ASCENDANT™
CONVENTIONAL COOLING – ACTIVE DESICCANT DEHUMIDIFICATION SYSTEM
HVAC systems have a major impact on:
- Infection control
- Hazard control
- Internal climate control
- Building energy consumption

SEMCO’s solution includes:
- Active desiccant hybrid system
- High efficiency systems
- An improvement to the building’s conventional HVAC System operation and energy consumption

Specialized solution for the high demands of healthcare applications

HVAC systems for hospital and healthcare facilities have special requirements because of the susceptibility of patients to infection. Heating and ventilation systems play an important part in providing a clean, safe and comfortable environment for patient recovery.
Specific Healthcare Demands

Healthcare facilities need more than just heating and ventilation. SEMCO can deliver equipment and complete systems for control of infection, air movement, and odor, yet maintain temperature, humidity, air quality and noise at superior comfortable levels for patients and staff.

Operating theaters specifically have unique HVAC design challenges:

VENTILATION AND AIR MOVEMENT

• Minimum of 4 air changes of outdoor air with a total of 20 air changes (ASHRAE 170-2013 table)

• Regardless of the amount outdoor air used – total energy recovery should be utilized in almost every region in the US. (ASHRAE 90.1-2013 Table 6.5.6.1-2)

OPERATING ROOM HUMIDITY CONTROL

• Must be able to maintain space humidity less than 60% RH with a commonly requested temperature of 65°F. (AIA/ASHRAE Guidelines)

• Both low end temperature and humidity must be achievable simultaneously

• This corresponds to a space dew point of approximately 40°F (not achievable with conventional chilled water system).
ASCENDANT™ is a conventional cooling – active desiccant dehumidification system, performance optimized to deliver and control low dew point air while minimizing regeneration energy input in compliance with ASHRAE/AIA guidelines.

OFFERING THE GREATEST DEHUMIDIFICATION CAPACITY
ASCENDANT™ provides more than three times the dehumidification capacity/CFM compared to customized DX cooling systems, enabling supply of much lower dew points (see below).

TIGHT LOW HUMIDITY AND TEMPERATURE CONTROL
Low space dew point conditions are easily achieved and tightly controlled by the customized control algorithms, factory installed sensors, and an on-board DDC controller.

REDUCED COOLING TONS
Fewer tons of mechanical cooling capacity are required to achieve a low supply air dew point - up to 60% less cooling capacity required compared to custom DX systems. Many hours exist where dehumidification is accommodated with only the active desiccant wheel and no cooling is required.

SUBSTANTIAL ENERGY SAVINGS
ASCENDANT™ operates with 25% to 50% less energy cost than other conventional dehumidification systems as a result of improved cooling efficiency (higher suction temperatures) and by shifting much of the latent load from electrically driven vapor compression over to lower cost regeneration energy.

ASCENDANT™ IS DESIGNED TO:
• Offer substantial energy and first cost savings
• Ensure hospitals are able to operate continuously around the clock
• Improve hygiene by ensuring that the ASHRAE required final filters remain dry

NO RETURN AIR PATH NEEDED
While total energy recovery is an important option when return air is available, it is not required to achieve efficient operation.

OPTIONAL TRUE 3Å WHEEL
SEMCO True 3Å wheel decreases outdoor air cooling tons by up to 60%. True 3Å wheel also limits contaminant carry-over to less than 0.045%, and has been used in hospital applications for decades.

ASCENDANT™ vs. Conventional Cooling Approach
The ASCENDANT™ system processes outdoor and/or return air streams to a moderate leaving coil temperature condition (when needed), thereby delivering saturated air to the active desiccant wheel which promotes highly efficient moisture adsorption, further depressing the supply air humidity content to very low dew points.

By employing moderate chilled water or refrigerant temperatures, the efficiency of the cooling system employed is high. (This is in sharp contrast to refrigeration based dehumidification systems which rely on low suction temperatures and very deep cooling coils to achieve lower dew points.)

An integral modulating bypass damper allows the cool, moderately dry air leaving the cooling coil to be mixed with the appropriate quantity of warm, very dry air leaving the dehumidification wheel to deliver the required supply air dew point. If tight temperature control is also required, a small sensible only post cooling coil is employed.

Regeneration of the desiccant wheel is also achieved with high energy efficiency. A typical regeneration airflow quantity is only 20% - 40% of the supply airflow volume. Only moderate regeneration temperatures (140°F to a maximum of 200°F) are required, allowing the use of hot water, steam, direct fired gas or waste heat (i.e. by-product of a power generation (CHP)).

For applications where an exhaust airstream is available (i.e. hospital operating theaters) preconditioning the outdoor air with SEMCO total energy recovery is highly recommended since it substantially increases overall system energy efficiency and substantially reduces precooling input requirements. It also provides valuable winter season preheat and humidification.
Case 1: Total Energy preconditioning to Conventional AHU

- Operating theaters conditioned to achieve 65°F and not more than 60% RH as required for Delivery Rooms by AIA/ASHRAE guidelines
- Coldest possible chilled water used (40°F at the chiller), and deepest cooling coil (10 row) to achieve 48°F air off of the coil
- Air reheated to 59°F to accommodate sensible load in the space
- Total energy recovery is utilized to precondition the outdoor air portion as per ASHRAE 90.1
- Preconditioned air (10,000 cfm) is delivered to conventional AHUs supplying enough air to provide 3,333 cfm to each of the 15 operating rooms to achieve the required 25 air changes/Hr.

Conventional Approach: Requires 150 Tons, 600K BTU Reheat
Case 2: ASCENDANT™ preconditioning to Conventional AHU

- Operating theaters operated in an attempt to achieve 65°F and 60% RH as required for Delivery Rooms by AIA/ASHRAE guidelines (Note: Colder room conditions—often desired for surgeon comfort—and lower space humidity can be easily achieved with ASCENDANT™)

- Traditional chilled water used (45°F at the chiller), thereby increasing chiller efficiency and sensible only cooling coil (4 row) in AHUs

- No reheat required to deliver the 59°F to the space

- Total energy recovery is utilized to precondition the outdoor air portion as per ASHRAE 90.1 combined with integrated active desiccant to deliver very dry outdoor air to each AHU. All latent load handled by ASCENDANT™ so AHU coils are sensible only

ASCENDANT™ Approach: Requires only 58 Tons, No Reheat
**SYSTEM COMPARISON:**
Conventional vs. ASCENDANT™

<table>
<thead>
<tr>
<th>Outdoor Air Preconditioning</th>
<th>Case 1: Conventional</th>
<th>Case 2: ASCENDANT™ Preconditioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airflow provided (for ten ORs)</td>
<td>10,000 cfm</td>
<td>10,000 cfm</td>
</tr>
<tr>
<td>Pretreatment used</td>
<td>Total energy recovery</td>
<td>Total recovery, precooling, active dehumidification</td>
</tr>
<tr>
<td>Cooling capacity required (at peak)</td>
<td>None required</td>
<td>20 tons[^1]</td>
</tr>
<tr>
<td>Regeneration capacity required (at peak)</td>
<td>None required</td>
<td>352,000 btu/hr</td>
</tr>
<tr>
<td>Supply Air to Operating Rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airflow provided (for ten ORs)</td>
<td>50,000 cfm</td>
<td>50,000 cfm</td>
</tr>
<tr>
<td>Outdoor air percentage</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Cooling capacity required</td>
<td>150 tons[^2]</td>
<td>38 tons[^1]</td>
</tr>
<tr>
<td>Chilled water temperature required</td>
<td>40°F</td>
<td>45°F</td>
</tr>
<tr>
<td>Reheat energy required</td>
<td>594,000 btu/hr</td>
<td>None required</td>
</tr>
<tr>
<td>Total System Summary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling capacity required</td>
<td>150 tons[^2]</td>
<td>58 tons[^1]</td>
</tr>
<tr>
<td>Reheat/regeneration energy required</td>
<td>594,000 btu/hr</td>
<td>352,000 btu/hr (peak, less at part load)</td>
</tr>
<tr>
<td>Total fan HP estimate</td>
<td>59 BHP</td>
<td>62 BHP</td>
</tr>
<tr>
<td>Dehumidification season cooling electrical cost[^3] ($0.08/KWH)</td>
<td>$32,312</td>
<td>$11,190</td>
</tr>
<tr>
<td>Dehumidification season heat ($10 MMBTU)</td>
<td>$21,408</td>
<td>$12,900</td>
</tr>
<tr>
<td><strong>Total Operating Energy Cost Estimate</strong> (Dehumidification season)</td>
<td><strong>$53,720</strong></td>
<td><strong>$24,090</strong></td>
</tr>
</tbody>
</table>

[^1]: Reflects higher chiller efficiency with 45°F water.
[^2]: Reflects lower chiller efficiency with 40°F water.
[^3]: Assumes Philadelphia weather data, 24 hour/day operation, $.08/KWH, $10/MMBTU steam.

**Results from Example Analyses**

Numerous important design advantages were recognized when the outdoor air delivered to the operating theaters was preconditioned by the ASCENDANT™ technology. When compared to the conventional approach, the ASCENDANT™ system achieved the desired space humidity conditions using 61% fewer tons of cooling capacity (58 vs 150), eliminated approximately 600,000 BTUs of reheat energy and cut the cost of operation by 55%.

The cooling efficiency is improved with ASCENDANT™ since the desired air temperature leaving the coil could be achieved using traditional 45°F chilled water while the conventional approach needed chilled water at 40°F or below. Chillers operated to deliver 40°F require substantially more energy input (KW/ton) then do chillers delivering water at 45°F. Many hospitals deliver these inefficient chilled water conditions to the entire facility simply because the need them for the operating theaters. ASCENDANT™ solves that problem.
Case 3: ASCENDANT™ Exceeds AIA guidelines at the Desired Space Temperatures

Perhaps the greatest benefit offered by the ASCENDANT™ technology is the additional dehumidification capacity provided so that HVAC systems are able to meet the required space humidity conditions within the operating theaters even when space temperatures colder than 65°F are desired. The high lighting intensity and machinery common in today’s operating theaters combined with protective clothing typically requires space temperatures at or below 62°F for surgeons’ comfort during strenuous procedures.

Another key reason for providing additional dehumidification capacity is to accommodate latent loads infiltrating from higher humidity spaces adjacent to the OR when the automatic doors are opened before and during surgery. Experience has shown that these latent loads are often missed during the design process which is problematic since they are significantly greater than those associated with the occupants.

As shown within the Case 3 psychrometric chart (below), ASCENDANT™ can easily maintain OR space conditions down to 62°F and below while achieving the desired 50% relative humidity level. This is possible due to the ASCENDANT™ system’s ability to deliver air with a dew point as low as 20°F. Surprisingly, these conditions can be efficiently maintained without the need for substantially more cooling or regeneration energy input than required by Case 2 and substantially less than required by the conventional approach shown in Case 1.
Dedicated Outside Air System
with Optional Integrated Total Recovery

- Pre-treats downstream air handling systems
- Optional benefit of total energy recovery for more energy efficient operation
- Provides preheat and humidification during the heating season

Total Conditioning System

- Incorporates post cooling and final high efficiency filtration to allow for independent control of both temperature and humidity, providing total conditioning without supplemental air handlers to laboratories or large operating theaters

1 Outdoor Air Damper
2 Outdoor Air Filter
3 Optional True 3Å Wheel
4 Wheel Bypass Damper
5 Heating Coil
6 Pre & Post Cooling Coil
7 Active Desiccant Wheel
8 Supply Air Fan
9 Final Filtration
10 Regen Inlet Damper
11 Regen Air Filtration
12 Regeneration Source
13 Recirculation Damper
14 Regen Fan
15 Optional Return Air Opening
16 Return Air Filtration
17 Exhaust Air Fan
18 Exhaust Air Damper
STANDARDS AND OPTIONS

STANDARD FEATURES

Active Desiccant Wheel
- Fluted media composed of porous inorganic fiber impregnated with high quality adsorbent
- Driven using lube-free chain for longevity and ease of maintenance

Active Desiccant System
- DX or chilled water pre-cooling coils
- Regeneration heat - hot water, steam, electric, or gas (indirect and direct)
- Wheel bypass damper lowering wheel pressure drop and providing greater control over supply temperature and humidity

SEMCO Panel System
- Double-wall panel construction (4 inches thick with 18-gauge outer skin)
- Double-wall removable panels provided for large internal components
- Gasketed double-wall access doors for all compartments

Supply and Regeneration Air Fans
- Direct drive plenum supply and SWSI regeneration fans
- Variable frequency drives

Filter Sections
- 30 percent efficient filters are provided for supply and regeneration air streams

OPTIONAL FEATURES

- Recirculation damper to allow regeneration heat source to be used for supply air during winter operation
- Post-cooling coil if cooler supply air is required
- Process Heating
- MERV 11-14, HEPA, and ULPA high efficiency final filters on supply side
- Return fan for partial outdoor air systems
- Total energy recovery wheel when exhaust air is available to reduce required cooling input
- Custom options and configurations are supported to meet your unique requirements

DDC CONTROLS

Advanced integrated DDC controls are utilized to optimize the performance of ASCENDANT™ to achieve the desired supply air humidity and temperature conditions while minimizing energy consumption.

Five standard parameters that are controlled:
1. The fraction of the supply airflow that is processed by the active dehumidification wheel and the integral modulating bypass damper
2. The temperature of the air leaving the pre-cooling coil
3. The regeneration energy used (temperature)
4. The supply airflow delivered
5. The regeneration airflow utilized

ASCENDANT™ UNIT SIZES AND DIMENSIONS

<table>
<thead>
<tr>
<th>Unit Size</th>
<th>Airflow CFM Range</th>
<th>Unit Height</th>
<th>Unit Width</th>
<th>Make up Air Unit Length</th>
<th>Dedicated Outside Air System with True 3Å Wheel Unit Length</th>
<th>Total Conditioner Unit Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>005</td>
<td>2,720 - 5,500</td>
<td>62”</td>
<td>102.25”</td>
<td>259”</td>
<td>364.5”</td>
<td>351”</td>
</tr>
<tr>
<td>009</td>
<td>3,740 - 8,500</td>
<td>74”</td>
<td>114.25”</td>
<td>259”</td>
<td>380.5”</td>
<td>358.75”</td>
</tr>
<tr>
<td>013</td>
<td>6,130 - 10,500</td>
<td>88”</td>
<td>114.25”</td>
<td>263”</td>
<td>402.25”</td>
<td>360.75”</td>
</tr>
<tr>
<td>018</td>
<td>7,600 - 15,000</td>
<td>100”</td>
<td>138.25”</td>
<td>274.25”</td>
<td>420”</td>
<td>368.75”</td>
</tr>
<tr>
<td>024</td>
<td>9,600 - 20,000</td>
<td>112”</td>
<td>150.25”</td>
<td>297.75”</td>
<td>462.5”</td>
<td>387.5”</td>
</tr>
</tbody>
</table>
Since ASCENDANT™ can produce substantially drier air the dehumidification capacity offered at a given airflow is many times greater. As a result it can typically be operated with only one third to one forth the airflow required by more conventional systems.

The Carnegie Mellon Intelligent Workplace employs an ASCENDANT™ to dehumidify ventilation air to solve serious condensation issues on their passive chilled beams experienced with a prior, more conventional system.
ASCENDANT™ has the capacity to deliver air dehumidified over a wide range to handle fluctuations in latent loads for a variety of applications. The on-board DDC controls allow the user to optimize temperature and humidity levels. An optional post cooling coil provides additional temperature control if required to ensure a steady and consistent indoor relative humidity.

**LOW DEW POINT SPACES:**
**Hospital Operating Theaters**

To minimize reinfection and maximize comfort, commonly hospitals require operating rooms to be controlled at 50% relative humidity down to 62°F. This equates to a dew point of 42°F in the space.

Most hospitals operate with chilled water systems and these conditions cannot be achieved using chilled water alone.

Hospitals operate chillers inefficiently, at great operating expense, to produce the coldest possible chilled water while still not achieving the required humidity levels.

The ASCENDANT™ can deliver the low dew point air necessary to below the 50% RH at 62°F while allowing the chiller to operate at its optimum efficiency level, delivering 45°F water.

**CONDENSATE AVOIDANCE:**
**Chilled Beam Installations**

Active or passive chilled beam designs are most energy efficient when system fans are sized to deliver only outdoor ventilation air.

Handling the latent load associated with people and infiltration with the outdoor air volume alone often requires dew points lower than what is achievable with conventional systems.

Space humidity needs to be controlled well below the dew point of the water temperature delivered to the beams to avoid condensation.

ASCENDANT™ can process three times the latent load of a custom refrigeration based DOAS allowing it to prohibit beam condensation using the minimum possible outdoor air quantity.

**DRY AIR STORAGE:**
**Warehouse, Cave Storage**

The desire to handle dehumidification loads with the smallest airflow possible (lower the dew point the better) – fewer systems.

To preserve the products, avoid rust and prevent condensation, the need for cooling and heating of these spaces can be avoided if effective active dehumidification is employed.

Relative humidity is a function of both moisture and temperature. Unheated warehouses, cave storage, etc. result in high RH conditions and potential condensation.

Warm, very dry air delivered by ASCENDANT™ is highly beneficial and can substantially reduce the cost of operating these facilities.

**TIGHT HUMIDITY CONTROL:**
**Archives/Museums/Libraries**

Archives, museums and libraries exist to preserve documents and artifacts for a long as possible and to avoid any “preventable” premature damage.

HVAC systems can significantly impact the life of these objects by consistently maintaining the relative humidity at approximately 50% and avoiding swings over time.

Humidity spikes can accelerate damaging chemical reactions and biological attack.

ASCENDANT™ systems with post cooling can carefully track space conditions and precisely control them to consistent levels due to the high dehumidification capacity and advanced DDC controls.

**DRYING VENTILATION AIR:**
**Hotels/Condominiums**

There is a very high latent load associated with ventilation air and infiltration in hotels and condominiums located in humid climates.

ASCENDANT™ can effectively deliver outdoor air dehumidified to very low dew points allowing the ventilation air alone to control space humidity regardless of the internal sensible load.

By deep drying the ventilation air, the packaged cooling units can be downsized, reducing the size of ductwork, noise produced and energy consumption.

Since the ventilation airflow is provided continuously, ASCENDANT™ continues to provide substantial dehumidification even on cloudy, humid days when the call for space cooling is minimal.
**SEMCO PRODUCTS TO COMPLEMENT THE ASCENDANT™**

**ENERGY RECOVERY TRUE 3Å WHEEL**
- Industry’s highest recovery performance (AHRI Certified) and Recovery Efficiency Ratios (RER)
- Contaminant carry-over to less than .045%
- Anti-corrosion, anti-microbial anti-stick face coatings standard
- Extruded aluminum structural hub, spokes and rim system
- Available singly, in self-contained conditioning units, or as retrofits of existing wheels.

**NEUTON™ CONTROLLED CHILLED BEAM PUMP MODULE**
- Zone level water control for chilled beams
- Proactive condensation control
- Provides load matching with only necessary amount of cooling/heating that the space requires
- Variable speed pump maximizes energy savings
- Allows the beam coil to be dual temperature, maximizing the amount of both cooling and heating a beam can provide

**IQHC ACTIVE CHILLED BEAM**
- Industry best capacity to energy consumption ratio
- Utilizes the lowest air and water pressure to enhance the overall energy benefit of chilled beams
- Universal duct and water connections for easy to installation
- Superior indoor air quality and energy efficiency.

**SEMCO Products Working Together: ASCENDANT, NEUTON, & Chilled Beams**

Outdoor Air to Beams
- 68°F, 42 grains

**ASCENDANT™ DOAS**

**FAN COIL UNIT**

**BEAM LOOP**
- (multiple beams)
- 62°F
- 58°F

**BEAM LOOP**
- (multiple beams)
- 62°F
- 58°F

**BEAM LOOP**
- (multiple beams)
- 62°F
- 58°F

**PRIMARY PUMP**
- 62°F

**BOILER**
- 55°F

* Component not supplied by SEMCO.*
BETTER AIR
PRODUCTS FROM SEMCO

EP/EPD SERIES
- Provides ultimate level of performance in the transfer of energy
- Preconditions air for a conventional air handler or can perform as an independent, integrated system with a variety of heating and cooling options
- Indoor or outdoor installation
- Airflow capacities range from 2,000 to 70,000 CFM

PINNACLE® PRIMARY VENTILATION SYSTEM
- Manages 100% of a building’s ventilation, humidity, and temperature, while simultaneously reducing energy loads
- Dual wheel dedicated outside air system designed to ventilate and deliver air direct to space
- Ideal primary air system utilized to decouple latent load of the building with the least amount of air
- Supports ductwork reduction and central plant energy reduction

FV SERIES
- High recovery efficiency with low pressure loss
- Designed for rooftop installation in but can easily be installed indoors and still provide a very quiet, continuous supply of fresh air
- Provides a healthy, comfortable indoor atmosphere in a cost efficient package
- Airflow capacities range from 600 to 10,000 CFM

eQ SERIES
- Energy savings through efficient component design and operation
- High efficiency energy recovery with the right balance of pressure and effectiveness (RER)
- Robust frame and tight sealing configurable for both indoor and outdoor installation
- Airflow capacities range from 2,500 to 15,000 CFM
SEMCO® is a global leader in air management. We specialize in the design and manufacture of a wide range of air climate and air movement solutions. Our collective experience is unrivaled.

Our constant aim is to provide systems that precisely deliver the best indoor air quality and performance, as well as maximize energy efficiency.

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