUCTS - UNIT VENTILATORS

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. Frames assembled with mechanical fasteners shall not be acceptable.

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 18 gauge steel with no sharp edges and shall receive an electrostatically applied powder paint, and be oven baked with environmentally friendly thermosetting urethane powder finish to provide a high quality appearance. Finish color shall be off-white.

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. 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 CEILING UNITS (CEILING UNITS SHALL BE SIMILAR IN CONSTRUCTION TO FLOOR UNITS, WITH THE FOLLOWING ADDITIONAL FEATURES)

A. Three bottom panels, two of which are hinged, shall be provided for ease of service access and handling. Retainer chains shall be provided to prevent sudden release of the hinged bottom panels. End panels shall be secured to the unit with recessed, tamper resistant, Allen head fasteners. Slots for flat head screwdrivers shall not be acceptable as tamper resistant.

B. Ceiling mounted units shall have a built-in metal wire raceway from right end compartment to left end compartment to contain any line voltage electrical wiring separate from the air stream. Line voltage wiring shall not be touchable in the air stream of the unit during normal maintenance procedures of oiling bearings or motors.

C. The discharge opening of the unit shall be fitted with an adjustable four-way deflection grille with the outer blades horizontal.

D. A ceiling trim flange shall be provided for recessed units. The trim flange shall be 3-sided or 4-sided as required.

E. The centerline of the cooling condensate drain shall be a minimum of 4" above the bottom of the unit to allow for appropriate trapping of the condensate disposal line.

2.03 COILS

A. Coil assembly shall be of a modular construction so that it is removable from the bottom of the unit.

B. 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.

C. 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.

D. Electric heat coils shall be open wire (cal rods inserted into a tube shall not be acceptable.). Electric heat coils shall have the following factory-installed safety devices of an automatic reset high temperature limit and a manual resetable high temperature limit that requires a maintenance operator to determine the cause of the trip.

2.04 DRAIN PAN

A. All units (either heating only, heat/cool, cool only or reheat) shall come furnished with an insulated drain pan constructed of galvanized steel. A drain outlet shall be provided on both ends of the drain pan with one outlet capped. The drain hand of connection shall be easily field-reversed by relocating the cap to the opposite end without disassembly of the unit or movement of the unit drain pan.

B. The drain pan shall be able to be sloped in either direction for proper condensate removal.

2.05 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. Motors shall be 208 volt, single phase, 60Hz, ECM with auto reset internal thermal overload device designed specifically for unit ventilator operation. Motors shall be located out of the conditioned air stream.

E. High Static units with external static pressures (ESP) up to 0.45 shall utilize an Electrically Commutated Motor (ECM).

F. All components of the fan/motor assembly shall be removable from the bottom of ceiling mounted units.

G. 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.

H. ECM Motor speed shall be factory programed for three (3) speeds, HIGH-MEDIUM-LOW-OFF (not accessible from the exterior of the unit). Fan motor shall have hot leg protected by a factory installed cartridge fuse.

2.06 VALVE CONTROL TYPE UNITS

A. Each unit shall be provided with a factory-installed metal blockoff to ensure all air is drawn from the filter through the coil. This shall be in addition to the outside front panel.

2.07 OUTDOOR & ROOM DAMPERS

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

B. The room air damper shall be two-piece, double-wall construction fabricated from aluminum, and be counterbalanced against back pressure 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 glass fiber 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.

2.08 FILTER

A. Each unit ventilator shall be equipped with a one-piece filter located to provide filtration of the return air/outdoor air mixture, in lieu of separate filters for each air stream. The entire filter surface must be usable for filtration of 100% room air or 100% of outdoor air. The filter shall be easily accessible from the bottom, and removable in one piece without removal of the unit return air damper stop. The unit shall ship with a factory installed 1” thick permanent wire mesh washable.

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.

2.09 CONTROL COMPONENTS

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

B. The hot water or steam heating coil shall use a factory selectable, 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.

C. 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.

D. Each optional Local User Interface (LUI) Touch Pad shall have a Digital Display status/fault indication. Communication ports shall allow monitoring and adjustment from a portable IBM compatible PC using USB protocol for service or monitoring using the applicable software computer or future connection to a network control and monitoring system. When using this PC, the unit shall be capable of reacting to commands for changes in control sequence and set points.

E. 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 controller will automatically monitor the remote sensor and disregard the unit-mounted sensor.

F. 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.

G. 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.

H. Night set-back/set-up control shall be provided by the internal time clock as described in the temperature control specification.

I. 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. [OPTIONAL] A Remote Wall Mounted Temperature Sensor; OR
2. External Output Options (by others): motorized water valve open/close, fault indication signal, pump restart, exhaust fan on/off or auxiliary heat signal; OR
3. External Output Options (by others): motorized water valve open/close, fault indication signal, pump restart, exhaust fan on/off or auxiliary heat signal.

2.010 CONTROL FUNCTIONS

A. The Unit Ventilator Digital Controller (here after referred to as UVC) shall support ASHRAE Cycle II operation. The control cycle shall be used to maintain the required minimum amount of ventilation whenever possible, which can be increased during normal operation for economizer cooling, but can also be reduced to prevent excessively cold discharge air temperatures.

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 logic sequences required to control unit ventilator operation within that particular state, while other functions 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.

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 or a network connection shall be able to force the unit into the Off mode.
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.
3. When Off Mode becomes active, the UVC shall stop all normal heating, cooling, ventilation (OA damper shall be closed), and fan operation. The UVC shall continue to monitor space conditions, indicate faults, and provide network communications (if connected to a network) as long as power is maintained to the unit.

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. 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 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. The modulating valve shall be positioned to maintain the classroom temperature setpoint.
2. When the Cool mode super state becomes active, the UVC shall automatically determine which UVC state to make active, Econ, Econ Comp/Water, Comp/Water, DA Heat, Low Limit, or Dehumid 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 Comp/Water State shall be provided as a "normal" state that the UVC can go into when Cool mode is active. The Econ Comp/Water 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 Comp/Water State becomes active, the OA damper shall be set to 100% open, and the UVC shall use the unit's compressor or chilled water 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 unit's 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.
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 air coil 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.

H. 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.

I. 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 Can't 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.

J. 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.

K. 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 through the LUI or via an optional 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 if heating is available. 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 and available. 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.

L. Occupancy Modes

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 Occupancy Manual Command 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 interface 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 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.
4. 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. The optional field-installed 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 field-installed 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.

M. 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.

N. LUI Setpoint Offset Adjustment

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

O. [OPTIONAL] Remote Wall-Mounted Sensor with +/- 5F Adjustment

1. When the optional Remote Wall-mounted Sensor with +/- 5°F adjustment dial is used, the UVC shall effectively write the value of the setpoint adjustment dial to the Setpoint Offset Input variable.

P. [OPTIONAL] Remote Wall-Mounted Sensor with 55 degrees F to 95 degrees F Adjustment

1. When the optional Remote Wall-mounted Sensor with 55 degrees F to 95 degrees F adjustment dial is used, the UVC shall effectively write the value of the setpoint dial to the Space Temp Setpoint Input variable.

Q. Indoor Air Fan Operation

1. The UVC shall support a three-speed IAF with Low, Medium, and High speed or a variable speed motor. 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.

R. Outdoor Air Damper Operation

1. The UVC shall be configured for an Outdoor Air Damper operated by a proportional actuator. The OA damper actuator shall contain a spring to ensure that the OA damper is closed upon loss 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 Temperature Comparison Economizer (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.

S. Actuator Auto-Zero, Overdrive and Sync

1. The UVC at power-up shall auto-zero all 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 an 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.

T. Modulating Valve Control

1. The UVC shall be configured for a modulating valve operated by a proportional actuator.

U. External Binary Inputs

1. The UVC shall be provided with four(4) binary inputs that can provide the following functions. Two of these inputs each shall allow a single set of dry-contacts (no voltage source) to be used as a signal to the UVC and two of the inputs shall allow a single 24VAC signal. Multiple units can be connected to a single set of dry-contacts.
2. 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.
3. 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. The Ventilation Lockout Input Signal shall allow a signal to 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.
5. The Exhaust Interlock Input Signal shall signal to 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.

2.011 UNIT VENTILATOR OPTIONS / ACCESSORIES

A. 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 use gravity for preventing outside air from blowing into the room and shall be made of a temperature resistant glass fabric impregnated with silicone rubber for flexibility. The fabric shall retain its original properties down to –50°F.

B. 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. All accessory section to be with draft-stop system where the unit ventilator is so indicated. Shelving lengths to be scaled from drawings. Top of shelving to be made of Formica. Sinks to be stainless steel. All sections to have adjustable kick plates, and leveling legs and slots for spline attachment to the unit ventilator matching edges.

C. Outdoor Air Intake Louver: Outdoor air intake louver shall be provided by unit ventilator manufacturer except as otherwise noted on the drawings. The outdoor air intake louver shall be:

1. Masonry wall intake louver shall be constructed with horizontal chevron type blades. Provide 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 intake assembly and frame shall be 16 ga. horizontal chevron type aluminum blades in a 12 ga. frame, with:

   a. Unfinished, capable of field painting; OR

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

   c. Clear anodized finish.

   OR

2. 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 intake assembly and frame shall be 16 ga. vertical blade double brake type aluminum blades in a 14 ga. frame, with:

   a. Unfinished capable of field painting; OR

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

   c. clear anodized finish.

3. [OPTIONAL] Where indicated, 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.
4. [OPTIONAL] 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.

D. [OPTIONAL] SD Card: An optional SD card shall be available as a factory installed option, to be used to collect trend data.

E. USB Port: A USB port shall allow monitoring and adjustment from a Windows PC using serial communications for service or monitoring using the applicable software. When using this PC, the unit shall be capable of reacting to commands for changes in control sequence and set points.

2.012 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 for approval before bidding. Equipment or manufacturers not listed in this specification shall not be acceptable or approved for installation. Provide required information as specified in Section 01350.

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.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.