2010 CA Higher Education Sustainability Conference

Energy Efficiency Partnership Program
Best Practice Awards Application

Project Category

New Construction: HVAC Design / Retrofit

THE VISION TO CHANGE.
THE INTEGRITY TO SUSTAIN.

Cal Poly San Luis Obispo
Student Recreation Center Expansion & Remodel

Rendering Used Courtesy of Cannon Design

I. Contact Information

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II. Project Category

New Construction: HVAC Design / Retrofit

III. Project / Practice Information

Project Name: Student Recreation Expansion and Remodel
Project Location: Cal Poly San Luis Obispo
Architect: Cannon Design
MEP Engineers: P2S Engineering
Implementation Cost: $790,000 (MEPT)
Estimated annual energy savings (as applicable):
452,000 kWh total (160,000 kWh HVAC)
Estimated annual energy cost savings
$44,296 ($0.098 /kWh) electrical savings and
$20,790 ($0.77/therm) gas savings

III. Project Information (continued)

Description- Provide a detailed narrative describing the project or practice.

The Student Recreation Expansion and Remodel was voted upon and funded by the Cal Poly San Luis Obispo student fee initiative. A student referendum mandated that the building be LEED certified. The project entails a renovation of the existing Student Recreation Center (65,000 GSF) and an expansion of the recreation center by over 95,000 GSF. The building houses the main gym, a new recreational gym, a multipurpose gym, racquetball courts, cardio and weight rooms, multipurpose room, administration areas, renovations around the existing lap pool, a new leisure pool, and an open grass area for outdoor activities. The project design and construction has been through the CSU Construction Manager Services (CM) at Risk Program.

In general, recreation centers require a higher amount of air changes per hour in order to keep occupants comfortable within a building. However, energy efficiency was very important to the students and user groups. Due to the moderate climates with a drier outside air wet bulb summer condition in Cal Poly San Luis Obispo, 2- stage indirect/direct evaporative cooling HVAC systems were utilized for the project. Design day conditions were taken from ASHRAE climatic data, summer conditions as 87°F DB/64°F and winter conditions as 30°F.

There are ten air handlers that utilized variable air volume (VAV) in its air distribution, with VAV reheat supplied from the campus heating hot water central plant system. To optimize indoor air quality, these units provide 100% outside air into the building during occupied hours. Two of the ten air handlers implemented a direct expansion (DX) heat pipe heat recovery feature which helps pre-heat the outside air before it enters the building and also provides added dewpoint control before the air leaves the air handling unit. These air handlers were chosen because they service areas in which the most concentrated load of people are contained (people/sf). The other eight air handlers have a return air recirculation path to help pre-heat air during winter conditions before occupancy. These eight air handling units also have 50% bypass. When OSA conditions are ideal, 50% of airflow can bypass the 2-stage evaporative system, thus reducing parasitic losses in fan energy. All of the air handling units are also connected to the campus chilled water system. The chilled water coil assists with dehumidification along with trimming down supply air dry bulb when outside air conditions are higher than expected.

Solar thermal pool heating has also bee designed into the building. A heat exchanger connected to the campus central heat hot water system will provide back-up heating for the pools when solar heating output is not at its optimum performance.

The renovated building's energy performance is 24.7% better than Title 24 baseline requirements, highly due to large savings in the HVAC system and energy efficient building envelope. This provides 5 points under the LEED Energy and Atmosphere category, Credit 1. The expansion and renovation project meets the LEED V2.2 Silver certification requirements. Over $200,000 in energy efficiency incentive money is being awarded to Cal Poly San Luis Obispo thru the CSU Partnership program from PG &E.

Project Information

Relevancy to the Best Practices program- Describe the features of the project/practice that qualify it as a best practice of potential interest to other campuses (eg. replicability).

One of the main benefits of a 2-stage indirect/direct evaporative cooling design it the utilization of a moderate climate with drier OSA conditions. It also consumes less energy than a standard chilled water system. Studies have proven that refrigeration ton hours are reduced by over 50% utilizing a 2-stage evaporative cooling system over a standard 25% economizer system with climates comparable to Cal Poly San Luis Obispo (ASHRAE 2007Applications, Chapter 51, and Figure 9). Another benefit is that indoor air quality is improved by utilizing 100% outdoor air during cooling, and increased ventilation in the winter with the heat pipe heat recovery technology. The peak building electrical and gas heating demand requirement are reduced, especially for applications that required higher amounts of outdoor air, such as a student recreations center. The main media for cooling is water and the indirect/direct evaporative cooling design consumes 25% less water than a standard central plant cooling tower. The VAV turndown of fans during cooler ambient conditions decrease fan parasitic energy losses because of the 50% bypass within most of the air handlers. VAV turndown also increases the indirect evaporative cooling effectiveness (IEE) of the heat pipe and the direct evaporative cooling. In cooler weather, resetting supply air down to 50°F and using only the direct evaporative cooler extends free cooling hours and reduced fan energy.

Design integration- If appropriate, describe the ways in which this project/practice incorporated multiple disciplines and/or stakeholders into the design process. Describe how collaboration produced sustainable solutions or improved the project's performance.

In order to be awarded the design of the project, the design team was interviewed by user groups from Cal Poly Recreation Departments, Facilities, and most importantly by the Cal Poly student government representing the students. At the time of the interview, the one of the largest areas of concern was "Green Design" implementation, a high priority of the students.

P2S Engineering and Cannon Design worked closely together to ensure the envelope of the new building and the renovation of the existing building helped down size the HVAC system. The roof R-value is R-35 and Solarban 60 Low E glass was used for the windows. A high efficiency lighting system with daylighting/dimming controls also reduced internal heat gain and subsequent cooling requirements. Also, in cooperation with the air handler manufacturer, Munters Des Champs, the air handler control system was replaced with the campus standard compliant control system. This will assist Cal Poly maintenance engineers to maintain, monitor, and control the HVAC system campwide.

The students and user groups were heavily involved in design review meetings and review of construction documents from the schematic design phase through the final construction documents. The CSU Mechanical Systems Reviewer (MSR) and the commissioning agent were also involved throughout each phase of design. Since it will be a LEED Silver certified building, the commissioning agent worked hand in hand with P2S Engineering to ensure the desired energy efficient design approach is implemented into the sequence of operations. This ensures that the system will operate efficiently and can be commissioned once construction is completed.

The air handler design approach and technology was presented to the entire Cal Poly team. Interaction between Facilities and P2S Engineering was valuable in completing the life cycle cost analysis and understanding the type of maintenance this air handler technology requires. The

Project Information

life cycle cost analysis relfects a payback of less than 10 years. During design development, P2S Engineering and Cal Poly Facilities made a trip to the CSU Sonoma State Student Recreation Center where this air handler technology was also implemented. On this trip, they were able to view the units and ask valuable questions to the CSU Sonoma State personnel.

Currently, a Cal Poly San Luis Obispo senior level architectural class and ASHRAE student club are assisting with the LEED documentation completion and assisting the commissioning agent respectively. Our LEED consultant is assisting with directing the senior architectural group with all the components of LEED as related to this project. Their first task is to develop a program or framework to connect student design teams and volunteers with the LEED process on both new construction and existing buildings. With this, they will determine how the student design team can be of assistance. Individual students of student teams will work with consultants and contractors as either volunteers or paid interns, as club or class projects, for academic credit. This is intended to be an ongoing program for any and all future projects on campus. Our commissioning agent will also work with the ASHRAE club to create a commissioning training session for the students, as related to this project. The students will be offered as a resource for our team to use the University's and design team's discretion. Everyone is eager and optimistic to make this relationship work for this and future projects as a benefit to the students.

Load management- If appropriate, describe how the project/practice provides on-peak electricity demand reduction, or demand response capability.

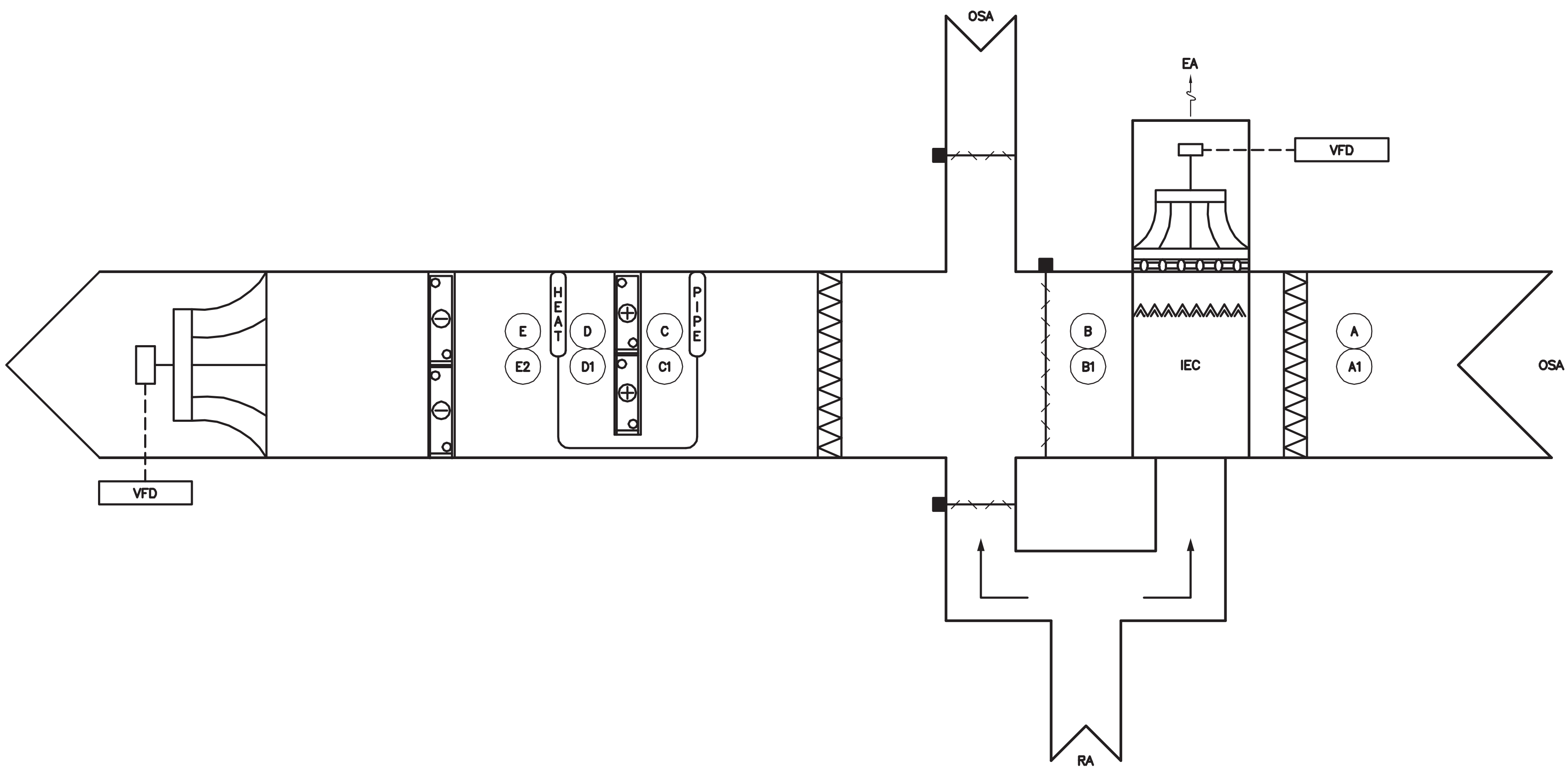
The total peak tonnage required for the new student recreation building is 380 tons. Approximately 50 tons of supplemental cooling will be provided by the Cal Poly central plant chilled water system. This will occur less than 20% of the year, when the outside air conditions are higher than design dry bulb and/or wet bulb. Therefore, approximately 85% of peak demand load has been saved with the 2-stage indirect/direct evaporative cooling technology. Unlike other buildings, during peak electrical demands when HVAC systems operate at peak conditions, this building will consume fractional amount of electricity to support its HVAC system peak demands.

Best Overall Sustainable Design; HVAC Design; HVAC Retrofit; Lighting Design/ Retrofit; and Water Efficiency/ Site Water Quality, if applicable: Please describe how the project/practice has been received by building occupants. Describe what has been met with satisfaction or dissatisfaction, and why.

The entire project has been widely received by the Cal Poly user groups, the Facilities, and most importantly, by the students whose own student initiative funded the project and feedback drove the design of the buildings to be environmentally friendly. Because of the collaborative efforts between all parties, including the design team and the general contractor, the project design process has been beneficial to all parties.

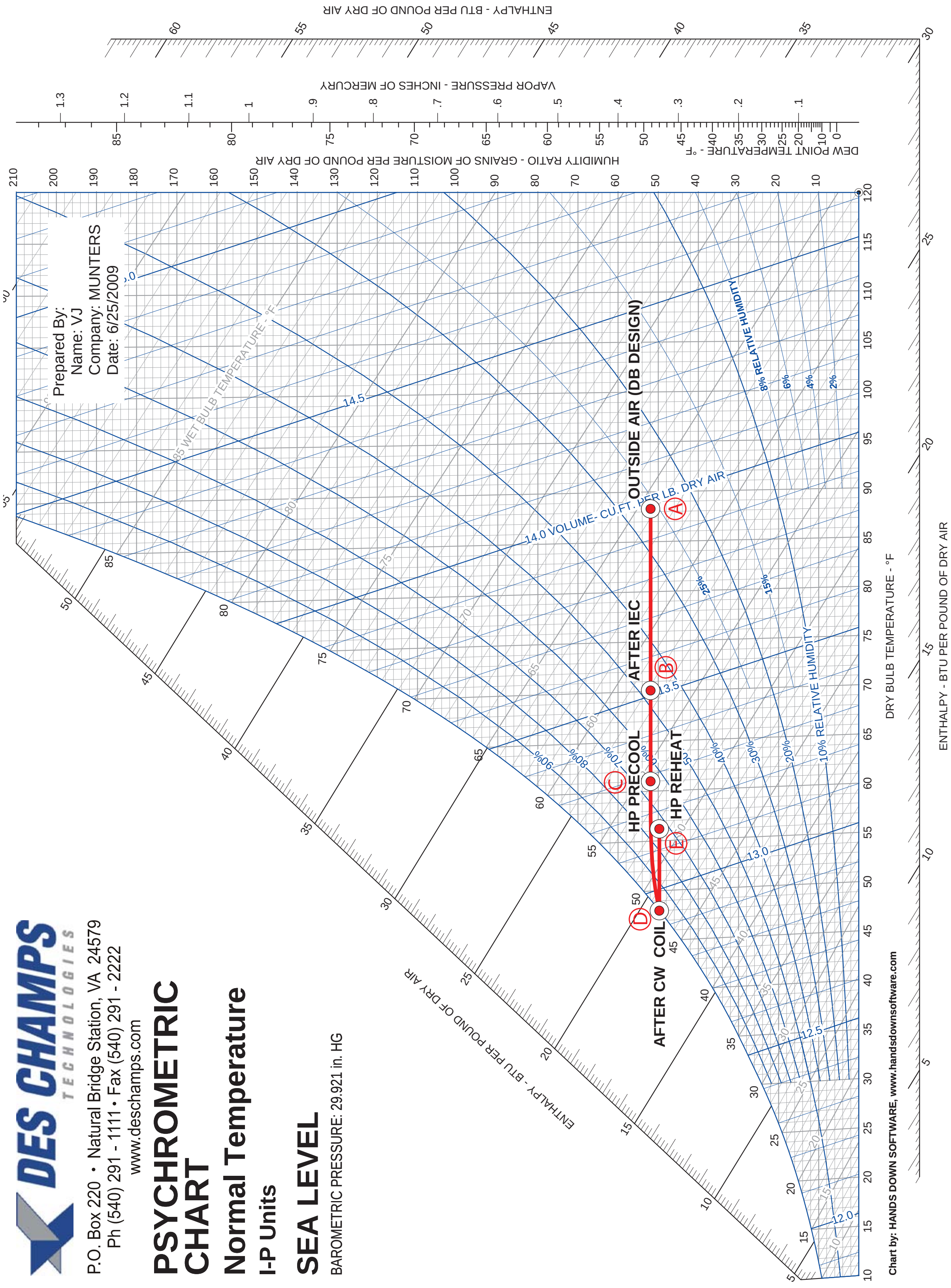
Please provide any additional information necessary to assist the selection team in understanding and evaluating the project. Supplemental information in the form of photos, drawings, etc. may be submitted.

We have submitted building renderings, the control schematic for the air handler servicing the largest amount of people per square foot, and psychometric charts to view operation of the air handler in each function of the air handler compartment.



CONTROL SCHEMATIC FOR AHU-10

Project Information



AHU-10 Design Day

Project Information

DES CHAMPS TECHNOLOGIES

P.O. Box 220 • Natural Bridge Station, VA 24579
Ph (540) 291 - 1111 • Fax (540) 291 - 2222
www.deschamps.com

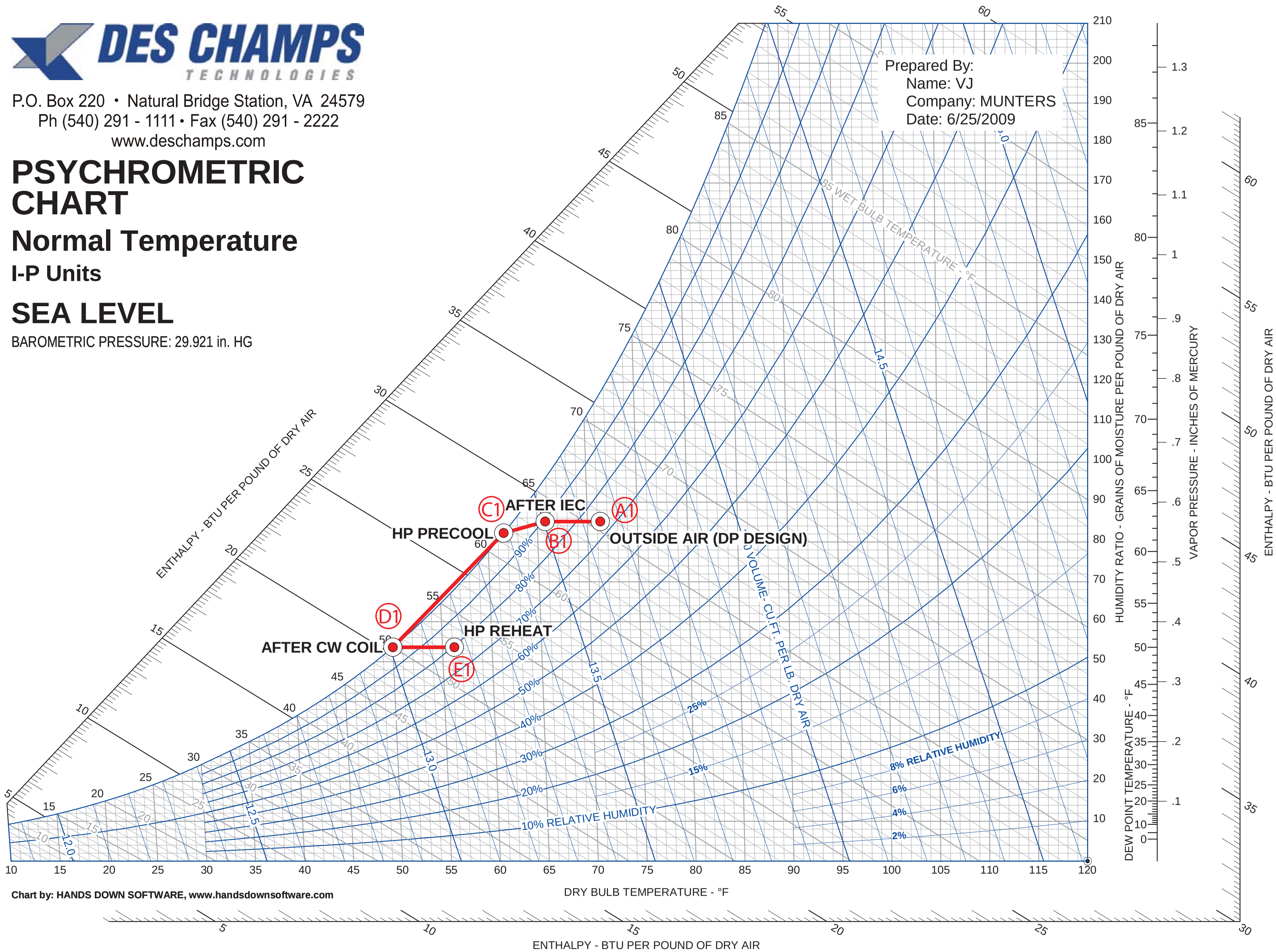
PSYCHROMETRIC CHART

Normal Temperature

I-P Units

SEA LEVEL

BAROMETRIC PRESSURE: 29.921 in. HG



AHU-10 Higher WB / Lower DB