FläktGroup®

SEMCO®

PINNACLE® II SYSTEM

DEDICATED OUTDOOR AIR SYSTEM

TECHNICAL GUIDE

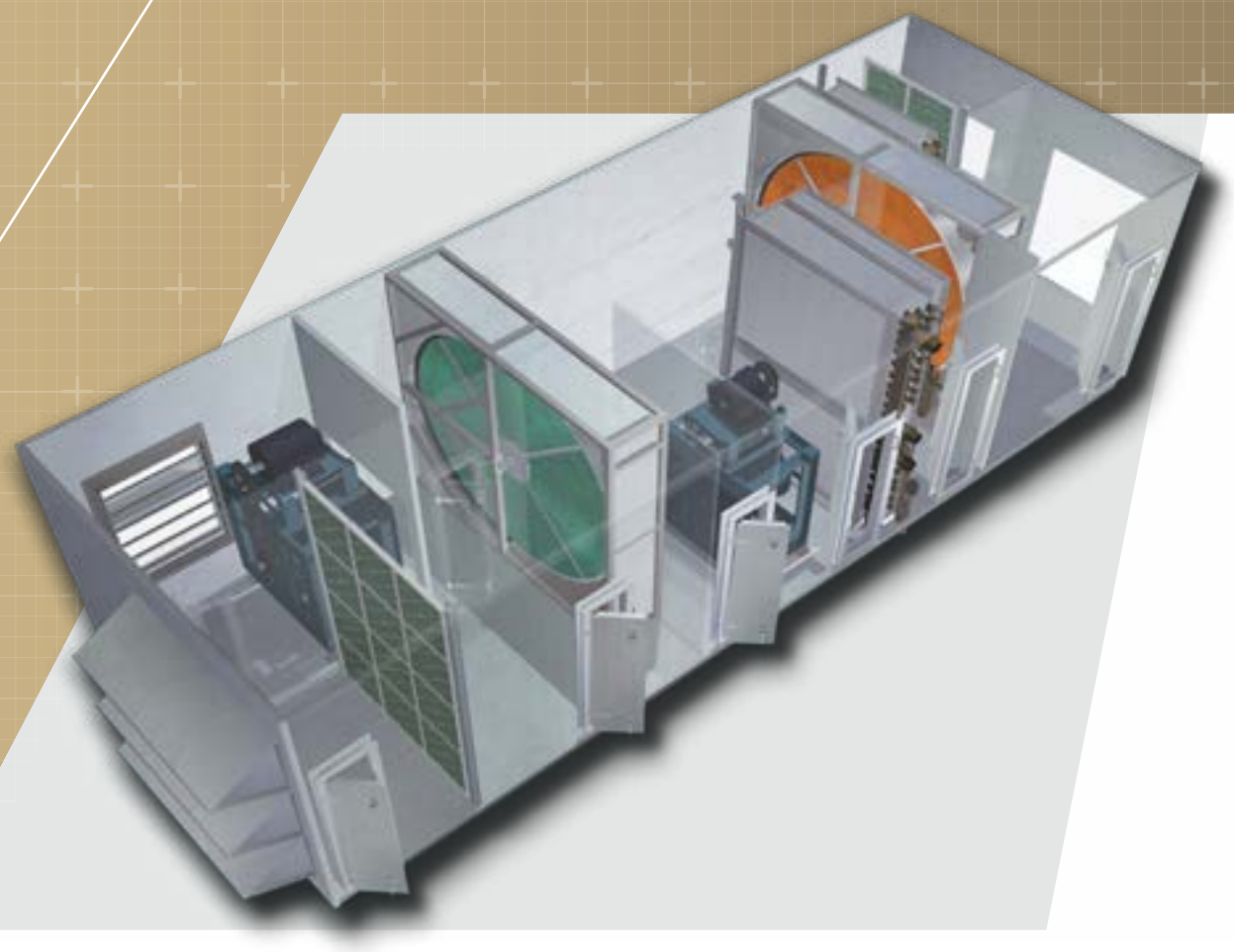


TABLE OF CONTENTS

OVERVIEW

Energy efficient design and indoor air quality are the two challenges facing mechanical engineers today in the field of Heating, Ventilating and Air Conditioning (HVAC). To minimize the loss of energy, building envelopes have been made more energy efficient. This reduces the cost associated with cooling or heating the building. By tightening the building envelopes, the amount of outside air entering the building is reduced. However, that outside air is needed to remove the air contaminants generated indoors. Flushing these pollutants from the indoors to the outdoors has been the most effective way of reducing indoor air contaminants to acceptable levels.

The HVAC industry has responded to these indoor air quality (IAQ) concerns through its professional organization, The American Society of Heating and Refrigerating and Air Conditioning Engineers (ASHRAE). ASHRAE IAQ Standard 62, entitled “Ventilation for Acceptable Indoor Air Quality,” emphasizes the need for continuous outdoor air ventilation as well as the importance of maintaining indoor humidity levels. This standard has now been integrated, in some fashion, into each of the major building codes used throughout the United States.

Most people are aware that outdoor air pollution can damage their health, but many do not know that indoor air pollution can also cause harm. Environmental Protection Agency (EPA) studies of human exposure to air pollutants indicate that indoor levels of pollutants may be 2-5 times, and occasionally more than 100 times, higher than outdoor levels. These levels of indoor air pollutants are of particular concern because it is estimated that most people spend about 90% of their time indoors.

Studies have found that the quality of indoor air has been linked to many illnesses (sick building syndrome and building related illnesses), and has been shown to have a direct impact on worker and student productivity and comfort. New research strongly suggests that indoor humidity levels have a far greater impact on the health of building occupants than previously suspected. For example, microbial activity (e.g., mold and fungus), which increases at higher indoor humidity levels, has been shown to emit harmful organic compounds. Childhood asthma is now suspected by some researchers to be linked to microbial activity.

In addition to direct health effects, the odors associated with microbial activity are often cited as a primary reason why indoor air quality is considered unacceptable to occupants. When odors are encountered in a building, building managers often respond by increasing outdoor air quantities in an attempt to eliminate odors. This intensifies the problem because increasing outdoor air quantities often results in higher indoor humidity levels, which, in turn, fosters continued microbial activity.

CURRENT DESIGN PRACTICES

Systems currently being employed to accommodate the new IAQ code requirements fall into two categories; traditional designs using a cool-and-reheat approach or more advanced, desiccant-based solutions. The cool-and-reheat method increases the cooling capacity to "over-cool" the outdoor air volume to the required humidity content, then reheat the "over-cooled" air-stream to near-room neutral temperature. This approach is perceived as the "lowest cost" solution and is therefore the most popular, yet the energy consumption is very high.

More advanced systems, such as those that include both active and passive desiccant based technology, provide far more energy efficient solutions. They typically require only a third of the energy consumed by the cool-and-reheat method. In the past, their size and first cost has limited their widespread acceptance in the marketplace.

So, there is, a significant need for a novel, compact system design which effectively controls the indoor space humidity while simultaneously providing high quantities of outdoor air in an energy-efficient and cost-effective manner. The benefit of such a system is greatly increased if that system can also provide preconditioned outdoor air to a space at humidity levels well below what is possible with conventional cooling alone.

BACKGROUND OF PINNACLE® SERIES TECHNOLOGY

Facilities with high occupancy rates or elevated levels of indoor contaminants, such as schools, hospitals, nursing homes, and many offices, require large amounts of outdoor air. This presents a significant HVAC design challenge. This challenge is further exacerbated in hot and humid climates, due to the high humidity levels and large number of partial-load cooling hours. Maintaining relative humidity levels recommended by the ASHRAE Standard 62 is difficult and costly if conventional HVAC approaches are used for such facilities.

Conventional packaged equipment is designed to accommodate approximately only 15 to 20% outdoor air on an intermittent basis. If the equipment is applied to provide higher outdoor air quantities on a continuous basis — as called for by ASHRAE Standard 62 — unacceptably high space humidities can result for extended periods of time.

At partial load conditions, e.g., on days when the temperature is moderate but the humidity is high, a packaged HVAC unit will quickly bring the space to the desired set point temperature, then cycle off. Generally, no outdoor air is brought into a conditioned space as long as the thermostat does not call for cooling. Since there is no humidity control exercised, the indoor humidity increases until the sensible load in the space causes the thermostat to call for cooling. By this time, the mixed air condition supplied to the coil is elevated in humidity. This results in a high dew point temperature leaving the cooling coil.

The space temperature is maintained but humidity control is lost, resulting in elevated space humidity conditions, which promote microbial growth and other moisture related IAQ problems.

Given that all of the major building codes now require compliance with the ASHRAE Standard 62 and that data supporting the need for improved humidity control is available and that 80-90% of all HVAC sold in the U.S. each year are conventional packaged units — effective solutions that will allow packaged equipment to accommodate more outdoor air on a continuous basis are needed. The solution is the Pinnacle® Series.

THE PINNACLE® SERIES

The Pinnacle® Series economically provides high quantities of outdoor air and controls indoor humidity levels at the same time. It accomplishes this by dehumidifying the supply air to very low dew points in an energy efficient manner, without the use of a regeneration heating source. It continuously delivers the outdoor air to the occupied space while simultaneously controlling humidity levels at the conditions recommended by ASHRAE, even at partial-load conditions. The Pinnacle® Series is capable of providing a very high degree of latent cooling using only a minimum amount of conventional cooling input.

The Pinnacle® Series approach utilizes the strengths of passive total energy recovery, conventional cooling technology and a new class of desiccant product, the passive dehumidification wheel, to provide the best possible outdoor air preconditioning system.

The system is comprised of a supply fan, an exhaust fan, a total energy wheel, coil(s), a passive dehumidification wheel and compressor. The total energy wheel is used to precondition fresh air using the exhausted building air. The cooling coil and passive dehumidification wheel then work in concert to further treat this fresh air stream to produce room temperature air at a much reduced humidity level.

An example of the Pinnacle® Series Capabilities:

A 10,000 CFM Pinnacle® Series can provide as much as 50 tons of latent load (68 tons of total load) with only an input of 32 tons of conventional cooling.

Using the conventional over-cooling approach would require 90 tons of cooling input and would require 15,000 CFM plus reheat energy.

HOW IT WORKS

The key to providing the exceptional dehumidification capability provided by the Pinnacle® II System is the passive dehumidification wheel. This wheel uses a desiccant material that is optimized to remove moisture from a saturated air stream.

The Pinnacle® II System can provide dry outdoor air in an extremely energy efficient manner. All the components, coil(s), total energy recovery wheel, compressor and the passive dehumidification wheel — are optimized to operate in their most efficient respective envelopes. The result is minimal cooling energy input and maximum latent cooling output. As importantly, by changing the rotational speed of the "passive" dehumidification wheel, the amount of dehumidification capacity and the amount of reheat energy available can be optimized to meet the requirements of varying space temperatures and humidities.

The Pinnacle® II System has the advantage over conventional HVAC systems of being able to respond to various combinations of temperature and humidity, including the conditions described above, in an energy efficient manner and while providing humidity levels well below that possible with other conventional approaches.

The Pinnacle® II System is able to respond to these varying conditions by modulating the rotational speed of the passive dehumidification wheel, and/or adjusting the energy input to the cooling coil. The rotational speed can be adjusted to control the level of temperature and moisture exchanged by the passive dehumidification wheel. The integrated DX loop further controls the cooling and dehumidification capacities and can be adjusted and optimized based upon the conditions in the space, providing various combinations of temperature and humidity, to maintain the desired, indoor conditions.

For example, during times when the space humidity content is as desired but is too hot, the controlled space can be cooled by the Pinnacle® II System without substantially lowering the space humidity. To do so the Pinnacle® II control system would increase the cooling output and adjust the rotational speed of the passive dehumidification wheel to a predetermined range at which it would provide a minimal amount of reheat to the supply air stream.

When the space is too hot and too humid, the controlled space is cooled and dehumidified by increasing the output of the coil(s), and optimizing the rotational speed of the passive dehumidification wheel so that the dehumidification provided is maximized while the reheat capacity is minimized.

When the space is too cold and too humid, the controlled space is dehumidified without being cooled, by increasing the cooling output of the coil(s) and adjusting the rotational speed of the passive dehumidification wheel to provide maximum dehumidification and maximum reheat.

And finally, when the space requires heating, the passive dehumidification wheel and the cooling coil are turned off. The total energy recovery wheel preheats and humidifies the incoming air. In many buildings, this is sufficient to allow the building to be heated by its internal loads.

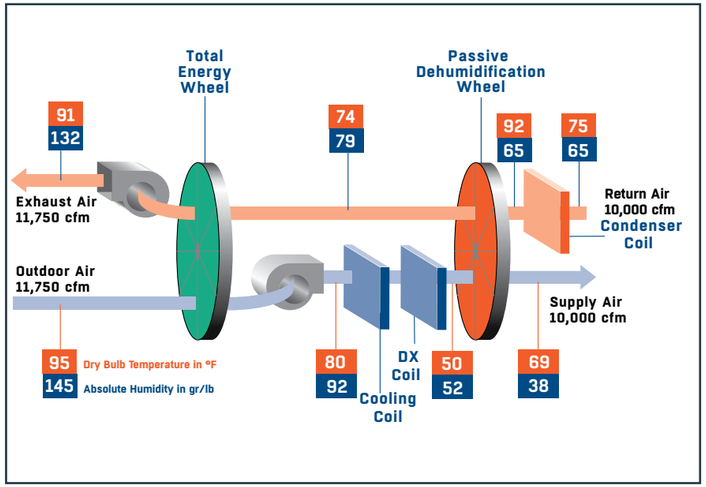


FIGURE 1 Operating at peak space latent load providing 88 tons of total cooling, and more importantly, 61 tons of latent cooling (0.26 sensible heat ratio) using only 41 tons of chilled water for stage 1 cooling (total 54 tons, including integrated stage 2 DX circuit). The system delivers supply air at a 41 degree dewpoint (38 grains). This is accomplished using traditional chilled water temperatures. A conventional system would require approximately 135 tons of installed compressor capacity and 300,000 BTU/HR of reheat energy.

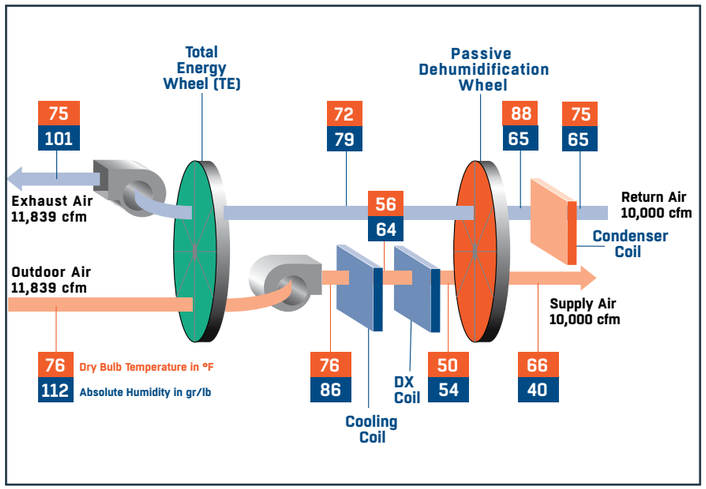


FIGURE 2 Operating at part-cooling load providing 42 tons of total cooling at a SHR of 0.18 using only 30.6 tons of refrigeration input. An equivalent conventional system would require 72.1 tons of cooling and 260 MBtuh of reheat to achieve the same leaving cooling coil temperature, yet without being able to deliver the same dew point of 42.3°F.

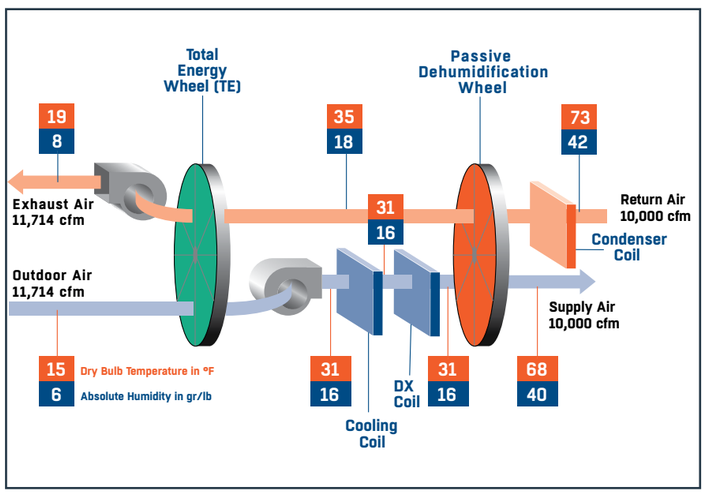


FIGURE 3 Operating in heating mode providing 573 MBtuh of energy and 231,000 MBtuh of free humidification.

LECTURE HALL APPLICATION

There are many challenges when designing HVAC systems for colleges and universities. These challenges are often a result of a considerable distance between campus buildings and the school's central heating and cooling plant. In addition to the inherent efficiency losses, this distance makes it difficult for the plant to consistently deliver chilled water at a temperature low enough to achieve proper space dehumidification. This is especially true when applying dedicated outdoor air systems (DOAS) serving active chilled beams.

Unlike more conventional DOAS systems, Pinnacle® II was engineered to provide outdoor air dehumidified to very low dewpoints, while utilizing moderate chilled water temperatures. As importantly, the Pinnacle® II System does so in a highly energy efficient manner, while using only a fraction of the refrigeration input and fan energy associated with more conventional DOAS systems. As a result, it is an ideal technology for delivering pre-conditioned outdoor air to college and university facilities.

This application example will examine four 1,000 sq. ft. university lecture halls, which are to be conditioned using only the minimum required outdoor air volume to serve active chilled beams. The Pinnacle® II System utilized, is particularly well suited for "decoupling" all the latent load (outdoor and space) from each lecture hall, designed to deliver only 8 CFM/student of outdoor air in order to be in compliance with ASHRAE 62-2013. The internal latent load calculated for a typical 1,000 sq. ft. lecture hall accommodating 150 students, seated at rest, plus modest infiltration is approximately 19,380 BTUs. The sensible load associated with the lights, occupants and infiltration, is approximately 37,164 BTUs.

The project involves four lecture halls, and the overall design goal is to reach high energy efficiency and ideal indoor air quality, so active chilled beams are used to optimize occupant comfort, energy efficiency and noise reduction. The primary energy savings contribution provided by chilled beams is reduced fan energy. With an ideal chilled beam system design, low airflows are employed at very low static pressures, and where the only air moved mechanically is the prescribed outdoor air volume. This can only be done when the primary air, in this case the outdoor air, can be dehumidified to a level which can accommodate the entire indoor latent load.

As shown to the right in **FIGURE 4**, for this sample project the air must be delivered at a level of 41 grains of moisture or a 43° F dewpoint in order to maintain the target space relative humidity of 50% and avoid the possibility of condensation on the chilled beams. The Pinnacle® II unit can be operated to easily deliver these conditions using the university's conventional chilled water temperature. The Pinnacle® II is highly energy efficient, requiring only 19 tons of chilled water input (23 tons total including the integrated secondary cooling circuit) while delivering a total cooling output of 34 tons with, most importantly, 24 tons of latent capacity.

The single Pinnacle® II unit sized to deliver 4,800 CFM of low dewpoint, outdoor air, serves eight 6 foot chilled beams in each lecture hall. Each beam is fed by 0.5 GPM of 58° F water to process the remaining 24,200 BTUs of sensible load in each lecture hall, while inducing room air to supply a total system airflow quantity in the range of 15,000 CFM. This results in a system with optimum energy efficiency, low noise, ideal humidity control and comfort.

Continuous outdoor air is provided and cannot be closed off by plant maintenance (since heating and air conditioning would be lost), thereby ensuring ASHRAE compliance over time.

Conventional systems, utilizing chilled water, can only achieve a supply humidity level of approximately 50 grains of moisture. To satisfy the internal latent load, these systems would have to be increased in size to be able to deliver the 8,000 CFM of primary air to the beams. This substantially increases the fan energy consumption, duct size, beam pressure and an associated sound generation. Additionally, substantial reheat energy is required to avoid overcooling of the space at such a high airflow and low leaving coil temperature during times of low occupancy. The conventional systems would utilize 48 tons of cooling input, even when utilizing effective total energy recovery, versus 23 tons used by the Pinnacle® II. The conventional system approach would also necessitate 83,000 BTUs of reheat energy, while the Pinnacle® II eliminates the need for any parasitic reheat energy.

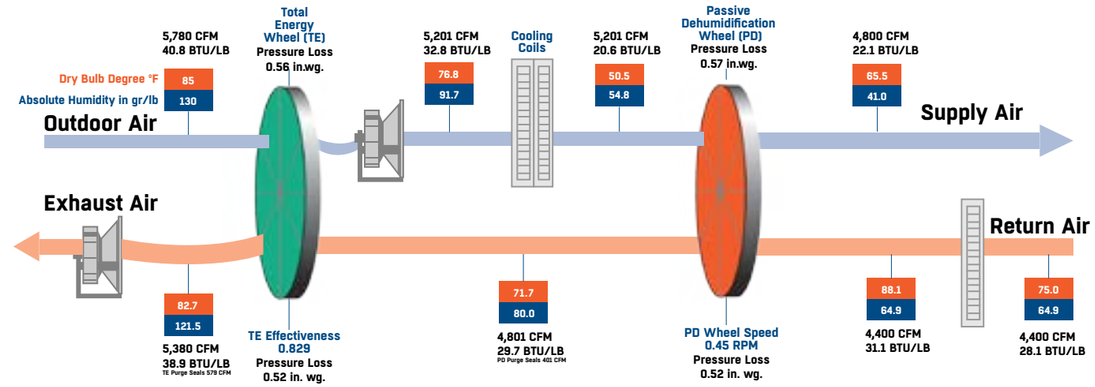


FIGURE 4

KEY LECTURE HALL EXAMPLE METRICS	
VENTILATION REQUIREMENTS:	*PER ASHRAE 62-2013 (FOR A LECTURE HALL THAT SEATS 150 STUDENTS)* 8 CFM PER PERSON OR 1,200 CFM PER LECTURE HALL
SENSIBLE LOAD:*	**TOTAL SENSIBLE LOAD**: 37,164 BTU **PEOPLE LOAD**: 150 PEOPLE AT 225 BTU/PERSON = 33,750 BTU; **LIGHTING LOAD**: 2,314 BTU BASED ON 0.68 WATTS/SQ.FT. (*HIGH EFFICIENCY LIGHTING*) **INFILTRATION**: 100 CFM x 1.08 x (85 DEGREES - 75 DEGREES) = 1,100 BTU
LATENT LOAD:*	**TOTAL:** 19,830 BTU **PEOPLE LOAD:** 150 PEOPLE AT 105 BTU PER PERSON = 15,570 BTU **INFILTRATION:** 100 CFM x 0.68 x (125 GRAINS - 65 GRAINS) = 4,080 BTU
SUPPLY HUMIDITY REQUIRED TO ACCOMMODATE THE LATENT LOAD:*	**SUPPLY GRAINS:** 41 GRAINS **SUPPLY GRAINS** [19,830 BTU OF LATENT LOAD/(1200 CFM x 0.68)]
SENSIBLE LOAD SUMMARY:	**PINNACLE® II UNIT DELIVERED SENSIBLE LOAD: 12,960 BTUS** DELIVERING 65 DEGREE AIR = {1,200 x 1.08 x (75°F -65°F)} **REMAINING SENSIBLE DELIVERED BY CHILLED BEAMS: 24,200 BTUS** BEAM SENSIBLE LOAD = 37,164 BTUS - 12,960
TYPICAL CHILLED BEAM SELECTION:*	**8 CHILLED BEAMS/LECTU-T 6 FOOT LENGTH EACH** 150 CFM OF OUTDOOR AIR AND 0.5 GPM OF 58 DEGREE WATER TO EACH BEAM
PINNACLE® II METRICS (4 LECTURE HALLS):	4,800 CFM x 0.68 x (130 GRAINS - 41 GRAINS) = **290,496 BTU OF LATENT LOAD** 4,800 CFM x 1.08 x (85° F-65° F) = **103,680 BTU OF SENSIBLE LOAD** **TOTAL: 34 TONS; LATENT TONS**: **24**; **COOLING INPUT USED: 23 TONS**
CONVENTIONAL ANALYSIS WITH RECOVERY:	8,000 CFM AT 50 DEGREES SAT; ENTHALPY AT 19.5 BTU/LB. WITHOUT RECOVERY: 8,000 SCFM x 4.5 x (40.8 BTU/LB - 19.5 BTU/LB) / 12,000 BTU/TON = 64 TONS RECOVERY REDUCTION : 4,800 SCFM x 4.5 x {(40.8 BTU/LB - 28.2 BTU/LB) x 0.7} / 12,000 BTU/TON = 15.9 TONS TONS REQUIRED WITH RECOVERY: 48 TONS REHEAT REQUIRED: 8,000 x 1.08 x (65°F - 49°F) = 82,945

**For each 1,000 sq. ft. lecture hall*

ADVANTAGES OF THE PINNACLE® II SYSTEM

The two most significant advantages offered by the Pinnacle® II system, when compared with the traditional over-cooling-and-reheat systems, are that the dehumidification or latent capacity (e.g., dryness of the air provided to the controlled space) is significantly increased and the energy efficiency is greatly improved.

The Pinnacle® II System has more latent capacity and higher energy efficiency than a desiccant-based cooling (DBC) or a dual-wheel energy recovery system (DWERS).

For example, a DBC system processing outdoor air on a latent design day (85°F and 130 gr/lb) is limited to a supply air condition of approximately 60 grains with technology currently available. To reach this condition requires the equipment to be operated at very low face velocities (resulting in very large system space requirements) and requires that the air be reheated at very high regeneration temperatures at very high regeneration temperatures (large, costly energy inputs).

The DWERS and other conventional over-cooling-and-reheat systems are limited by the humidity level of the air leaving the cooling coil. Since most conventional cooling systems have a practical limit of approximately 48°F leaving air temperature, the absolute humidity level obtainable from most conventional systems is about 50 grains per pound of moisture (gr/lb).

As a result, the only commercially available way to dehumidify outdoor air below approximately 50 grains of moisture involves cooling the outdoor air below approximately 48°F, and requires expensive, non-standard cooling equipment with very deep cooling coils, complex controls with defrost cycles and significantly elevated kW/ton energy consumption (i.e. poor energy efficiency).

The Pinnacle® II System can provide outdoor air at a humidity content of 40 gr/lb using standard cooling equipment. This results in a 90 gr/lb reduction at the typical latent design condition of 130 gr/lb, and can be designed and operated to provide air as dry as 35 gr/lb. Providing very dry air using conventional cooling equipment has many advantages including a significant reduction of energy consumption and thereby cost. With very dry air, lower air flow quantities can handle far more latent load.

For example, an office building could reduce energy consumption by operating its VAV air handling systems serving the space with dry cooling coils, allowing the supply air leaving temperature to be set by the controlled space sensible loads. This is possible if the outdoor air volume provided to the VAV air handling system is dehumidified enough to handle both the outdoor air and space latent loads. Because the percentage of outdoor air compared to the total supply air volume of a typical office designed to comply with ASHRAE Standard 62 may only be 15-20%, the outdoor air would need to be very dry if the entire internal latent load is to be handled by the outdoor air volume (dry cooling coils).

BENEFITS DURING UNOCCUPIED PERIODS
*WHEN EQUIPPED WITH OPTIONAL RECIRCULATION DAMPER

Another advantage offered by the Pinnacle® II System is its ability to control humidity levels in unoccupied facilities which can not be effectively accomplished with current preconditioning technologies.

During unoccupied times, as research has shown, the building materials (e.g., carpeting, furnishings, etc.) act as a moisture sponge as the humidity level rises. This rise in humidity is typical because many building operators reduce the capacity of or cycle off the HVAC system in an attempt to conserve energy. Because the sensible load in unoccupied buildings is minimal, controlling humidity can only be accomplished effectively if reheat is utilized after the air leaves the coils. This reheat capability is seldom designed into projects or utilized if the capability exists.

The Pinnacle® II System can be operated to provide an effective solution to either “dry out” the humidity stored in the building materials or to provide humidity control during unoccupied periods. This is both practical and energy efficient because additional reheat is not required, since it is provided by the passive dehumidification wheel.

The Pinnacle® II System can also reduce the quantity of outdoor air as a function of building occupants, e.g., demand controlled ventilation, as shown in FIGURE 5. This strategy allows schools to control humidity during the summer vacation with very low airflow rates through the system when compared to the flow volume delivered when the controlled space is occupied. Reducing the flow through the system results in reduced fan horsepower, reduced chilled water requirements at the cooling coil, increased recovery efficiency at the total energy wheel and the ability to provide drier air from this passive dehumidification wheel.

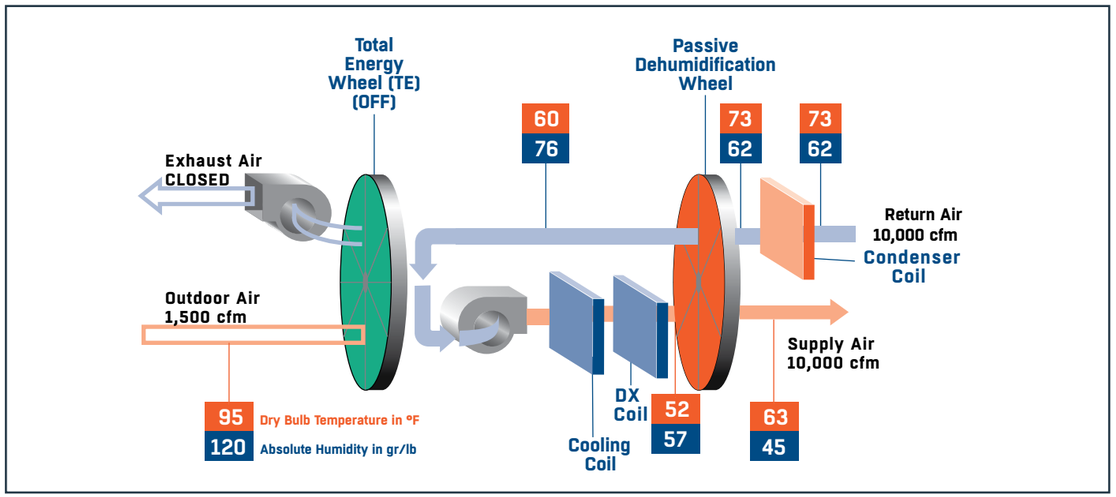


FIGURE 5 Operating in unoccupied mode. The system can operate in 100% recirculation mode and with very little refrigeration input effectively controlling the indoor humidity, to comply with ASHRAE 62.1 addendum ae.

BENEFITS DURING HEATING SEASON

Another advantage of the Pinnacle® II system is that, during the heating mode, both the total energy wheel and the desiccant-based dehumidification wheel can be operated to recover more than 90% of the energy (temperature and humidity.) In most cases, this level of recovery efficiency allows the controlled spaces to be self heating, even on very cold days, once normal lighting and people loads are introduced to the controlled space.

IN SUMMARY

The Pinnacle® II system offers a cost effective solution to the ventilation mandate and the humidity control dilemma facing designers as a result of ASHRAE Standard 62. The system's flexibility allows engineers to consider whole new design schemes. This is a result of its ability to provide very dry outdoor air in a straight forward, simple, energy efficient manner delivered by a totally integrated packaged system.

A very significant reduction in energy consumption during the cooling season is recognized with the Pinnacle® II system when compared to conventional over-cool and reheat designs applied most often today. These reductions are typically in the range of 50 to 60%. With the Pinnacle® II system, winter time heating and humidification is reduced to only 10 to 15% of what it would be without the system. As importantly, the unoccupied dehumidification, made possible with the technology, allows building owners to maintain humidity levels during unoccupied times at a fraction of the cost of alternate systems.

The Pinnacle® II significantly reduces energy consumption for commercial buildings in the US; offsetting the significant energy increase that would otherwise come as a result of the increased compliance with IAQ code requirements (i.e. ASHRAE Standard 62).

SELECTION PROCEDURE

A selection program has been developed to assist in choosing achievable performances for varying building applications. The selection tool allows the user to complete performance modeling for the Pinnacle® II System and supplies the following information:

PERFORMANCE TOOL OUTPUT

PERFORMANCE DATA:

- Space peak latent conditions
- Space peak sensible condition
- Outdoor peak heating conditions

ENERGY SAVINGS ANALYSIS:

- Estimate of the Pinnacle® II System annual cost of operation
- Estimate of the over-cooling/reheat approach annual cost of operation
- ROI/life cycle costs — available upon request

SCHEDULE:

- Pinnacle® II System performance schedule based upon input parameters

SPECIFICATION:

- Pinnacle® II System sample specification

REQUIRED INPUTS

To complete your selection you will need the following information:

AIRFLOW:

The main criterion for basic unit selection is the amount of ventilation air to be processed.

Air flow is determined by the higher value desired between the supply air flow (CFM) and the return air flow (CFM). To determine minimum airflow for the building application review ASHRAE 62.1 airflow recommendation with building load requirements.

When the required airflow is available in multiple unit sizes, you should consider the following options:

BOX SIZE OR JOB SITE AREA FOR UNIT

- Smaller units are lighter in weight and take up less project space.

PERFORMANCE

- Larger units have lower face velocities, which results in higher performance.

COST

- Smaller units are less costly to build.

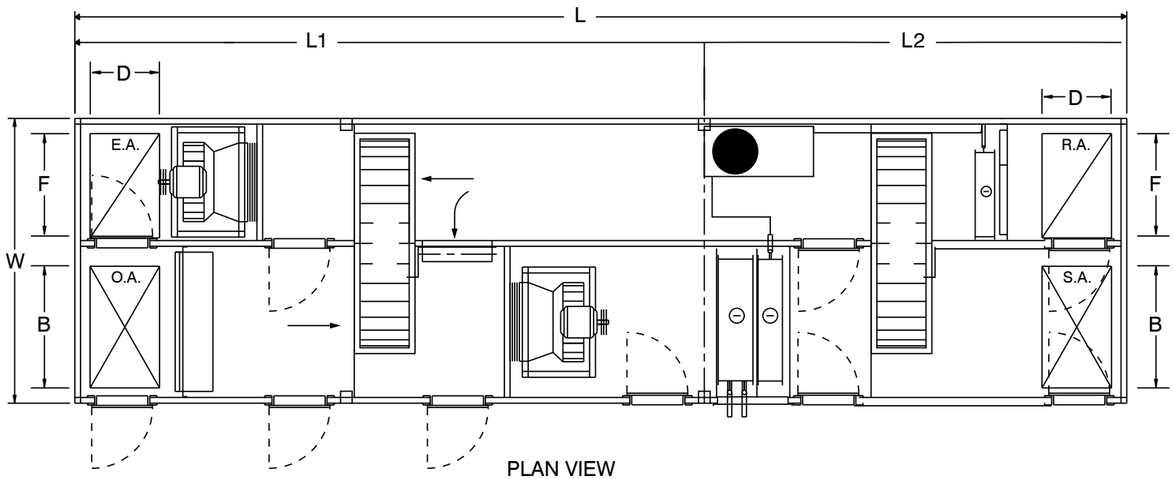
FIGURE 6 System sizes and airflow capacities

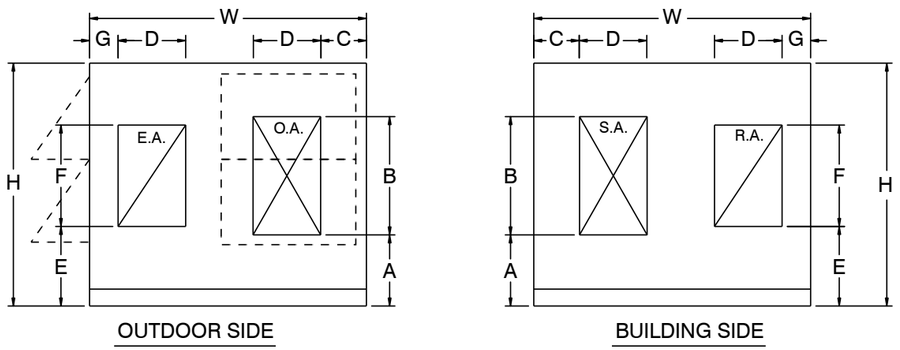
MODEL	AIRFLOW CAPACITY	
PVS II-05	LOW	3,000
	MID	4,000
	HIGH	4,500
PVS II-09	LOW	4,500
	MID	6,000
	HIGH	8,000
PVS II-13	LOW	6,000
	MID	8,000
	HIGH	10,000
PVS II-18	LOW	8,000
	MID	10,000
	HIGH	15,000
PVS II-24	LOW	11,000
	MID	14,000
	HIGH	18,000

To receive a copy of the Pinnacle® II System modeling program please contact your local representative. You can find a listing of representatives at: **www.semcohvac.com.**

UNIT WEIGHTS AND DIMENSIONS

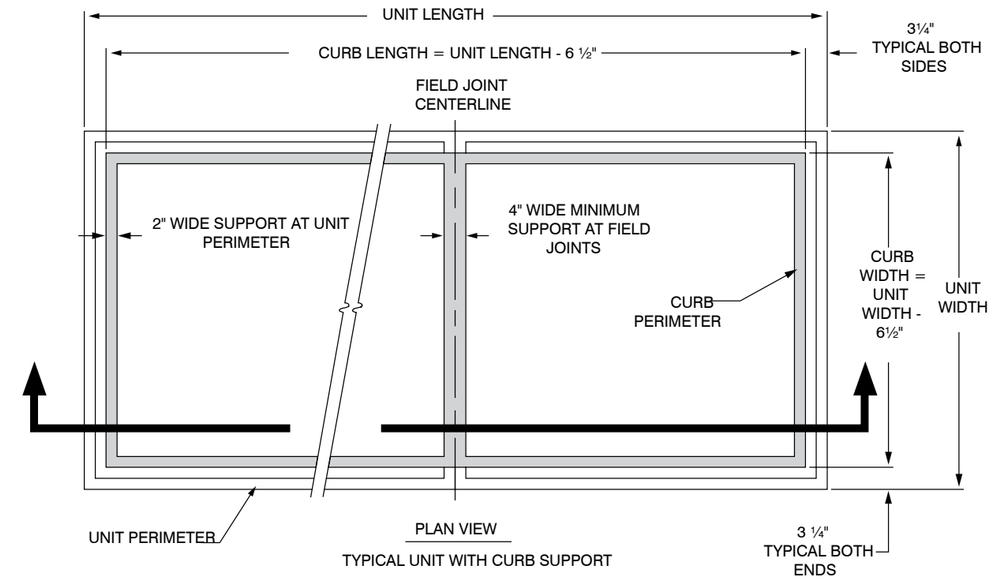
PINNACLE SERIES (PVS)
SIZES 5-24

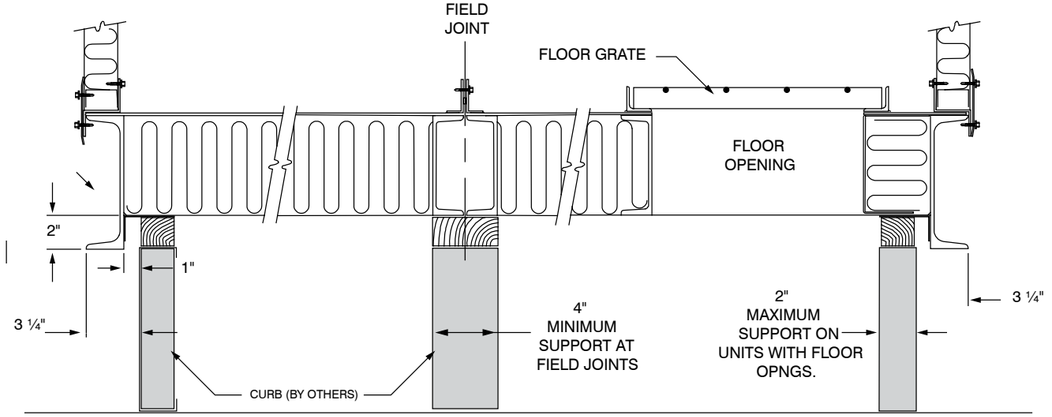




MODEL	W	H	A	B	C	D	E	F	G	WEIGHT L1	WEIGHT L2	L	L1	L2
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	LBS.	LBS.	IN.	IN.	IN.
PVSII-05	86.25	60.25	15.25	34.25	14.25	20.00	20.25	24.00	14.25	8,700	0	296.50	0.00	0.00
PVSII-09	98.25	72.25	15.25	46.25	20.25	20.00	21.25	34.00	14.25	11,000	0	304.38	0.00	0.00
PVSII-13	98.25	86.25	23.25	46.25	17.25	26.00	29.25	34.00	11.25	4,400	9,750	333.13	99.63	233.50
PVSII-18	122.25	98.25	23.25	58.25	23.25	26.00	29.25	46.00	17.25	5,800	12,250	348.88	107.50	241.38
PVSII-24	122.25	110.25	29.25	58.25	20.25	32.00	35.25	46.00	14.25	6,700	14,150.	364.63	115.38	249.25

MOUNTING DETAILS, CURB SUPPORT





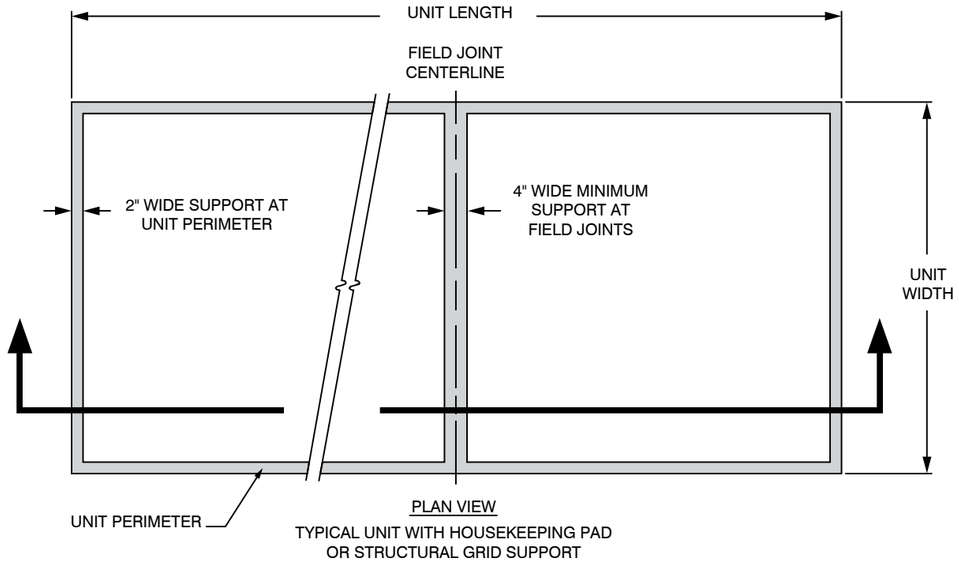
NOTES

1. ROOF CURB SHOULD BE SIZED TO ALLOW UNIT TO HANG OVER CURB.
2. CURB SIZE:
   WIDTH = UNIT WIDTH - 6.5"
   LENGTH = UNIT LENGTH -6.5"
3. UNIT SUPPORT IS REQUIRED AROUND THE ENTIRE PERIMETER AND ALONG BOTH SIDES OF ANY FIELD JOINTS.
4. WHEN UNITS REQUIRE FIELD JOINTS, SUPPORT SHOULD BE LEVEL TO 1/16" BETWEEN FIELD JOINTS.

SECTION

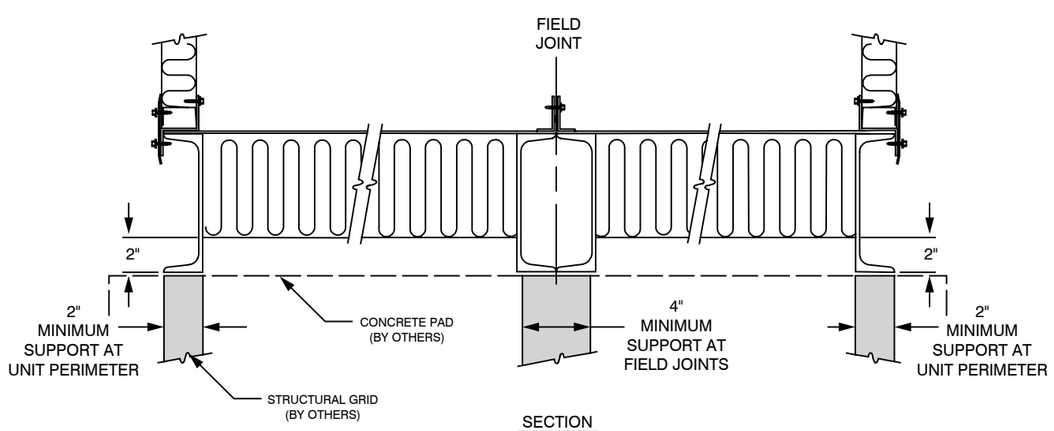
SELF FLASHING UNIT BASE
SHOWING CURB SUPPORT REQUIREMENTS

MOUNTING DETAILS, GRID OR PAD SUPPORT



PLAN VIEW

TYPICAL UNIT WITH HOUSEKEEPING PAD OR STRUCTURAL GRID SUPPORT



SECTION

UNIT BASE WHEN MOUNTING ON PAD OR STRUCTURAL GRID

NOTES

1. UNIT SUPPORT IS REQUIRED AROUND THE ENTIRE PERIMETER AND ALONG BOTH SIDES OF ANY FIELD JOINTS.
2. WHEN UNITS REQUIRE FIELD JOINTS, SUPPORT SHOULD BE LEVEL TO 1/16" BETWEEN FIELD JOINTS.

ELECTRICAL DATA

HP	3 PHASE FULL LOAD AMPS			MINIMUM EFFICIENCY STANDARD MOTORS	MINIMUM EFFICIENCY HIGH EFF. MOTORS
	208 V	240 V	480 V		
1/6	0.6	0.6	0.3	—	—
1/4	1.0	1.0	0.5	—	—
1/2	2.4	2.2	1.1	—	—
3/4	3.5	3.2	1.6	73	—
1	4.6	4.2	2.1	76.6	82.5
1-1/2	6.6	6.0	3.0	80	84
2	7.5	6.8	3.4	79.9	84
3	10.6	9.6	4.8	83.1	86.5
5	16.7	15.2	7.6	83.4	87.5
7-1/2	24.2	22	11	86.6	88.5
10	30.8	28	14	88.2	89.5
15	46.2	42	21	89.3	90.2
20	59.4	54	27	90.4	91
25	74.8	68	34	90.5	92.4
30	88.0	80	40	89.3	93
40	114	104	52	90	93
50	—	130	65	91.2	94.1
60	—	—	77	92	93.6
75	—	—	96	92.4	94.1
100	—	—	124	92.5	94.1

HP	3Ø VARIABLE FREQUENCY DRIVE			YASKAWA MODEL #
	208 V	280 V	480 V	
1	7.3	7.3	7.3	CIMR-VU-2A0006FAA
1	—	—	2.1	CIMR-VU-4A0002FAA

SIZE	CONTROL POWER TRANSFORMER		
	208 V	240 V	480 V
150 VA	0.7	0.6	0.4
500 VA	2.4	2.0	1.0
2 KVA	9.62	8.7	4.17

NOTE: All Pinnacle® units have SCCR 10K

To determine minimum circuit ampacity, add the FLA's for each fan motor, the FLA of the constant speed wheel motor or the variable frequency drive. Then add the CPT amps and 25 percent of the largest motor FLA.

Fuse recommendations: size fuses at the unit FLA and 75% of the largest motor FLA, then select the next larger size dual-element, time-delay fuses (LOW-PEAK®, FUSETRON® or equivalent). If the fuses don't hold, consult N.E.C. for suitability of larger sized fuses.

Use a 2 KVA transformer for units with line side 120 volt lights. Otherwise use the 500 VA transformer.

COMPONENT PRESSURE DROP TABLES

DUAL WHEEL UNIT PRESSURE DROPS

SIZE	PVS-5			PVS-9			PVS-13		
CFM	3,000	4,000	4,500	4,500	6,000	8,000	6,000	8,000	10,000
TE WHEEL PURGE	404	409	412	596	601	609	844	849	855
PD WHEEL PURGE	338	345	350	453	461	477	589	597	607
SUPPLY FAN CFM	3,338	4,345	4,850	4,953	6,461	8,477	6,589	8,597	10,607
EXHAUST FAN CFM	3,742	4,754	5,262	5,549	7,062	9,086	7,433	9,446	11,462
OA OPENING	0.01	0.01	0.02	0.01	0.02	0.03	0.01	0.01	0.02
EA OPENING	0.08	0.13	0.16	0.18	0.29	0.48	0.08	0.14	0.20
RA OR EA OPENING	0.05	0.09	0.11	0.06	0.10	0.18	0.06	0.11	0.17
SA OR OA OPENING	0.03	0.04	0.06	0.03	0.05	0.10	0.03	0.06	0.09
DAMPER	0.01	0.02	0.02	0.01	0.02	0.03	0.01	0.02	0.03
OA FILTER	0.25	0.36	0.44	0.21	0.30	0.40	0.25	0.36	0.44
RA FILTER	0.20	0.28	0.34	0.28	0.44	0.72	0.28	0.46	0.66
TE WHEEL	0.59	0.82	0.95	0.53	0.73	1.06	0.46	0.62	0.81
PD WHEEL	0.58	0.81	0.95	0.53	0.73	1.07	0.46	0.62	0.82
COOLING COIL	0.39	0.66	0.82	0.30	0.51	0.94	0.36	0.61	0.99
MAIN HEATING COIL	0.05	0.09	0.11	0.04	0.07	0.13	0.05	0.09	0.13
MISC. LOSSES	0.169	0.30	0.38	0.13	0.232	0.414	0.144	0.257	0.401
EVAPORATOR	0.14	0.24	0.29	0.12	0.20	0.34	0.14	0.23	0.35
CONDENSER	0.11	0.18	0.22	0.14	0.23	0.37	0.14	0.23	0.40

SIZE	PVS-18			PVS-24		
CFM	8,000	10,000	15,000	11,000	14,000	18,000
TE WHEEL PURGE	1,112	1,115	1,127	1,411	1,416	1,424
PD WHEEL PURGE	727	734	756	875	884	899
SUPPLY FAN CFM	8,727	10,734	15,756	11,875	14,884	18,899
EXHAUST FAN CFM	9,839	11,849	16,883	13,286	16,300	20,323
OA OPENING	0.01	0.01	0.03	0.01	0.01	0.02
EA OPENING	0.15	0.21	0.24	0.10	0.15	0.23
RA OR EA OPENING	0.06	0.09	0.20	0.07	0.12	0.19
SA OR OA OPENING	0.04	0.06	0.13	0.05	0.07	0.12
DAMPER	0.01	0.02	0.04	0.02	0.02	0.04
OA FILTER	0.21	0.29	0.46	0.27	0.38	0.51
RA FILTER	0.24	0.32	0.60	0.30	0.46	0.68
TE WHEEL	0.44	0.55	0.89	0.46	0.59	0.79
PD WHEEL	0.45	0.56	0.92	0.47	0.60	0.81
COOLING COIL	0.27	0.41	0.95	0.38	0.59	1.02
MAIN HEATING COIL	0.04	0.06	0.13	0.05	0.09	0.14
MISC. LOSSES	0.120	0.188	0.423	0.148	0.24	0.398
EVAPORATOR	0.11	0.17	0.35	0.16	0.25	0.40
CONDENSER	0.10	0.15	0.30	0.17	0.24	0.36

Filter pressure drops based on 2 inches thick, 30% efficient Class II filter.

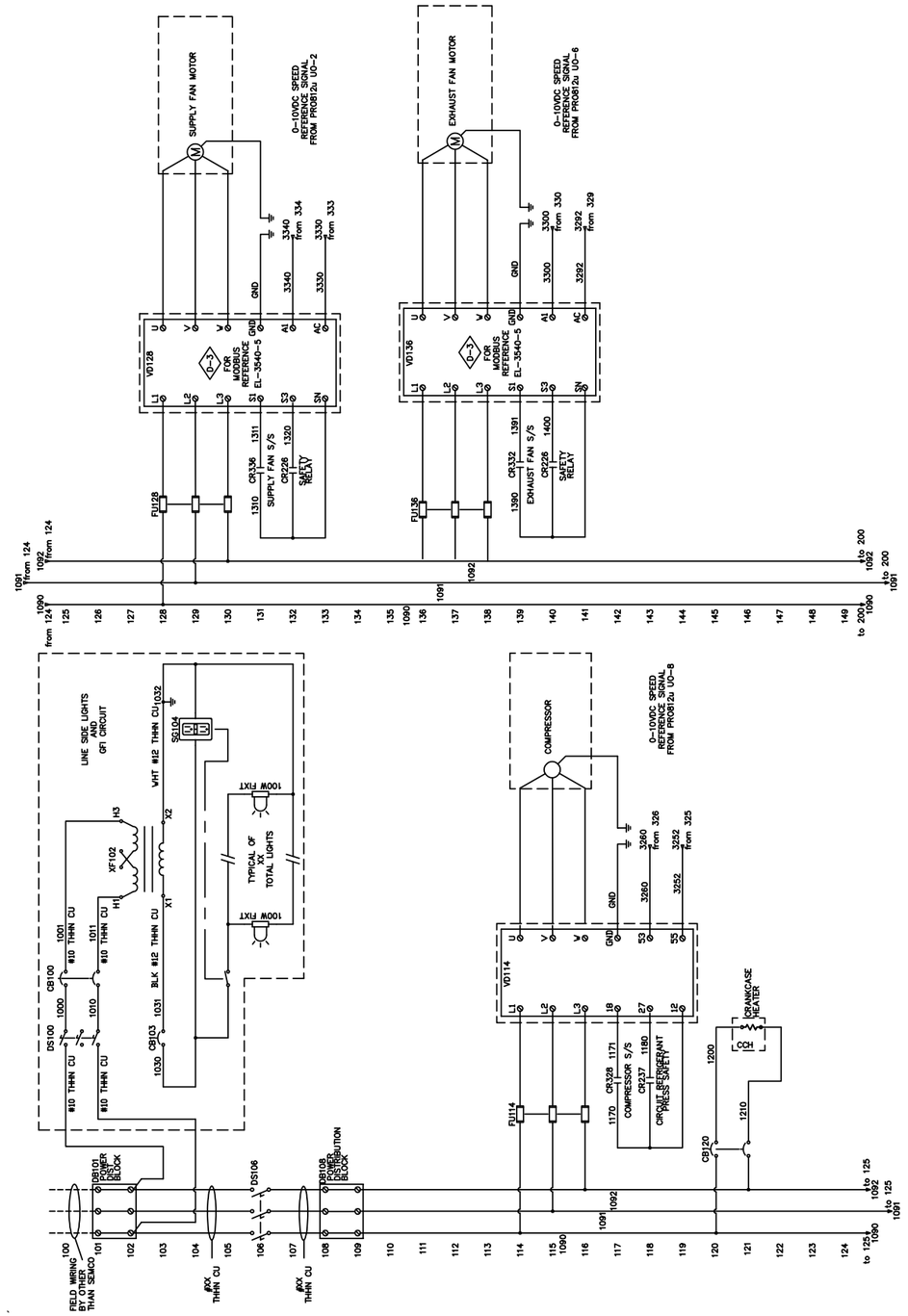
Cooling coil pressure drops based on 6 row, 10 fins per inch single-circuited coil.

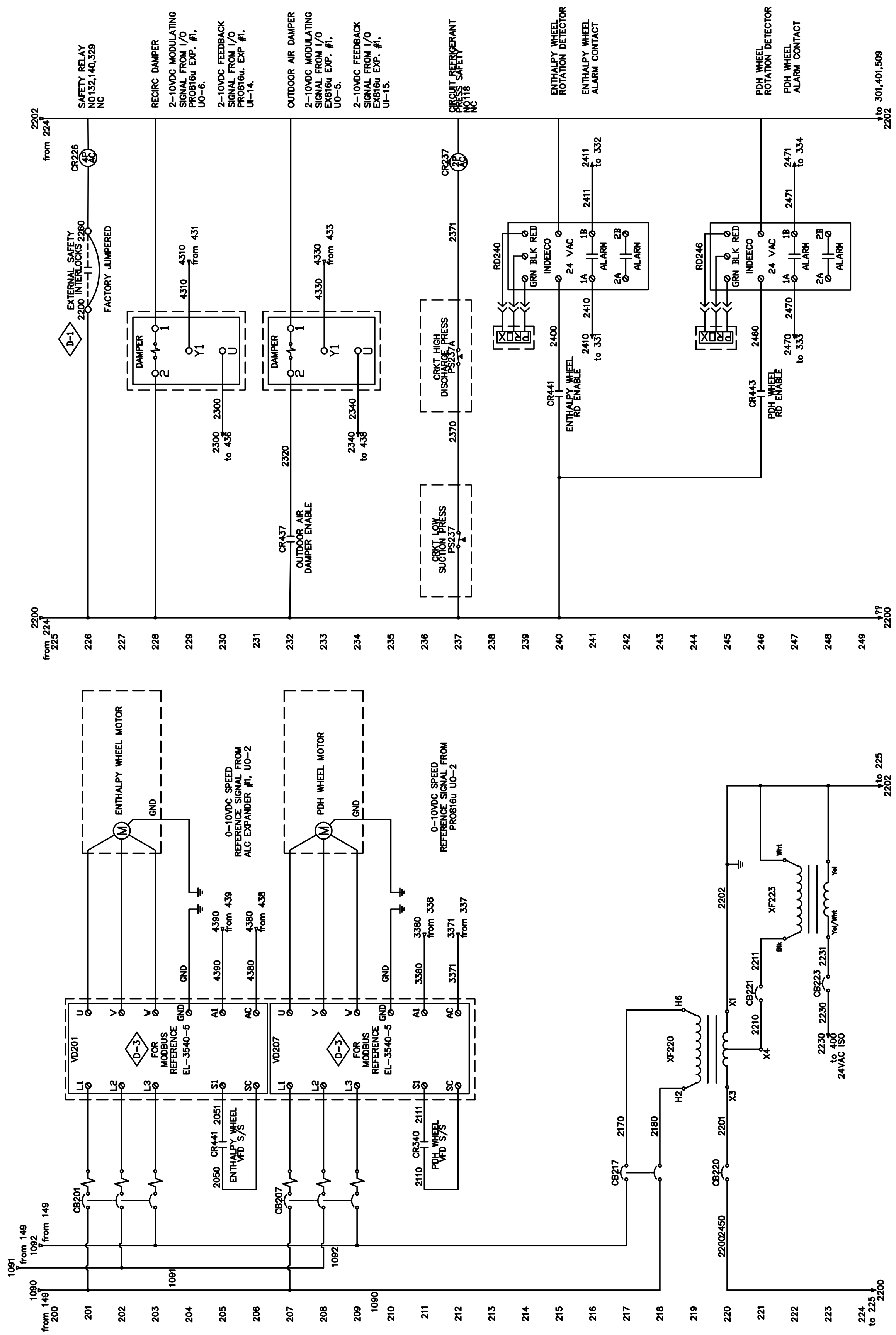
Heating coil pressure drops based on 1 row, 6 fins per inch.

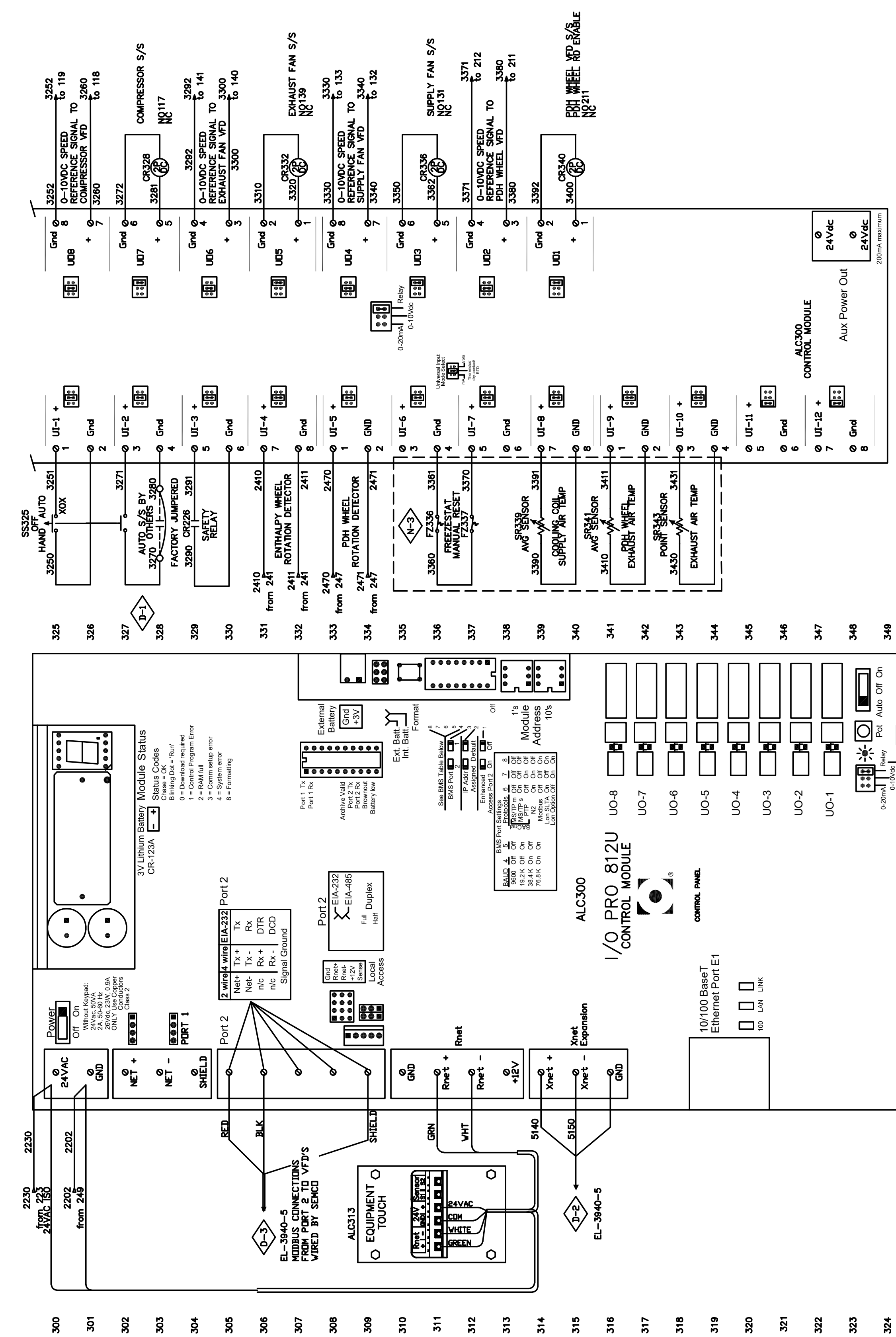
Purge volumes based on 4 inches P_{OA}-P_{RA} for enthalpy wheel and 1 inch for PD wheel.

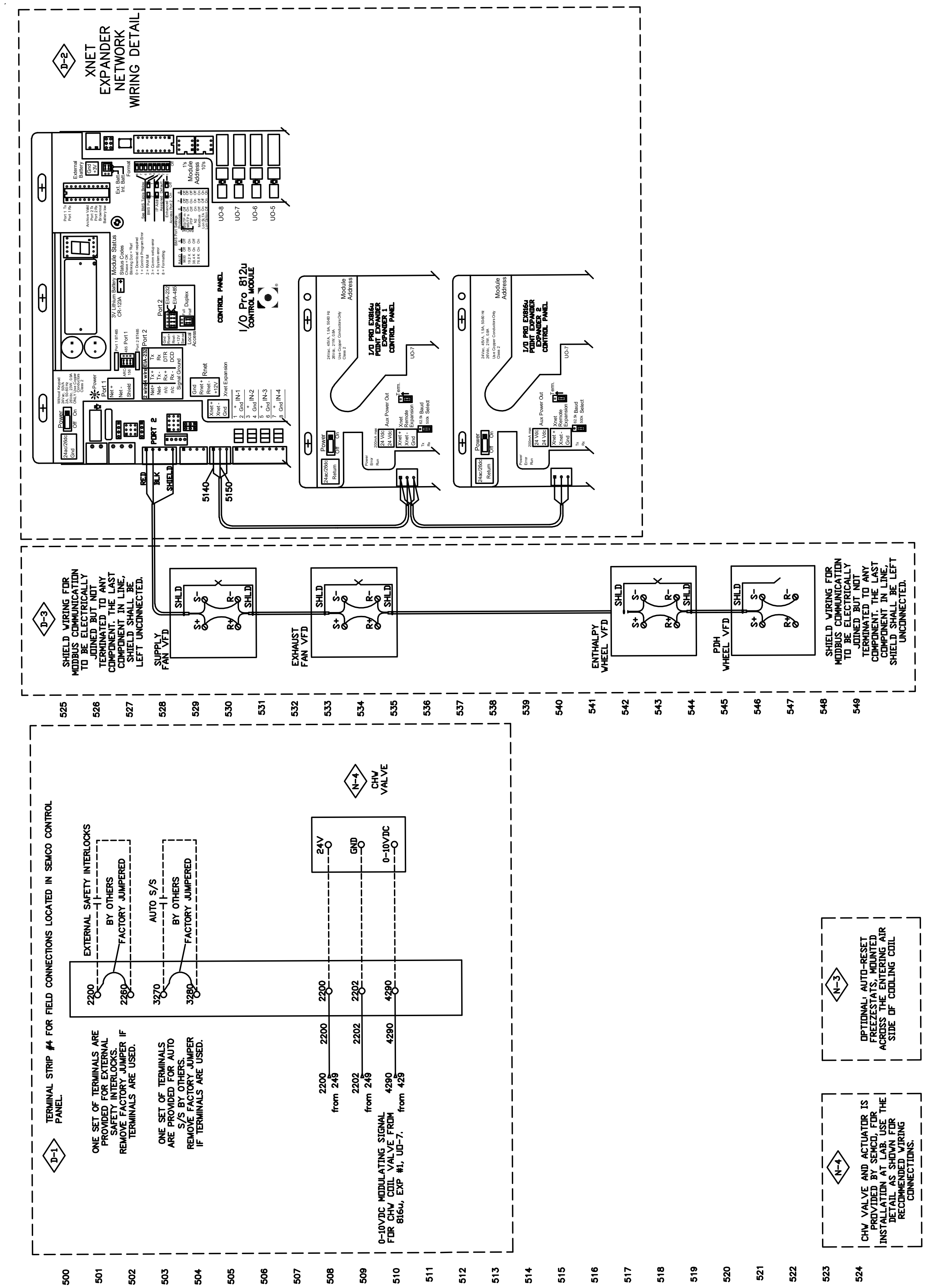
Casing losses include fan inlet losses.

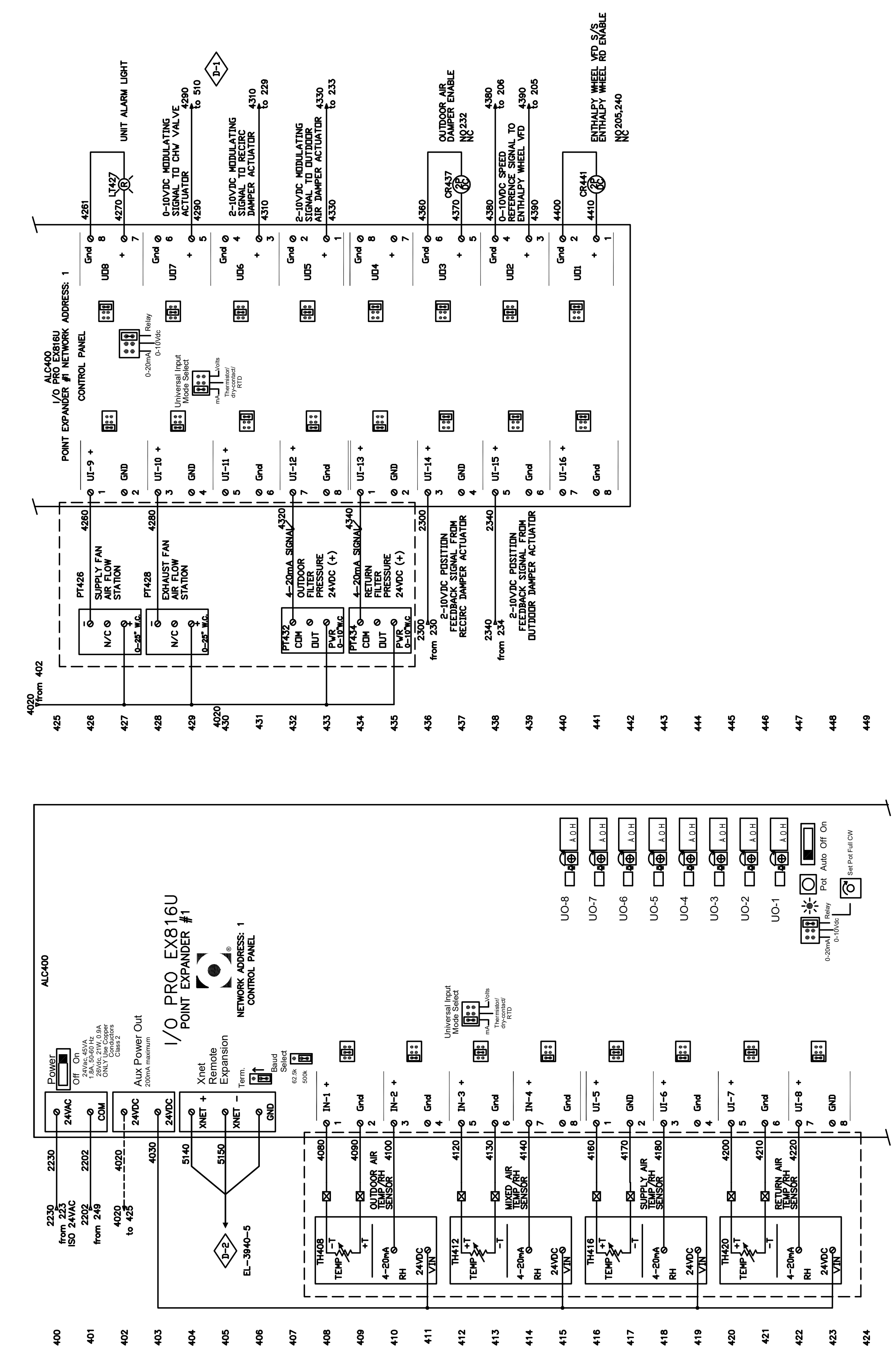
SAMPLE ELECTRICAL SCHEMATIC








XNET EXPANDER NETWORK WIRING DETAIL
I/O Pro 812u CONTROL MODULE
CONTROL PANEL
SHIELD WIRING FOR MODBUS COMMUNICATION TO BE ELECTRICALLY JOINED BUT NOT TERMINATED TO ANY COMPONENT IN LINE. SHIELD SHALL BE LEFT UNCONNECTED.
SUPPLY FAN VFD
EXHAUST FAN VFD
ENTHALPY WHEEL VFD
PIM WHEEL VFD
TERMINAL STRIP #4 FOR FIELD CONNECTIONS LOCATED IN SEMCO CONTROL PANEL.
EXTERNAL SAFETY INTERLOCKS BY OTHERS FACTORY JUMPERED
AUTO S/S BY OTHERS FACTORY JUMPERED
ONE SET OF TERMINALS ARE PROVIDED FOR EXTERNAL SAFETY INTERLOCKS. REMOVE FACTORY JUMPER IF TERMINALS ARE USED.
ONE SET OF TERMINALS ARE PROVIDED FOR AUTO S/S BY OTHERS. REMOVE FACTORY JUMPER IF TERMINALS ARE USED.
CHW VALVE
0-10VDC MODULATING SIGNAL FOR CHW COIL VALVE FROM 816u, EXP #1, UO-7.
OPTIONAL AUTO-RESET FREEZESTATS, MOUNTED ACROSS THE ENTERING AIR SIDE OF COOLING COIL
CHW VALVE AND ACTUATOR IS PROVIDED BY SEMCO FOR INSTALLATION AT LAB. USE THE DETAIL AS SHOWN FOR RECOMMENDED WIRING CONNECTIONS.


ALC400
I/O PRO EX816U POINT EXPANDER #1 NETWORK ADDRESS: 1 CONTROL PANEL
UNIT ALARM LIGHT
0-10VDC MODULATING SIGNAL TO CHW VALVE ACTUATOR
2-10VDC MODULATING SIGNAL TO RECIRC DAMPER ACTUATOR
2-10VDC MODULATING SIGNAL TO OUTDOOR AIR DAMPER ACTUATOR
OUTDOOR AIR DAMPER ENABLE
0-10VDC SPEED REFERENCE SIGNAL TO ENTHALPY WHEEL VFD
ENTHALPY WHEEL VFD S/S ENTHALPY WHEEL RD ENABLE
SUPPLY FAN AIR FLOW STATION
EXHAUST FAN AIR FLOW STATION
OUTDOOR FILTER PRESSURE
RETURN FILTER PRESSURE
2-10VDC POSITION FEEDBACK SIGNAL FROM RECIRC DAMPER ACTUATOR
2-10VDC POSITION FEEDBACK SIGNAL FROM OUTDOOR DAMPER ACTUATOR
OUTDOOR AIR TEMP/RH SENSOR
MIXED AIR TEMP/RH SENSOR
SUPPLY AIR TEMP/RH SENSOR
RETURN AIR TEMP/RH SENSOR
EL-3940-5

FAN DATA

Max motor size assumes the motor is mounted on top of the fan. A larger motor may be provided by mounting the motor and the fan on a common base. This will add length to the unit. Underlined variables indicates maximum static efficiency per class.

SIZE 5

MAXIMUM 10 HP MOTOR

	STATIC PRESSURE IN INCHES OF WATER																	
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		10" SP		12" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1,400	1,024	0.33																		
1,700	1,052	0.38																		
2,000	1,116	0.45	1,449	0.93																
2,300	1,191	0.53	1,473	1.03																
2,600	1,268	0.61	1,526	1.16	1,783	1.78														
2,900	1,351	0.71	1,596	1.30	1,816	1.94	2,052	2.67												
3,200	1,439	0.82	1,671	1.46	1,872	2.13	2,077	2.88	2,292	3.70										
3,500	1,531	0.95	1,747	1.63	1,942	2.35	2,122	3.11	2,314	3.95	2,511	4.86								
3,800	1,626	1.09	1,827	1.81	2,017	2.59	2,185	3.38	2,353	4.23	2,531	5.15	2,713	6.14	2,893	7.20				
4,100	1,722	1.25	1,910	2.00	2,092	2.83	2,257	3.68	2,410	4.55	2,568	5.49	2,734	6.49	2,902	7.55				
4,400	1,820	1.43	1,998	2.22	2,169	3.09	2,332	4.00	2,479	4.92	2,621	5.86	2,769	6.88	2,924	7.95	3,236	10.27		
4,700	1,920	1.63	2,088	2.46	2,250	3.36	2,407	4.32	2,552	5.30	2,687	6.28	2,820	7.30	2,960	8.40	3,252	10.74	3,543	13.30
5,000	2,020	1.85	2,181	2.73	2,334	3.66	2,484	4.66	2,627	5.70	2,759	6.73	2,885	7.79	3,010	8.88	3,277	11.25	3,553	13.82
5,300	2,121	2.09	2,275	3.01	2,420	3.98	2,563	5.02	2,702	6.10	2,834	7.21	2,956	8.31	3,074	9.43	3,316	11.82	3,573	14.42
5,600	2,224	2.36	2,371	3.32	2,510	4.33	2,646	5.40	2,780	6.53	2,908	7.68	3,030	8.85	3,144	10.02	3,368	12.44	3,604	15.07
5,900	2,327	2.65	2,469	3.66	2,602	4.71	2,731	5.81	2,859	6.97	2,984	8.18	3,104	9.40	3,217	10.63	3431	13.12	3,647	15.76
6,200	2,430	2.97	2,567	4.02	2,695	5.12	2,818	6.25	2,941	7.45	3,062	8.70	3,179	9.97	3,292	11.26	3,500	13.84	3,702	16.52
6,500	2,535	3.31	2,666	4.41	2,790	5.55	2,908	6.72	3,025	7.95	3,142	9.24	3,256	10.56	3,367	11.91	3,573	14.60	3,766	17.34
6,800	2,639	3.69	2,766	4.83	2,886	6.02	3,000	7.23	3,112	8.49	3,224	9.81	3,335	11.18	3,443	12.57	3,648	15.40	3,836	18.22
7,100	2,745	4.09	2,866	5.28	2,983	6.51	3,093	7.76	3,201	9.06	3,308	10.41	3,415	11.81	3,520	13.25	3,722	16.18	3,909	19.13
7,400	2,850	4.53	2,968	5.76	3,080	7.03	3,188	8.34	3,292	9.67	3,395	11.05	3,498	12.49	3,600	13.97	3,798	17.01		
7,700	2,956	5.00	3,070	6.28	3,179	7.59	3,283	8.94	3,384	10.31	3,484	11.74	3,582	13.19	3,681	14.71	3,874	17.84		

CLASS I = MAX. 2,371 RPM CLASS II = MAX. 3,082 RPM CLASS III = MAX. 3,913 RPM APF181

SIZE 5X

MAXIMUM 10 HP MOTOR

	STATIC PRESSURE IN INCHES OF WATER																	
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		10" SP		12" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1,800	925	0.41																		
2,150	956	0.48																		
2,500	1,013	0.56	1,307	1.15																
2,850	1,077	0.65	1,330	1.28	1,597	2.03														
3,200	1,143	0.75	1,375	1.42	1,607	2.19														
3,550	1,214	0.87	1435	1.59	1,634	2.38	1,849	3.27												
3,900	1,288	0.99	1499	1.78	1,681	2.60	1,869	3.51	2,065	4.52										
4,250	1,367	1.14	1,564	1.97	1,740	2.85	1,905	3.78	2,081	4.81	2,261	5.92								
4,600	1,447	1.30	1,631	2.18	1,804	3.13	1,957	4.09	2,112	5.13	2,277	6.27	2,443	7.48						
4,950	1,529	1.49	1,702	2.40	1,868	3.41	2,017	4.43	2,157	5.49	2,304	6.64	2,458	7.87	2,612	9.17				
5,300	1,613	1.69	1,775	2.65	1,933	3.70	2,081	4.80	2,214	5.90	2,346	7.07	2,484	8.31	2,628	9.63	2,915	12.48		
5,650	1,697	1.91	1,852	2.92	2,001	4.01	2,144	5.17	2,276	6.35	2,399	7.54	2,523	8.79	2,654	10.12	2,925	13.00		
6,000	1,783	2.16	1,930	3.22	2,071	4.35	2,209	5.56	2,340	6.81	2,459	8.05	2,575	9.33	2,693	10.68	2,943	13.58	3,197	16.73
6,350	1,869	2.43	2,011	3.54	2,144	4.71	2,276	5.96	2,404	7.28	2,522	8.59	2,633	9.91	2,742	11.28	2,971	14.22	3,211	17.40
6,700	1,956	2.73	2,092	3.89	2,220	5.11	2,345	6.39	2,469	7.76	2,586	9.15	2,696	10.54	2,800	11.94	3,009	14.90	3,233	18.13
7,050	2,044	3.06	2,175	4.27	2,297	5.53	2,417	6.86	2,535	8.26	2,650	9.71	2,759	11.18	2,861	12.64	3,058	15.65	3,264	18.91
7,400	2,132	3.41	2,258	4.67	2,376	5.98	2,490	7.35	2,604	8.80	2,716	10.31	2,823	11.84	2,925	13.38	3,115	16.47	3,304	19.73
7,750	2,220	3.78	2,342	5.10	2,456	6.46	2,566	7.88	2,675	9.36	2,783	10.92	2,888	12.51	2,989	14.12	3,176	17.34	3,354	20.64
8,100	2,310	4.20	2,427	5.57	2,537	6.98	2,643	8.44	2,748	9.97	2,851	11.55	2,954	13.20	3,053	14.88	3,238	18.23	3,411	21.63
8,450	2,399	4.64	2,512	6.06	2,620	7.53	2,722	9.04	2,822	10.60	2,922	12.23	3,021	13.92	3,118	15.65	3,302	19.15	3,472	22.68
8,800	2,489	5.12	2,598	6.59	2,703	8.12	2,802	9.67	2,899	11.28	2,994	12.94	3,090	14.67	3,184	16.44	3,366	20.09		
9,150	2,579	5.63	2,685	7.16	2,786	8.73	2,883	10.35	2,976	11.99	3,069	13.70	3,161	15.46	3,252	17.28	3,430	21.03		

CLASS I = MAX. 2,135 RPM CLASS II = MAX. 2,775 RPM CLASS III = MAX. 3,522 RPM APF201

SIZE 9, 5XX

MAXIMUM 20 HP MOTOR

	STATIC PRESSURE IN INCHES OF WATER																	
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		10" SP		12" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2,000																				
2,500	836	0.56																		
3,000	885	0.67	1162	1.41																
3,500	949	0.80	1180	1.57																
4,000	1,016	0.94	1,223	1.78	1,432	2.74														
4,500	1,087	1.10	1,284	2.02	1,460	3.01	1,649	4.14												
5,000	1,164	1.29	1,349	2.29	1,510	3.34	1,672	4.49	1,843	5.76										
5,500	1,243	1.50	1,415	2.57	1,571	3.71	1,713	4.88	1,864	6.19	2,020	7.60	2,175	9.13						
6,000	1,326	1.75	1,484	2.87	1,636	4.10	1,770	5.35	1,901	6.67	2,040	8.10	2,183	9.63	2,325	11.27				
6,500	1,410	2.03	1,558	3.21	1,701	4.51	1,833	5.86	1,954	7.23	2,076	8.68	2,205	10.24	2,337	11.89				
7,000	1,495	2.34	1,634	3.59	1,769	4.95	1,898	6.39	2,016	7.85	2,127	9.33	2,240	10.90	2,360	12.58	2,605	16.18		
7,500	1,581	2.68	1,714	4.01	1,840	5.42	1,964	6.95	2,080	8.50	2,187	10.06	2,290	11.65	2,397	13.36	2,622	17.01	2,850	20.97
8,000	1,668	3.07	1,795	4.47	1,914	5.94	2,031	7.52	2,145	9.17	2,251	10.84	2,349	12.49	2,446	14.20	2,650	17.91	2,863	21.90
8,500	1,757	3.50	1,877	4.96	1,990	6.50	2,101	8.13	2,211	9.87	2,315	11.62	2,413	13.40	2,505	15.16	2,690	18.90	2,886	22.95
9,000	1,846	3.97	1,961	5.51	2,069	7.12	2,174	8.80	2,279	10.60	2,380	12.44	2,477	14.31	2,568	16.18	2,741	19.98	2,920	24.09
9,500	1,935	4.49	2,046	6.11	2,149	7.78	2,250	9.54	2,349	11.37	2,447	13.29	2,542	15.25	2,633	17.24	2,800	21.18	2,965	25.32
10,000	2,025	5.05	2,131	6.74	2,231	8.50	2,327	10.31	2,422	12.21	2516	14.19	2608	16.22	2,697	18.29	2,863	22.44	3,019	26.67
10500	2,116	5.67	2,218	7.44	2314	9.26	2,406	11.14	2,497	13.10	2587	15.13	2676	17.24	2,763	19.40	2,928	23.76	3,079	28.12
11000	2,207	6.35	2,305	8.19	2,398	10.09	2,487	12.04	2,574	14.06	2660	16.14	2745	18.30	2,830	20.54	2,992	25.08	3,142	29.64
11500	2,298	7.07	2,392	8.99	2,483	10.97	2,569	13.00	2,652	15.06	2735	17.22	2817	19.43	2,898	21.71	3,057	26.43		
12000	2,390	7.86	2,481	9.86	2,568	11.91	2,651	14.00	2,732	16.14	2811	18.34	2890	20.61	2,969	22.97	3,124	27.85		
12500	2,482	8.71	2,569	10.78	2,654	12.91	2,735	15.08	2,813	17.29	2890	19.56	2966	21.90	3,041	24.28				

CLASS I = MAX. 1,906 RPM CLASS II = MAX. 2,477 RPM CLASS III = MAX. 3,144 RPM APF221

SIZE 13, 9X, 5XXX

MAXIMUM 20 HP MOTOR

	STATIC PRESSURE IN INCHES OF WATER																	
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		10" SP		12" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2,400																				
3,000	737	0.68																		
3,600	771	0.80																		
4,200	823	0.95	1041	1.91																
4,800	878	1.11	1,069	2.13	1,268	3.34														
5,400	937	1.30	1,116	2.41	1,284	3.64	1,462	5.06												
6,000	999	1.50	1,170	2.72	1,317	3.99	1,474	5.44	1,634	7.04										
6,600	1,065	1.74	1,224	3.04	1,365	4.41	1,500	5.88	1,645	7.51	1,790	9.28								
7,200	1,133	2.02	1,281	3.39	1,419	4.88	1,542	6.40	1,668	8.05	1,801	9.84	1,935	11.78						
7,800	1,203	2.32	1,341	3.77	1,473	5.35	1,592	6.98	1,705	8.67	1,823	10.48	1,946	12.43	2,070	14.51				
8,400	1,274	2.67	1,404	4.19	1,529	5.86	1,646	7.60	1,752	9.35	1,857	11.19	1,968	13.18	2,082	15.26	2,311	19.82		
9,000	1,347	3.06	1,469	4.65	1587	6.39	1,701	8.25	1,805	10.11	1,903	12.01	2,001	14.00	2,105	16.14	2,319	20.70		
9,600	1,420	3.48	1,536	5.16	1,647	6.97	1,756	8.90	1,860	10.91	1954	12.89	2045	14.92	2138	17.07	2,335	21.71	2536	26.74
10,200	1,493	3.95	1,605	5.73	1,710	7.60	1,814	9.61	1,914	11.70	2,008	13.82	2,096	15.95	2,181	18.11	2,360	22.81	2,548	27.88
10,800	1,568	4.47	1,675	6.34	1,775	8.29	1,873	10.35	1,970	12.54	2,063	14.79	2,149	17.01	2,231	19.26	2,395	24.01	2,568	29.14
11,400	1,643	5.04	1,745	6.99	1,841	9.02	1,935	11.17	2,028	13.43	2,118	15.77	2,204	18.13	2,285	20.51	2,439	25.33	2,597	30.51
12,000	1,718	5.65	1,817	7.70	1,909	9.82	1,998	12.03	2,087	14.36	2,174	16.78	2,259	19.27	2,339	21.75	2,488	26.74	2,635	31.99
12,600	1,794	6.33	1,889	8.47	1,978	10.68	2,064	12.97	2,148	15.35	2,232	17.85	2,314	20.42	2,394	23.05	2,541	28.26	2,680	33.58
13,200	1,871	7.07	1,962	9.30	2,048	11.59	2,130	13.95	2,211	16.41	2,292	18.99	2,371	21.63	2,449	2,4.36	2,596	29.85	2,731	35.35
13,800	1,947	7.86	2,035	10.18	2,118	12.56	2,198	15.02	2,276	17.55	2,353	20.18	2430	22.92	2,505	25.70	2,650	31.43	27,84	37.17
14,400	2,024	8.72	2,109	11.13	2,190	13.62	2,267	16.15	2,342	18.76	2,416	21.45	2,489	24.22	2,563	27.13	2,705	33.05		
15,000	2,102	9.66	2,183	12.15	2,261	14.71	2,336	17.33	2,409	20.03	2,480	22.79	2,551	25.65	2,622	28.61	2,760	34.69		

CLASS I = MAX. 1,663 RPM CLASS II = MAX. 2,202 RPM CLASS III = MAX. 2,795 RPM APF251

SIZES 18, 13X, 9XX — MAXIMUM 30 HP MOTOR

CFM	1" SP RPM	1" SP BHP	2" SP RPM	2" SP BHP	3" SP RPM	3" SP BHP	4" SP RPM	4" SP BHP	5" SP RPM	5" SP BHP	6" SP RPM	6" SP BHP	7" SP RPM	7" SP BHP	8" SP RPM	8" SP BHP	10" SP RPM	10" SP BHP	12" SP RPM	12" SP BHP
3,000																				
3,800	633	0.87																		
4,600	662	1.03																		
5,400	699	1.21	896	2.47																
6,200	740	1.42	921	2.77																
7,000	787	1.65	959	3.14	1105	4.73														
7,800	837	1.91	997	3.52	1,138	5.23	1,269	7.08												
8,600	889	2.20	1,038	3.92	1,176	5.78	1,296	7.7	1,417	9.80										
9,400	942	2.53	1,083	4.36	1,213	6.34	1,333	8.41	1,439	1,0.51	1,552	12.87								
10,200	997	2.90	1,131	4.84	1,254	6.95	1,370	9.14	1,476	11.41	1,573	13.71	1,677	16.27						
11,000	1,054	3.33	1,181	5.36	1,297	7.58	1,408	9.90	1,513	12.31	1,608	14.75	1,698	17.24	1,794	19.99				
11,800	1,111	3.79	1,233	5.94	1,343	8.26	1,449	10.72	1,550	13.24	1,646	15.85	1,733	18.46	1,817	21.14	2,006	27.29		
12,600	1,170	4.32	1,286	6.57	1,392	9.00	1,492	11.56	1,589	14.21	1,683	16.95	1,771	19.74	1,852	22.53	2,012	28.43		
13,400	1,229	4.89	1,340	7.25	1,442	9.78	1,538	12.47	1,631	15.25	1,721	18.09	1,808	21.02	1,890	23.99	2,040	29.98	2,196	36.58
14,200	1,289	5.52	1,395	8.00	1,494	10.64	1,586	13.42	1,674	16.30	1,761	19.28	1,845	22.31	1,927	25.45	2,076	31.74	2,216	38.23
15,000	1,349	6.20	1,451	8.81	1,546	1,1.54	1,635	14.42	1,720	17.43	1,803	20.52	1,885	23.70	1,964	26.92	2,114	33.57	2,249	40.26
15,800	1,410	6.96	1,508	9.68	1,600	12.53	1,686	15.51	1,768	18.62	1,848	21.85	1,926	25.12	2,003	28.48	2,151	35.39	2,286	42.41
16,600	1,471	7.78	1,565	10.62	1,654	13.58	1,738	16.66	1,818	19.90	1,894	23.20	1,970	26.64	2,044	30.10	2,188	37.24	2,324	44.60
17,400	1,533	8.68	1,623	11.62	1,709	14.70	1,791	17.91	1,868	21.21	1,943	24.67	2,015	28.18	2,087	31.80	2,227	39.18	2,360	46.74
18,200	1,595	9.64	1,682	12.72	1,765	15.91	1,844	19.20	1,920	22.64	1,992	26.17	2,062	29.80	2,131	33.52	2,267	41.17	2,398	49.02
19,000	1,658	10.70	1,741	13.88	1,821	17.17	1,898	20.59	1,972	24.12	2,043	27.78	2,111	31.53	2,178	35.38	2,309	43.24		
19,800	1,720	11.82	1,801	15.13	1,879	18.56	1,953	22.07	2,025	25.70	2,094	29.45	2,161	33.32	2,225	37.23	2,352	45.35		

STATIC PRESSURE IN INCHES OF WATER

CLASS I = MAX. 1,476 RPM   CLASS II = MAX. 1,919 RPM   CLASS III = MAX. 2,435 RPM   APF281

SIZES 24, 18X, 13XX — MAXIMUM 50 HP MOTOR

CFM	1" SP RPM	1" SP BHP	2" SP RPM	2" SP BHP	3" SP RPM	3" SP BHP	4" SP RPM	4" SP BHP	5" SP RPM	5" SP BHP	6" SP RPM	6" SP BHP	7" SP RPM	7" SP BHP	8" SP RPM	8" SP BHP	10" SP RPM	10" SP BHP	12" SP RPM	12" SP BHP
5,000	563	1.13																		
6,000	592	1.34																		
7,000	625	1.57	796	3.18																
8,000	662	1.84	822	3.58																
9,000	703	2.13	854	4.03	983	6.07														
10,000	747	2.46	888	4.51	1,013	6.71	1,127	9.05												
11,000	792	2.82	924	5.02	1,046	7.40	1,152	9.84	1,258	12.51										
12,000	839	3.24	963	5.57	1079	8.11	1,185	10.75	1,279	13.43	1,377	16.38								
13,000	887	3.71	1,005	6.17	1,114	8.85	1,217	11.66	1,311	14.54	1,397	17.47	1,488	20.69						
14,000	936	4.23	1,049	6.83	1,152	9.66	1,250	12.60	1,344	15.69	1,428	18.78	1,508	21.97	1,592	25.42				
15,000	987	4.83	1,095	7.56	1,192	10.50	1,286	13.62	1,376	16.84	1,461	20.15	1,538	23.46	1,613	26.89	1,780	34.69		
16,000	1,038	5.48	1,141	8.34	1,235	11.43	1,324	14.69	1,410	18.05	1,493	21.52	1,571	25.05	1,643	28.60	1,785	36.09		
17,000	1,089	6.18	1,188	9.19	1,279	12.41	1,364	15.82	1,446	19.32	1,526	22.93	1,603	26.64	1,677	30.47	1,810	38.07	1,948	46.40
18,000	1,141	6.96	1,236	10.12	1,324	13.47	1,405	16.98	1,484	20.66	1,561	24.42	1,636	28.28	1,709	32.27	1,841	40.24	1,966	48.53
19,000	1,194	7.83	1,285	11.13	1,369	14.58	1,449	18.27	1,524	22.06	1,598	25.99	1,671	30.03	1,741	34.10	1,874	42.51	1,994	51.01
20,000	1,247	8.76	1,334	12.20	1,416	15.82	1,493	19.60	1,566	23.56	1,637	27.64	1,707	31.81	1,775	36.04	1,906	44.77	2,026	53.67
21,000	1,301	9.80	1,384	13.37	1,463	17.11	1,538	21.03	16,09	25.12	1,677	29.32	1,745	33.69	1,811	38.09	1,939	47.13	2,059	56.40
22,000	1,355	10.91	1,435	14.63	1,511	18.51	1,584	22.56	1,653	26.77	1,719	31.11	1,784	35.61	1,848	40.18	1,972	49.48	2,091	59.11
23,000	1,409	12.10	1,486	15.98	1,560	20.01	1,631	24.21	1,698	28.53	1,763	33.05	1,825	37.63	1,886	42.31	2,007	51.97	2,124	61.94
24,000	1,464	13.41	1,538	17.43	1,610	21.63	1,678	25.92	1,744	30.40	1,807	35.03	1,867	39.73	1,927	44.62	2,044	54.59	2,157	64.77
25,000	1,5,18	14.79	1,590	18.97	1,659	23.29	1,726	27.76	1,790	32.35	1,851	37.06	1,911	41.99	1,968	46.94	2,081	57.19		
26,000	1,573	16.29	1,643	20.64	1,710	25.11	1,774	29.68	1,837	34.44	1,897	39.29	1,955	44.31	2,011	49.42	2,120	59.93		

STATIC PRESSURE IN INCHES OF WATER

CLASS I = MAX. 1,310 RPM   CLASS II = MAX. 1,671 RPM   CLASS III = MAX. 2,160 RPM   APF321

SIZE 24X, 18XX — MAXIMUM 50 HP MOTOR

CFM	1" SP RPM	1" SP BHP	2" SP RPM	2" SP BHP	3" SP RPM	3" SP BHP	4" SP RPM	4" SP BHP	5" SP RPM	5" SP BHP	6" SP RPM	6" SP BHP	7" SP RPM	7" SP BHP	8" SP RPM	8" SP BHP	10" SP RPM	10" SP BHP	12" SP RPM	12" SP BHP
6,000																				
7,200	511	1.60																		
8,400	536	1.85																		
9,600	566	2.14	714	4.32																
10,800	598	2.45	735	4.78																
12,000	632	2.81	761	5.30	878	8.06														
13,200	666	3.18	790	5.85	899	8.75	1,005	11.94												
14,400	701	3.59	822	6.46	925	9.53	1,022	12.80	1,120	16.36										
15,600	738	4.06	855	7.12	954	10.37	1,046	13.80	1,135	17.45	1,226	21.35								
16,800	776	4.56	888	7.81	985	11.25	1,072	14.82	1,156	18.60	1,239	22.61	1,324	26.84						
18,000	816	5.14	922	8.55	1,017	12.18	1,101	15.94	1,182	19.90	1,259	23.98	1,336	28.30	1,415	32.81				
19,200	856	5.77	957	9.35	1,050	13.17	1,132	17.12	1,208	21.17	1,283	25.46	1,355	29.86	1,427	34.46				
20,400	896	6.44	992	10.18	1,083	14.21	1,164	18.35	1,238	22.61	1,309	27.00	1,379	31.60	1,447	36.34	1,584	46.33		
21,600	937	7.18	1,029	11.10	1,117	15.31	1,197	19.66	1,269	24.08	1,337	28.62	1,405	33.41	1,470	38.27	1,598	48.47		
22,800	978	7.99	1,067	12.09	1,151	16.45	1,230	21.01	1,301	25.62	1,367	30.33	1,432	35.26	1,495	40.27	1,617	50.71	1,739	61.79
24,000	1,020	8.88	1,106	13.16	1,186	17.67	1,263	22.41	1,334	27.25	1,399	32.16	1,461	37.19	1,522	42.39	1,640	53.13	1,755	64.41
25,200	1,062	9.84	1,145	14.28	1,222	18.96	1,297	23.89	1,367	28.94	1,432	34.09	1,492	39.25	1,550	44.54	1,665	55.64	1,776	67.26
26,400	1,104	10.87	1,185	15.50	1,259	20.34	1,331	25.41	1,400	30.67	1,464	35.98	1,524	41.40	1,581	46.89	1,692	58.30	1,799	70.14
27,600	1,147	12.00	1,225	16.78	1,297	21.82	1,366	27.03	1,434	32.51	1,497	38.00	1,557	43.66	1,613	49.34	1,719	60.91	1,824	73.15
28,800	1,189	13.18	1,266	18.18	1,335	23.35	1,402	28.75	1,468	34.39	1,530	40.08	1,590	45.97	1,645	51.81	1,749	63.77	1,851	76.35
30,000	1,232	14.47	1,307	19.65	1,374	24.99	1,439	30.58	1,502	36.31	1,564	42.28	1,622	48.26	1,678	54.41	1,780	66.71	1,878	79.49
31,200	1,275	15.85	1,348	21.20	1,413	26.70	1,476	32.46	1,537	38.35	1,598	44.52	1,656	50.77	1,711	57.08	1,812	69.77	1,907	82.81

STATIC PRESSURE IN INCHES OF WATER

CLASS I = MAX. 1,164 RPM   CLASS II = MAX. 1,486 RPM   CLASS III = MAX. 1,921 RPM   APF351

SIZE 24XX, 18XXX — MAXIMUM 50 HP MOTOR

CFM	1" SP RPM	1" SP BHP	2" SP RPM	2" SP BHP	3" SP RPM	3" SP BHP	4" SP RPM	4" SP BHP	5" SP RPM	5" SP BHP	6" SP RPM	6" SP BHP	7" SP RPM	7" SP BHP	8" SP RPM	8" SP BHP	10" SP RPM	10" SP BHP	12" SP RPM	12" SP BHP
7,000																				
8,500	455	1.90																		
10,000	476	2.20																		
11,500	503	2.56	639	5.19																
13,000	532	2.94	656	5.75																
14,500	562	3.37	680	6.41	786	9.75														
16,000	593	3.83	706	7.10	805	10.64	902	14.52												
17,500	625	4.34	735	7.86	828	11.59	917	15.63	1007	19.99										
19,000	658	4.90	764	8.64	853	12.58	937	16.80	1018	21.27	1,102	26.06								
20,500	693	5.54	795	9.53	881	13.67	961	18.10	1037	22.73	1,112	27.62	1,191	32.88						
22,000	729	6.24	825	10.42	911	14.87	987	19.48	1,060	24.32	1,130	29.35	1,200	34.65	1,273	40.24				
23,500	765	7.00	857	11.41	941	16.10	1,015	20.94	1,084	25.94	1,152	31.22	1,217	36.62	1,282	42.23				
25,000	802	7.85	889	12.45	971	17.39	1,044	22.47	1,110	27.64	1,175	33.10	1,238	38.73	1,299	44.50	1,425	56.94		
26,500	839	8.76	922	13.56	1,001	18.71	1,074	24.10	1,139	29.54	1,200	35.09	1,261	40.94	1,320	46.94	1,436	59.49		
28,000	877	9.78	957	14.81	1,033	20.19	1,104	25.78	1,168	31.45	1,228	37.29	1,286	43.29	1,343	49.47	1,453	62.29	1,564	76.01
29,500	915	10.88	992	16.12	1,064	21.65	1,134	27.52	1,198	33.48	1,256	39.47	1,312	45.67	1,367	52.05	1,474	65.34	1,578	79.25
31,000	953	12.06	1,028	17.54	1,097	23.27	1,165	29.37	1,228	35.58	1,286	41.87	1,340	48.22	1,393	54.80	1,497	68.52	1,596	82.66
32,500	991	13.33	1,064	19.03	1,131	25.02	1,196	31.27	1,258	37.73	1,316	44.32	1,370	50.99	1,421	57.72	1,521	71.76	1,617	86.29
34,000	1,030	14.74	1,101	20.66	1,165	26.82	1,228	33.30	1,288	39.94	1,346	46.83	1,399	53.69	1,450	60.76	1,546	75.09	1,640	90.09
35,500	1,069	16.24	1,137	22.32	1,200	28.75	1,260	35.38	1,319	42.29	1,376	49.42	1,429	56.57	1,479	63.82	1,573	78.62	1,664	93.98
37,000	1,108	17.84	1,175	24.20	1,235	30.76	1,294	37.69	1,351	44.79	1,406	52.06	1,459	59.52	1,509	67.06	1,601	82.26	1,689	97.99
38500	1,147	19.55	1,212	26.12	1,271	32.93	1,328	40.07	1,383	47.34	1,437	54.87	1,489	62.54	1,539	70.39	1,630	86.06		

STATIC PRESSURE IN INCHES OF WATER

CLASS I = MAX. 1,028 RPM   CLASS II = MAX. 1,337 RPM   CLASS III = MAX. 1,696 RPM   APF391

SAMPLE SPECIFICATIONS

Dedicated outdoor air system units will be SEMCO standard Pinnacle® II series with components as follows:

CASING

Standard panels shall consist of 2" thick dual wall 18 gauge (20 gauge for unit sizes 5 and 9) galvanized solid exterior skins and 22 gauge galvanized steel solid interior skins enclosing 2 inch thick 3 pcf mineral wool insulation with a U-factor of 0.10 BTU/(hr-sq.ft.-deg.) The housing shall be supported by a painted structural steel base. The base includes a solid welded floor with 6" thick (4" thick for unit sizes 3, 5, and 9) mineral wool insulation. The bottom face of the insulation shall be protected with a 22 gauge galvanized steel cover. The base is to be self-flashing when set on a properly sized curb. Floor openings have perimeter lips turned up into unit and are covered by a protective grate. Lifting lugs shall be welded to the structural base.

OUTDOOR CONSTRUCTION

Units shall have a factory-installed, 24 gauge galvanized steel standing seam sheet metal sloped roof. Roof field joints will consist of tapered expanded polystyrene filler panels and standing seam metal roof that must be installed and crimped by the contractor. Outdoor air intake and exhaust air discharge openings shall have galvanized steel sheet metal hoods with openings covered with bird screen. Hoods may ship loose for field installation depending on shipping width restrictions.

Outdoor Intake Filters - Research Products Industrial EZ-Kleen, aluminum mesh, 1" thick, washable filters shall be mounted in the outdoor air intake hoods. These shall be a low resistance-roughing filter.

ACCESS

Access shall be provided through large hinged, tightly sealed doors or easily removable access panels. Access doors shall be constructed of the same materials as the unit casing and use SEMCO's standard hardware. Each door shall be provided with two cam type handles and two heavy duty hinges to achieve maximum sealing. Handles are to be internal and external for opening from the inside or outside of the unit. All doors shall be air pressure closing. Removable panels shall be provided for heating and cooling coils.

FANS

Fan performance is based on tests conducted in accordance with AMCA Standard test code for air moving devices and shall bear the AMCA Certified Rating Seal for Air and Sound. Fans have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the efficiency peak to ensure quiet and stable operation. Fans shall be of the centrifugal plenum type, designed without a scroll type housing. Fans shall incorporate a non-overloading type backward inclined airfoil blade wheel, heavy gauge reinforced steel inlet plate with removable spun inlet cone, structural steel frame, and shaft and bearings in the AMCA Arrangement 4 configuration to form a heavy duty integral unit. Fan wheels have a spun non-tapered style blade-retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. Sizes 281 and larger shall have nine die-formed hollow airfoil blades continuously welded around all edges. Smaller sizes shall have nine airfoil-shaped aluminum extruded blades. Fan wheels are statically and dynamically balanced to a level of G6.3 (per ANSI 2-19) or better.

SHAFTS

The fan shaft is polished steel, accurately turned, ground and ring gauged for accuracy. Shafts shall have first critical speeds at least 1.43 times the maximum speeds of the fan.

BEARINGS

The fan wheel bearings are heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for minimum average bearing life (AFBMA L-50) in excess of 200,000 hours at the maximum class RPM.

FAN VIBRATION ISOLATION

Fans assemblies are mounted on spring isolators with flexible connections between fan and fan wall.

MOTORS

Fan motors shall be standard NEMA frame, EPACT compliant, with 1.15 service factor and open drip-proof enclosures.

ENTHALPY RECOVERY WHEEL

The rotor media shall be made of aluminum, which is coated to prohibit corrosion. All media surfaces shall be coated with a non-migrating solid adsorbent layer prior to being formed into the honeycomb media structure to insure that all surfaces are coated and that adequate latent capacity is provided. The media has a flame spread of less than 25 and a smoke developed of less than 50 when rated in accordance with ASTM E84.

The faces of the total energy recovery wheel shall be sealed with a two-part polymer acid resistant coating to limit surface oxidation. The media face coating shall also include a proprietary Teflon-based anti-stick additive shown, by independent testing, to effectively limit the collection of dust or smoke particulate and to aid in the surface cleaning process should cleaning be required.

The entire recovery wheel media face shall be treated with Avron46, and shall exhibit effective antimicrobial action, supported by independent test data. Any antimicrobial agent used must, by law, carry an EPA registration for use in duct systems. All desiccant surfaces within the transfer media shall also exhibit bacteria-static properties as supported by independent testing.

The desiccant is inorganic and specifically developed for the selective adsorption of water vapor. The desiccant utilizes a 3A molecular sieve certified by the manufacturer to have an internal pore diameter distribution, which limits adsorption to materials not larger than the critical diameter of a water molecule (2.8 angstroms.)

Equal sensible and latent recovery efficiencies are documented through a certification program conducted in accordance with ASHRAE 84-78P and the results presented in accordance with ARI 1060 standards. The certification has been conducted by a qualified independent organization.

Independent wheel testing from a credible test laboratory documents that the desiccant material utilized does not transfer pollutants typically encountered in the indoor air environment. The cross-contamination and performance certification reports shall be provided upon written request for engineering review.

PASSIVE DEHUMIDIFICATION WHEEL

Dehumidification wheel shall be specifically designed to dehumidify the outdoor air stream leaving the cooling coil, without the use of additional regeneration energy of any type. The dehumidification wheel media backbone shall be an aluminum film substrate. The substrate shall be coated, prior to being formed into the honeycomb media structure, with a dense layer of solid, non-migrating adsorbent desiccant materials specifically designed to provide optimum dehumidification performance. The desiccant coating and wheel media are suitable for use in a saturated, high humidity environment and cleanable with low temperature steam or hot water without adversely affecting performance. The media has a flame spread rating of less than 25 and a smoke developed of less than 50 when rated in accordance with ASTM E84.

ROTOR MAINTENANCE

The media is cleanable with low-pressure steam (less than 5 psi,) hot water or light detergent, without degrading the latent recovery. Dry particles up to 800 microns shall freely pass through the media.

PURGE SECTOR

The unit is provided with a factory set, field adjustable purge sector designed to limit cross contamination to less than .04 percent of that of the exhaust air stream concentration when operated under appropriate conditions.

ROTOR SEALS

The rotor is supplied with labyrinth seals only, which at no time are required to make contact with any rotating surface of the exchanger rotor face. These multi-pass seals shall utilize four labyrinth stages for optimum performance.

ROTOR SUPPORT SYSTEM

The rotor media is provided in segmented fashion to allow for field erection or replacement of one section at a time without requiring side access. The media is rigidly held by a structural spoke system made of extruded aluminum.

ROTOR HOUSING

The rotor housing is a structural framework, which limits the deflection of the rotor due to air pressure to less than 1/32". The rotor is supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from its spoke system.

Drive System - The rotor is driven by a black b-section v-belt and an integral gear motor for reliable operation. A/C motors are utilized for both constant and variable speed applications.

INTEGRAL DX SECTION

General - Integral condensing units shall be factory wired, piped, pressure tested, evacuated, charged with refrigerant and tested. The energy recovery unit and condensing unit share electrical and control panels.

COMPRESSOR

Compressors shall be heavy-duty commercial, high efficiency scrolls with oil level sight glass, low vibration, and discharge and suction Rotalock service valves.

AIR FILTERS

RETURN AIR FILTERS

Return air filters shall be 2" disposable.

2" PRE-FILTERS

Filters shall be Farr type 30/30. Air filters shall be 2" thick, pleated, disposable type. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. Filter media shall be a cotton and synthetic blend with at least 15 pleats per linear foot. A welded wire grid, spot-welded on one-inch centers and treated for corrosion resistance is bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation. The filter media shall have a Minimum Efficiency Reporting Value of MERV 7 when evaluated under guidelines of ASHRAE Standard 52.2-1999 and an average dust spot efficiency of 25-30% when evaluated under ASHRAE Standard 52.1-1992. The filter is listed by Underwriters' Laboratories as Class 2. A bank of 16-gauge galvanized steel universal holding frames with filter sealing flange, centering dimples, sealing gasket and lances for air filter fasteners shall be arranged for upstream access. Provisions shall be made on the downstream side of the frames to prevent filter blowout from moisture or overloading.

HIGH EFFICIENCY 95% OUTDOOR AIR FILTERS

Mounted in the same filter bank with the Pre-filters shall be 12" deep high performance filters, which shall be high lofted supported media disposable type. The media blanket shall be formed into uniform tapered radial pleats and bonded to a welded wire media support grid, which is spot-welded on one-inch centers, and treated for corrosion resistance. Media support contour stabilizers shall be mechanically fastened to diagonal support members of the same construction to create a rigid and durable filter enclosure. There shall be a minimum of four contour stabilizers on the air entering side and six on the air exiting side. The media shall have a Minimum Efficiency Reporting Value of MERV 14 when evaluated under guidelines of ASHRAE Standard 52.2-1999 and an average dust spot efficiency of 90-95% when evaluated under ASHRAE Standard 52.1-1992. The filter is listed by Underwriters' Laboratories as Class 2.

CHILLED WATER COIL

Primary surface is round seamless 5/8" O.D. by .020" thick copper tube on 1.5" centers, staggered in the direction of airflow. All joints shall be brazed.|

Secondary surface shall consist of .0060" rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube shall not be visible between fins and the fins shall have no openings punched in them to accumulate lint and dirt. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

Casings shall be constructed of galvanized steel. Coil side plates shall be of reinforced flange type.

Coils shall have equal pressure drop through all circuits. Coils shall be circuited for counter flow heat transfer to provide the maximum mean effective temperature difference for maximum heat transfer rates.

Headers on coils shall be seamless copper tubing. The headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility. Supply and return connections shall be steel with male pipe threads.

The complete coil shall be submerged in water and tested with a minimum of 315 psig air pressure to verify suitability for operation at 250 psig working pressures. Individual tube test and core tests before installation of headers shall not be considered satisfactory. Water-cooling coils shall be circuited for drain ability. Use of internal restrictive devices to obtain turbulent flow shall not be acceptable. Vents and drains shall be furnished on all coils. Coils shall be rated in accordance with ARI.

Coils shall be mounted in galvanized holding racks. Water coil supply and return connections shall be extended to the unit exterior. Water coil drain and vent connections are accessible inside the unit and are not extended. Cooling coils shall be mounted in an insulated pitched 304 stainless steel condensate pan. Banks with more than one coil high shall have insulated intermediate 304SS condensate pans individually piped to the lower pan.

HOT WATER COIL

Primary surface shall be round seamless 5/8" O.D. by .020" thick copper tube on 1.5" centers, staggered in the direction of airflow. All joints shall be brazed.

Secondary surface shall consist of .0075" rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube shall not be visible between fins and the fins shall have no openings punched in them to accumulate lint and dirt. Tubes shall be mechanically expanded into the ins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

Coils shall have equal pressure drop through all circuits. Coils shall be circuited to provide the maximum mean effective temperature difference for maximum heat transfer rates.

Headers on coils shall be seamless copper tubing. The headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility. Supply and return connections shall be steel with male pipe threads.

The complete coil shall be submerged in water and tested with a minimum of 315 psig air pressure to verify suitability for operation at 250 psig working pressures. Coils shall be circuited for drain ability. Internal restrictive devices to obtain turbulent flow shall not be used. Vents and drains shall be furnished on all coils. Coils shall be rated in accordance with ARI.

Coils shall be mounted in galvanized holding racks. Water coil supply and return connections shall be extended to the unit exterior. Water coil drain and vent connections are accessible inside the unit and are not extended.

MODULATING OUTDOOR AIR DAMPERS

Dampers could have galvanized steel frames and blades, with blade and jamb seals for low leakage performance. Dampers could have modulating electric actuators with an integral limit switch.

RECIRCULATION DAMPERS

Dampers could have galvanized steel frames and blades, with blade and jamb seals for low leakage performance. Dampers could have two-position electric actuators with an integral limit switch.

EXHAUST AIR DAMPERS

Dampers could be gravity operated back draft type. Dampers could have aluminum frames and blades, with blade seals for low leakage performance.

ELECTRICAL PANEL

Unit will require a 3 phase, 60 cycle field power connection at the main electrical panel. The electrical panel will be NEMA 4 rated and mounted on the unit exterior as shown on the General Arrangement drawings. The electric panel will consist of a non-fused disconnect and HOA switch for the unit. Separate branch circuits, each with overcurrent protection, are provided for each fan, wheel, and transformer. IEC full voltage starters are provided for each non VFD controlled fan and wheel.

Starter coils will be 24volt AC for motor contactors. Electrical panels will bear an ETL label. See the wiring schematic for additional information.

All high voltage wiring up through size #2 will be run in MC cable. All wire size #1 and larger wire is run in EMT. Fan motors requiring wire run in EMT will have less than 48" of flexible metal conduit between the EMT and the motor junction box. Plenum cable is used for low voltage wiring and is not run in conduit.

LIGHTS & GFI RECEPTACLE (POWERED SEPARATELY)

Vapor tight light fixtures with compact LED lamps will be provided in access compartments as shown on the General Arrangement drawing. Lights will be wired to a single GFI / switch combo on the unit exterior.

Power is optional line side or load side of main unit disconnect. A separate disconnect and enclosure serves the light and receptacle circuit and is independently fused.

An optional separate 120 volt field power connection if chosen will be required at the GFI receptacle to provide power for the lighting and GFI receptacle circuit.

WARRANTY

Please see the terms and conditions for your order or contact service.semco@flaktgroup.com.

PINNACLE® II SERIES - EQUIPMENT SUMMARY

MODEL SIZE	5	9	13	18	24
WIDTH	86.25	98.25	98.25	122.25	122.25
HEIGHT	284.625	292.5	316.125	337.0	352.75
SUPPLY AIR CFM RANGE [1]	3,000-4,500	4,500-8,000	6,000-10,000	8,000-15,000	11,000-18,000
RETURN AIR CFM RANGE [1]					
PURGE VOLUME [2]	1,005	1,278	1,620	1,977	2,366
HEAT/COOL COIL TOTAL FIN HEIGHT	45 in	54 in	66 in	78 in	90 in
HEAT/COOL COIL TOTAL FIN LENGTH	30 in	42 in	42 in	54 in	54 in
NUMBER OF STACKED COILS (HEIGHT)	(1) 45 in	(2) 27 in	(2) 33 in	(2) 39 in	(2) 45 in
SUPPLY FILTER QUANTITIES & SIZES	(2) 24x24	(6) 20x24	(6) 24x24	(3) 20x24	(12) 20x24
	(2) 12x24	-	-	(9) 20x20	-
RETURN FILTER QUANTITIES & SIZES	(2) 24x24	(2) 24x24	(3) 24x24	(6) 24x24	(8) 24x24
	(2) 12x24	(3) 12x24	(3) 12x24	(2) 12x24	-
DOOR SIZE (INCHES)	13.25x42.75	13.25x55.75	19x66	19x66	19x66

[1]Maximum airflow limitations vary. Consult SEMCO before laying out unit with velocities greater than 525 fpm on 2" filters, 525 fpm on cooling coils, and 1100 fpm on wheels.

[2]Dual wheel purge volume based on 4" P_{OA}-P_{RA} on Enthalpy wheel, 1" P_{OA}-P_{RA} on PD wheel.

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FläktGroup® SEMCO®
Corporate Headquarters
1800 East Pointe Drive
Columbia, Missouri 65201 USA

573.443.1481

sales.semco@flaktgroup.com

To learn more about FläktGroup® SEMCO® offerings and to contact your nearest representative please visit

www.semcohvac.com