

LOW DEW POINT

EFFICIENT & EFFECTIVE

ASCENDANT

CONVENTIONAL COOLING, ACTIVE
DESICCANT DEHUMIDIFICATION SYSTEM



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.



INDOOR AIR QUALITY
Category

HVAC systems have a major impact on:

- Infection control
- Hazard control
- Internal climate control
- Building energy consumption

Ascendant solution includes:

- Active desiccant hybrid system
- High efficiency systems
- An improvement to the building's conventional HVAC System operation and energy consumption

Specific Healthcare Demands

Healthcare facilities need more than just heating and ventilation. FläktGroup 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).

THE ASCENDANT SERIES FROM FLÄKTGROUP® SEMCO®

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.

Ascendant easily allows a design consultant compliance with ALL ASHRAE/AIA guideline conditions while using far less energy than conventional approaches that do not achieve a hospital’s required low space dew point requirements.

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 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

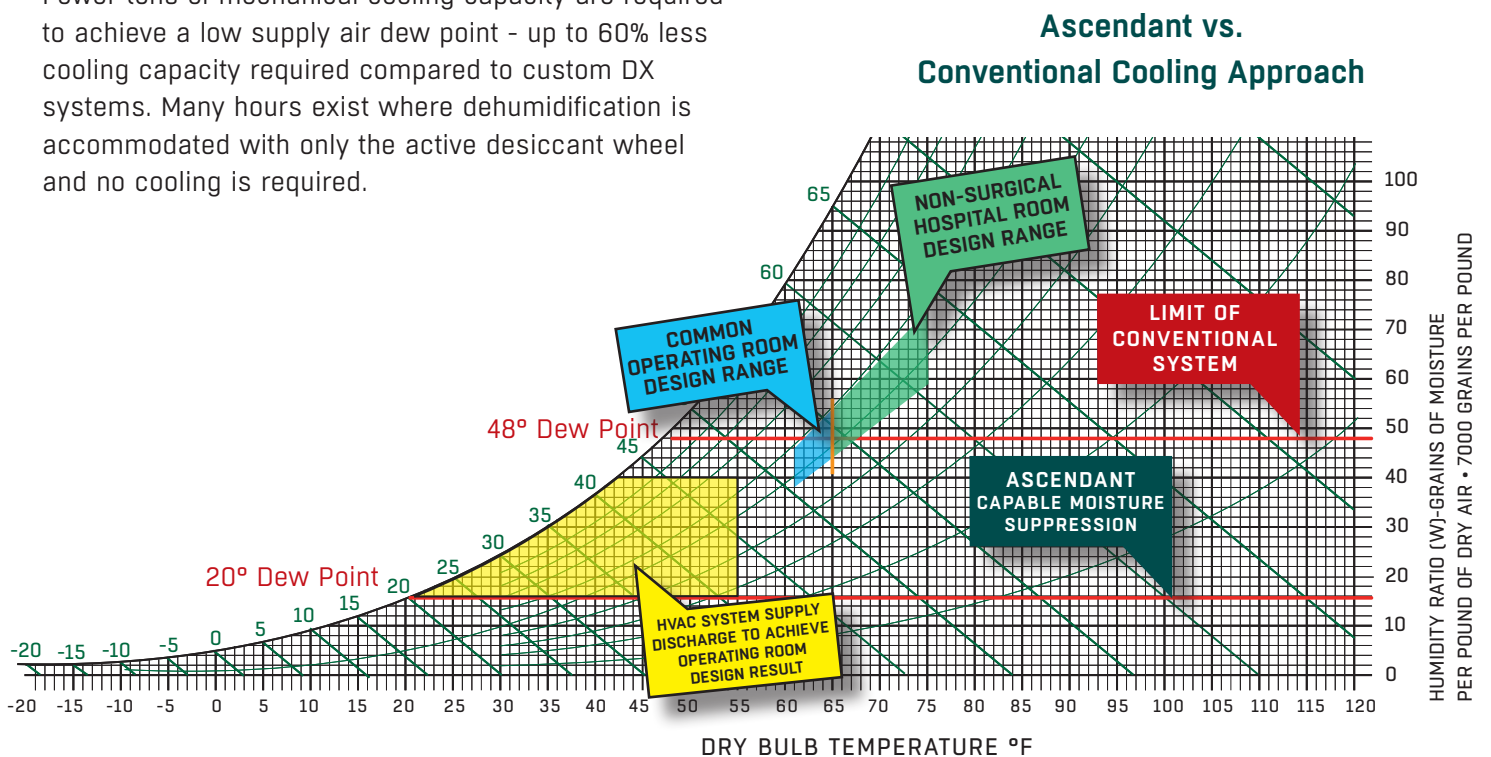
Ascendant operates with 25% to 50% less energy cost than other conventional dehumidification systems as a result of improved cooling efficiency (higher suction temperatures) and by shifting much of the latent load from electrically driven vapor compression over to lower cost regeneration energy.

ASCENDANT IS DESIGNED TO:

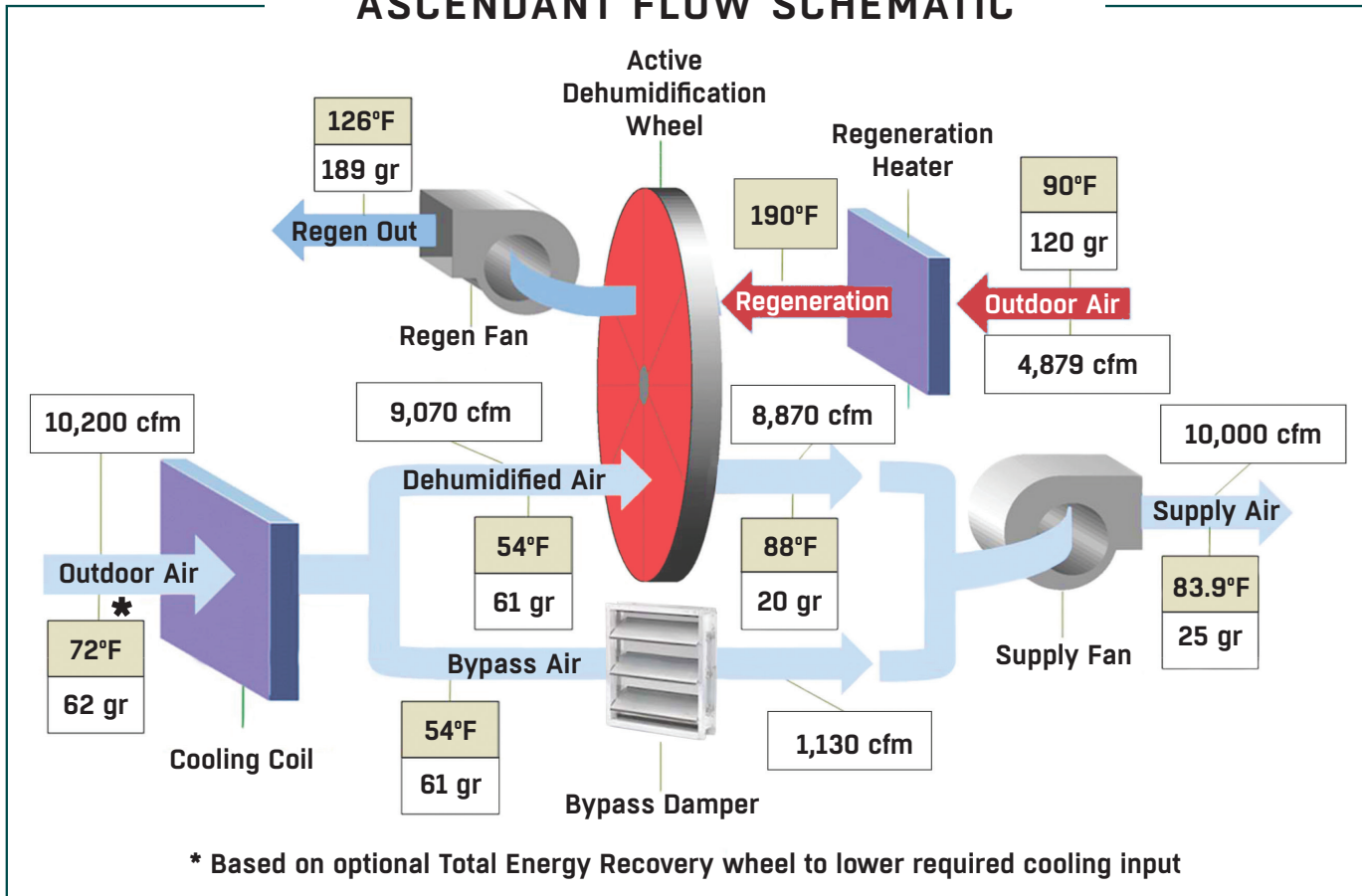
- Offer substantial energy and first cost savings
- Ensure hospitals are able to operate continuously around the clock
- Improve hygiene by ensuring that the ASHRAE required final filters remain dry

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.

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



ASCENDANT FLOW SCHEMATIC



HOW IT WORKS:

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 FläktGroup Semco total energy recovery is highly recommended since it substantially increases overall system energy efficiency and substantially reduces pre-cooling input requirements. It also provides valuable winter season preheat and humidification.

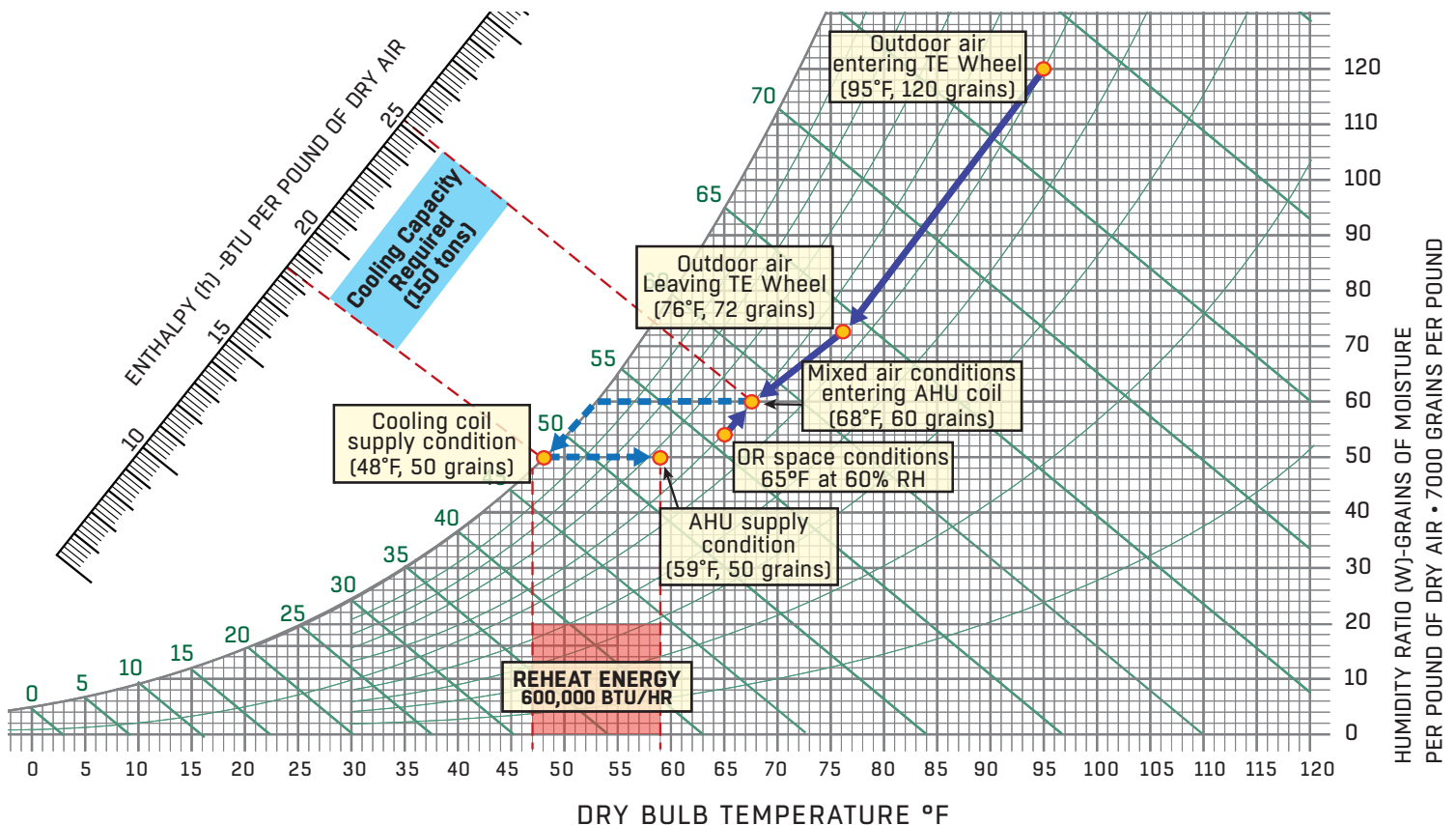
Operating Theater Design Analysis: Conventional vs. Ascendant

Example: Fifteen operating rooms designed in accordance with FGI/AIA/ASHRAE guidelines requiring 3,333 cfm each using 20% outdoor air

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.

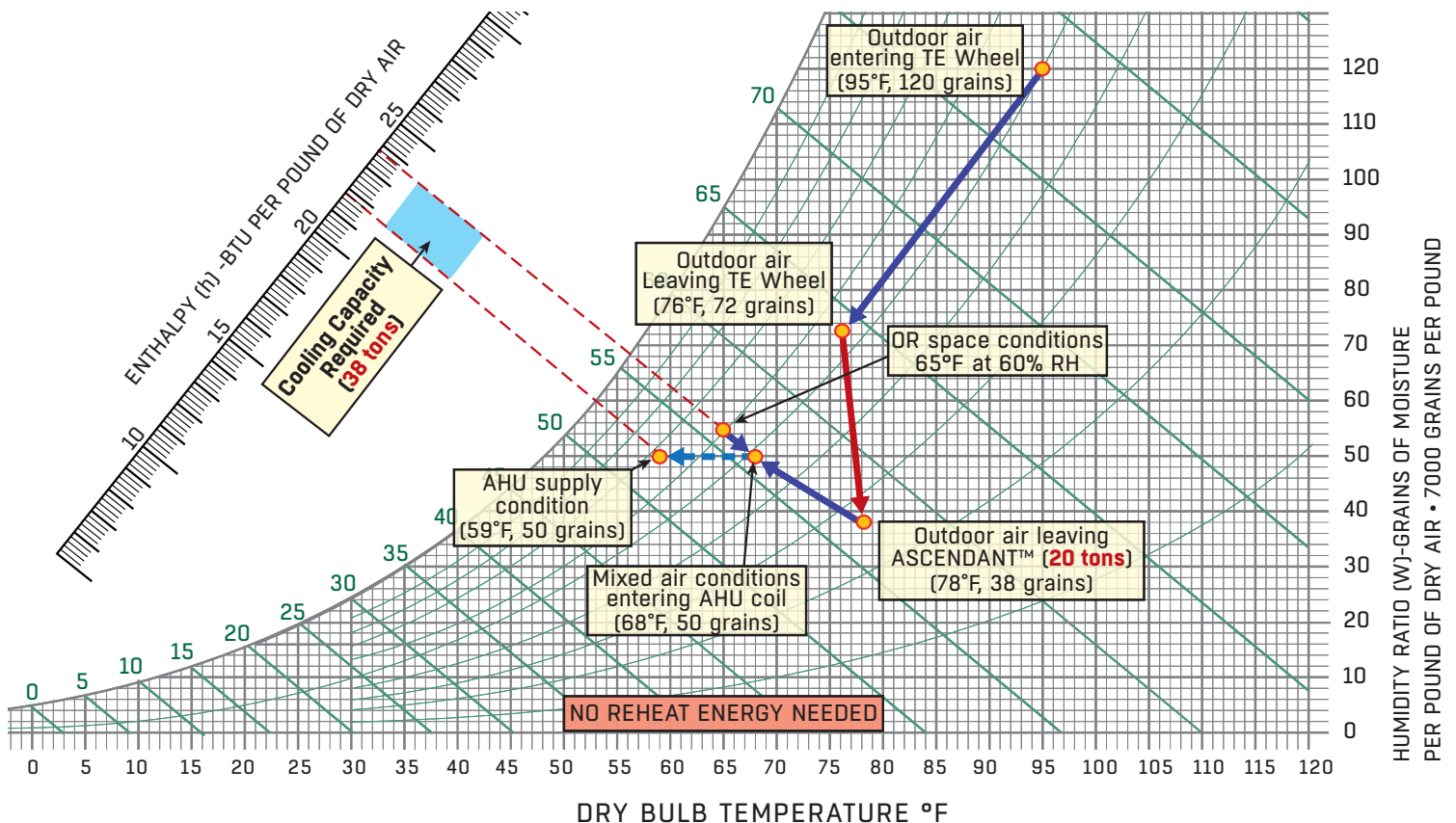
Conventional Approach: Requires 150 Tons, 600K BTU Reheat



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

	Case 1: Conventional	Case 2: Ascendant Preconditioning
Outdoor Air Preconditioning		
Airflow provided (for ten ORs)	10,000 cfm	10,000 cfm
Pretreatment used	Total energy recovery	Total recovery, pre-cooling, active dehumidification
Cooling capacity required (at peak)	None required	20 tons ⁽¹⁾
Regeneration capacity required (at peak)	None required	352,000 btu/hr
Supply Air to Operating Rooms		
Airflow provided (for ten ORs)	50,000 cfm	50,000 cfm
Outdoor air percentage	20%	20%
Cooling capacity required	150 tons ⁽²⁾	38 tons ⁽¹⁾
Chilled water temperature required	40°F	45°F
Reheat energy required	594,000 btu/hr	None required
Total System Summary		
Cooling capacity required	150 tons ⁽²⁾	58 tons ⁽¹⁾
Reheat/regeneration energy required	594,000 btu/hr	352,000 btu/hr (peak, less at part load)
Total fan HP estimate	59 BHP	62 BHP
Dehumidification season cooling electrical cost ⁽³⁾ (\$/.08/KWH)	\$32,312	\$11,190
Dehumidification season heat (\$10 MMBTU)	\$21,408	\$12,900
Total Operating Energy Cost Estimate (Dehumidification season)	\$53,720	\$24,090
⁽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) than 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.

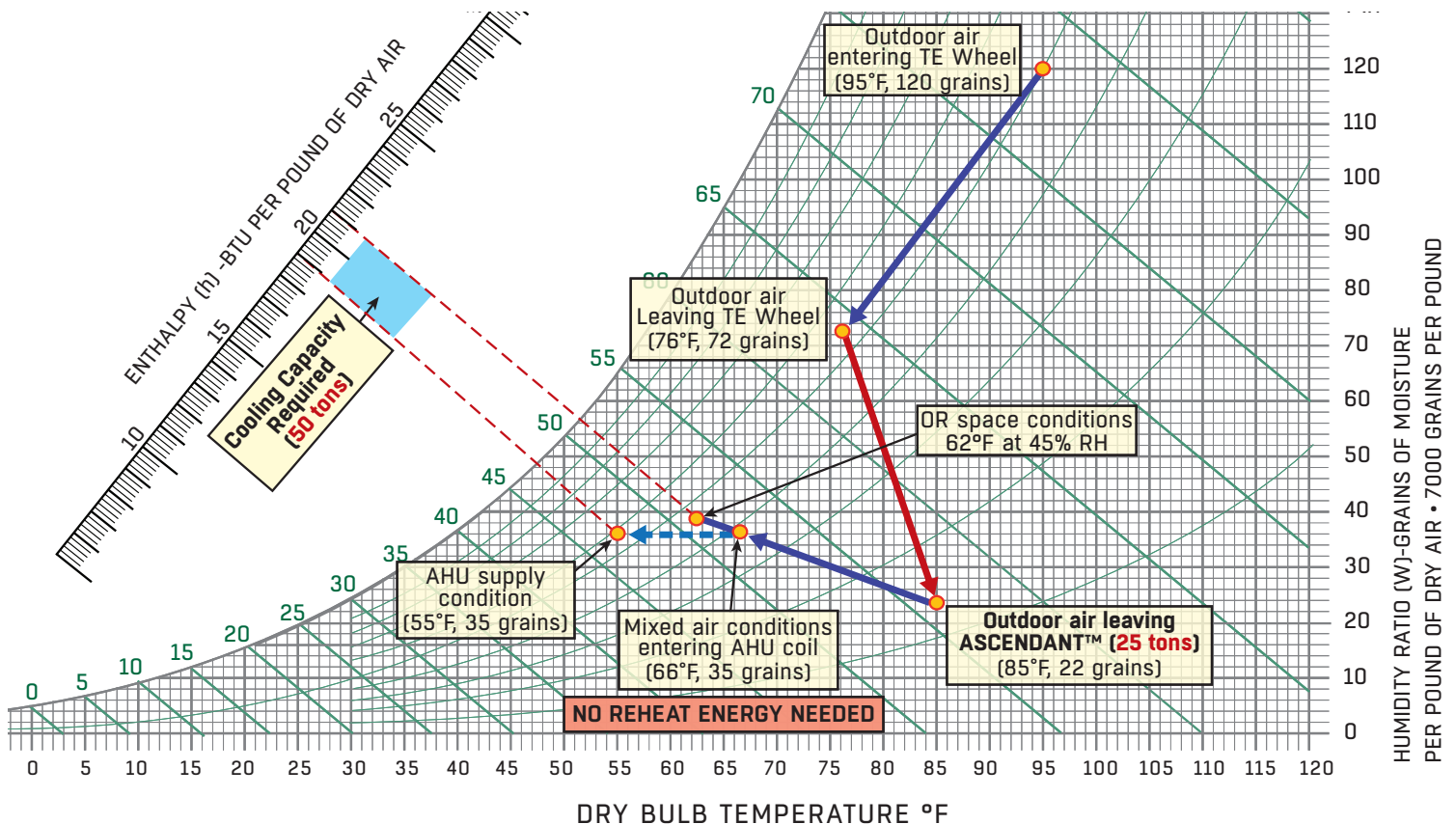
Case 3: Ascendant Exceeds AIA guidelines at the Desired Space Temperatures

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

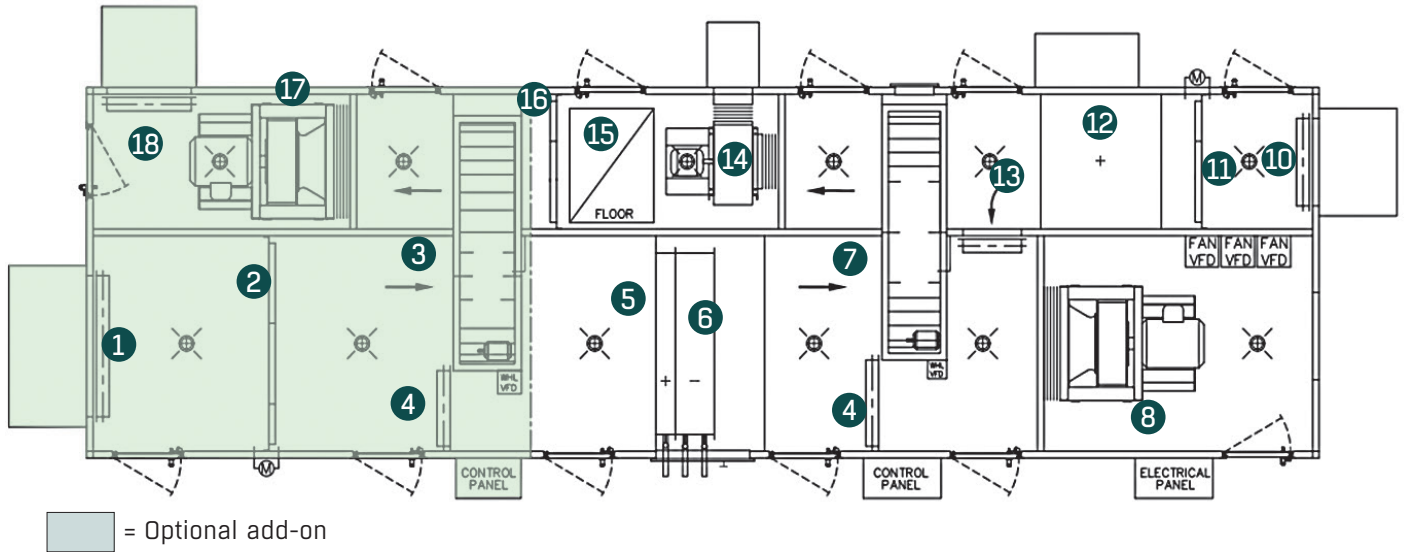
latent loads are often missed during the design process which is problematic since they are significantly greater than those associated with the occupants.

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.



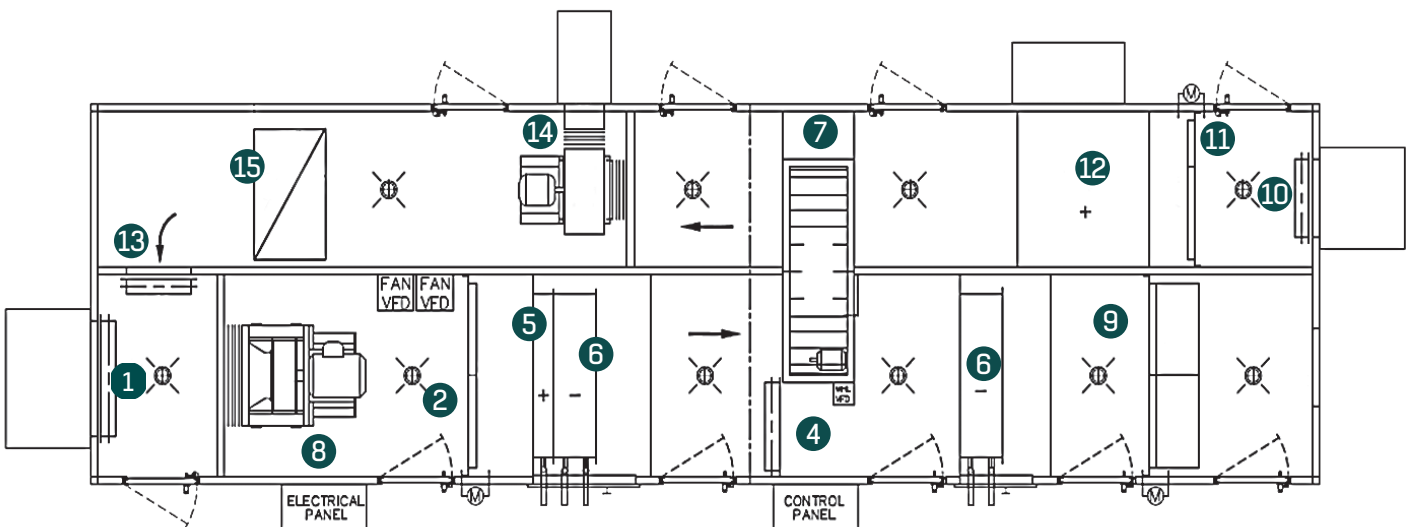
DEDICATED OUTSIDE AIR SYSTEM WITH OPTIONAL INTEGRATED TOTAL RECOVERY

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

- 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

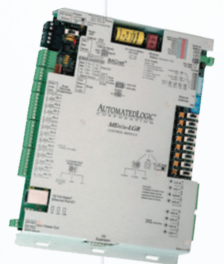
- Recirculation damper to allow regeneration heat source to be used for supply air during winter operation
- Post-cooling coil if cooler supply air is required
- Process Heating
- MERV 11-14, HEPA, and ULPA high efficiency final filters on supply side
- Return fan for partial outdoor air systems
- Total 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



UNIT SIZES AND DIMENSIONS

Unit Size	Airflow CFM Range	Unit Height	Unit Width	Make up Air Unit Length	Dedicated Outside Air System with True 3Å Wheel Unit Length	Total Conditioner Unit Length
005	2,720 - 5,500	62"	102.25"	259"	364.5"	351"
009	3,740 - 8,500	74"	114.25"	259"	380.5"	358.75"
013	6,130 - 10,500	88"	114.25"	263"	402.25"	360.75"
018	7,600 - 15,000	100"	138.25"	274.25"	420"	368.75"
024	9,600 - 20,000	112"	150.25"	297.75"	462.5"	387.5"

ASCENDANT APPLICATIONS



Ascendant 5

APPLICATION REFERENCES

Odessa Medical Center	Health Care	Ascendant 13	DOAS	Lubbock, TX
Laughlin Memorial	Health Care	Ascendant 5	Total Conditioning.	Knoxville, TN
Zeledyne	Industrial Mfg.	Ascendant 9	DOAS	Nashville, TN
Carlex	Industrial Mfg	Ascendant 9	DOAS	Nashville, TN
Red Star Yeast.	Food Processing	Ascendant 9	DOAS	Clive, IA
Hilmar Cheese.	Food Processing	Ascendant 9	Total Conditioning.	Lubbock, TX



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 fourth 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.

DELIVERING AIR DEHUMIDIFIED OVER A WIDE RANGE TO HANDLE FLUCTUATIONS IN LATENT LOADS.

A VARIETY OF APPLICATIONS

Ascendant is ideal for hospital operating rooms and much more! Delivering extremely dry outdoor air to manage the heavy infiltration load in hot/humid locations, Ascendant improves comfort while extending the life of furnishings and greatly reducing the risk of mold and mildew.

Dry air storage: Warehouse, Cave Storage

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

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

Warm, very dry air delivered by Ascendant can substantially reduce your operation costs.

Tight Humidity Control: Archives, Museums, Libraries

Archives, museums and libraries exist to preserve documents and artifacts avoiding any preventable, premature damage.

Ascendant can significantly extend the life of the items you are trying to preserve by consistently maintaining the RH at approximately 50% 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 at 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 provides substantial dehumidification even on cloudy, humid days when the call for space cooling is minimal.

Low Dew Point Spaces: Food Processing, Manufacturing

To minimize moisture and condensation in production areas, Ascendant provides an efficient solution. Unwanted moisture can make equipment under-perform, create hygiene concerns, and violate USDA codes, costing you money.

Ascendant will give you peace of mind that your product will be protected in every step of its journey from production to storage, improving product quality and reducing waste.

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.

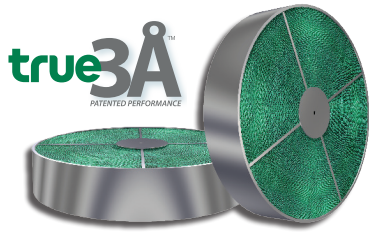
Space humidity needs to be controlled well below the dew point of the water temperature delivered to the beams to avoid condensation.

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.

FLÄKTGROUP® SEMCO® PRODUCTS TO COMPLEMENT THE ASCENDANT

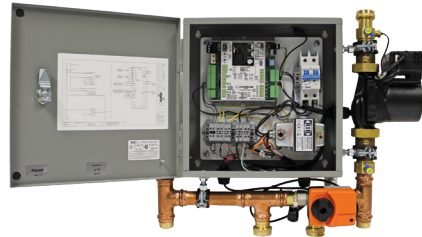


Use of the AHRI Certified™ mark indicates a manufacturer's participation in the certification program. For verification of certification for individual products, go to www.ahrinet.org.



TRUE 3Å ENERGY RECOVERY 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

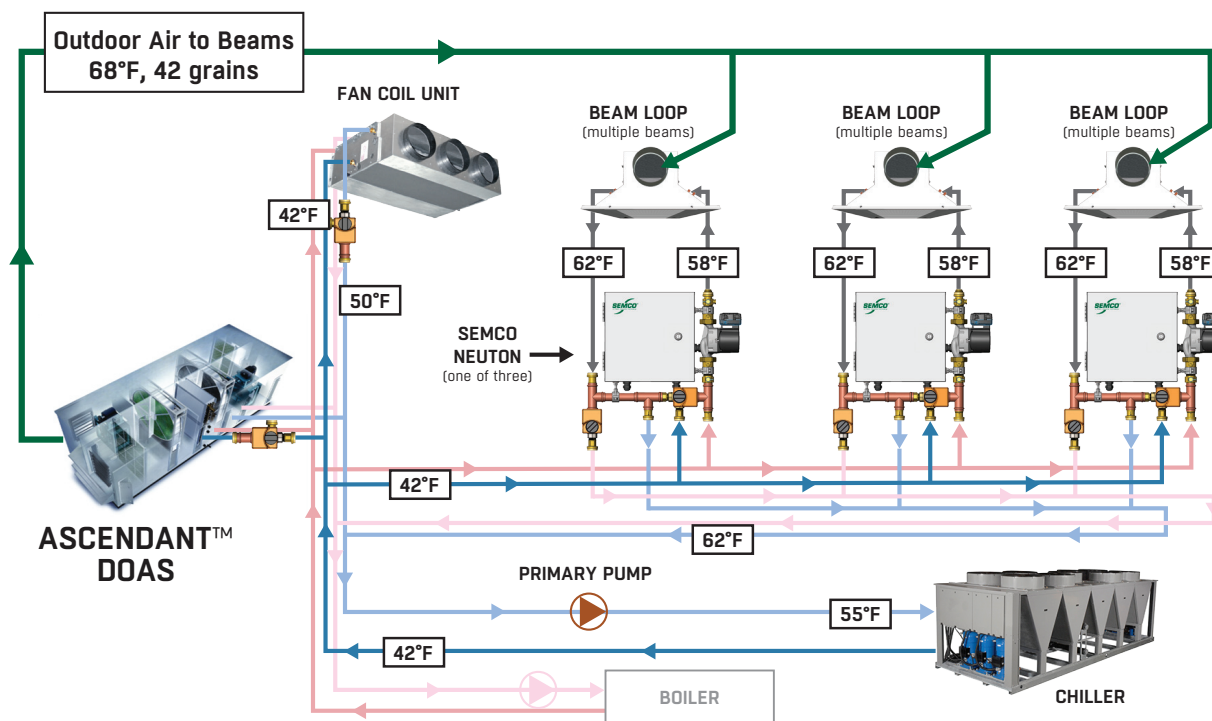
- Zone level water control for chilled beams
- Proactive condensation control
- Provides load matching with only necessary amount of cooling/heating that the space requires
- Variable speed pump maximizes energy savings
- Allows the beam coil to be dual temperature, maximizing the amount of both cooling 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.

Working Together for Maximum Efficiency: Ascendant, NEUTON, & Chilled Beams



* Component not supplied by FläktGroup Semco.

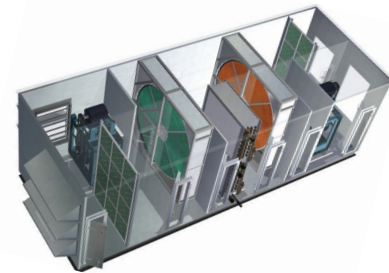
EXCELLENCE IN SOLUTIONS

PRODUCTS FROM FLÄKTGROUP® 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



EXCELLENCE IN SOLUTIONS

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FläktGroup[®] SEMCO[®] delivers smart and energy efficient Indoor Air and Critical Air solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than fifty years of accumulated industry experience. The widest product range in the market, and strong market presence in 65 countries worldwide, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

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