ClimateWorx Turns Theory Into Practice, Proving New Idea In Data Center Design

ClimateWorx devised a method of installing their EC plenum fan below the level of the raised floor in a data center, as a means of liberating more of the potential of the plenum fan to generate static pressure. (**See Figure 1)**

The plenum fan generates static pressure, as opposed to the conventional forward curved fan, which generates directional, velocity pressure. The Plenum fan allows the raised floor to be pressurized in a uniform manner greatly improving the ability to cool equipment regardless of the location of the equipment to the proximity of the air conditioning unit. (**See Figure 2 below)**

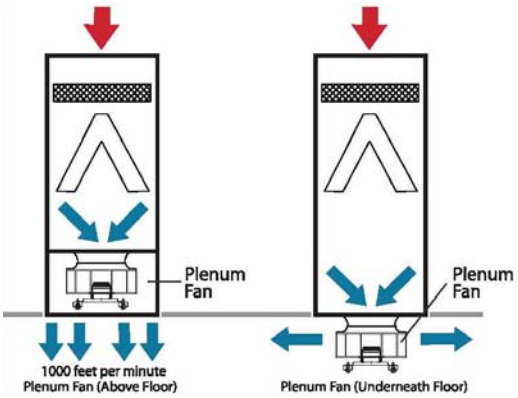


Figure 1

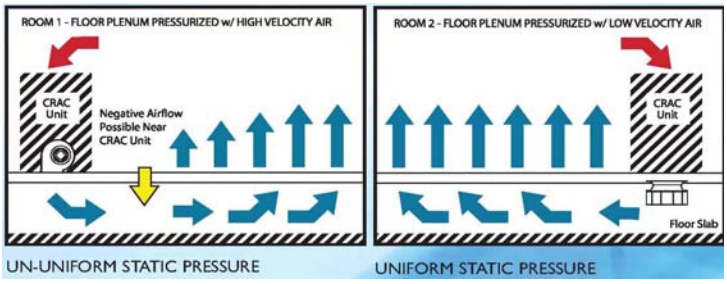


Figure 2

ClimateWorx first introduced the use of plenum fans with their M-Series product in 2003, as a means of competing in the European market place. The benefit of this fan was recognized by North American clients and resulted in the success of the M-Series product growth over the years. ClimateWorx's continuous improvement initiatives, extensive testing on motorized impellers and EC motors and the 'Works in a Drawer" concept of fan application, culminated in a design idea in 2006. The fan would ship in the upper position, slide out as an assembly and have the base of the unit converted to reinstall and drop into the floor below the unit. This idea met with favorable review by a team of professionals who were investigating new concepts for data center cooling, for a leading financial institution in North Carolina. ClimateWorx was successful in procuring the order. The initial design team for this institution consisted of consulting engineers, contractors, and a VP of facilities for the financial institution. Several of the design team members visited the ClimateWorx factory in early 2007 to witness the use of the plenum fan and the unique concept was then adopted for the project. ClimateWorx was given an opportunity to measure the results of the fan performance at that site.

Plenum Fan Position Verification Report:

A test was conducted to measure the power consumption with the fans :

1. In the raised up position, (normal CRAC unit configuration)

2. In the lower position under the raised floor and the CRAC Unit

The fan speed was adjusted to maintain the same pressurization and air flow, as a means of equalizing the results. ClimateWorx measured a savings in power to deliver the same amount of air, at the same static pressure, of just over 20% with the fans in the lower position. The EC fans were initially installed in the raised up position. **(See 1 Above)** The two CRAC units were allowed to operate normally with the EC fan speed under the control of the Building Management System (BMS), to maintain a constant static pressure on the 30 inch high, raised floor. There were three pressure transducers measuring the static pressure at three different locations around the room and the fan speed was modulated based on the average of these three sensor readings.

After allowing the floor to stabilize, the return air was measured on the two units and air flow was measured at several perforated tiles around the room. The air flow was measured by the local air balancing company, who recorded a total of 33,325 CFM. The average static pressure on the floor was 0.011" w.c. and the fans were operating at 94% of their maximum fan speed. The technician performing the tests reported that he had never seen such even readings of supply air from floor tiles. All tiles were at 400 CFM.

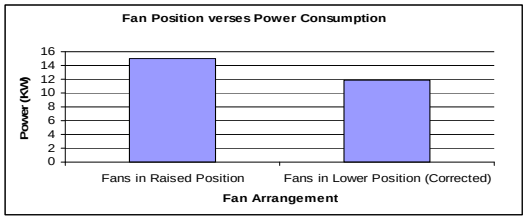
A power meter was then used to record the kilowatt consumption of each of the two units. The sum was 15 kW.

The two units were shut down and the fans were lowered into the raised floor. The change required less than three hours for two units. See photo below.

With the fans in the lower position, the BMS was allowed once again to bring the floor to an average static pressure of 0.011" w.c.. After a period of stabilization, the return air was measured at each unit and several supply air measurements were taken on perforated tiles. The air flow was recorded at a total of 33,112 CFM. The average static pressure on the floor was 0.010" w.c. and the fan speed with the fans in the lower position, dropped to 88% of their maximum.

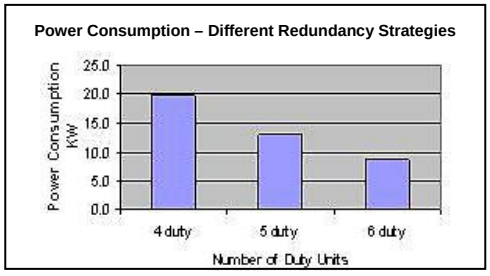
The power consumption was recorded for both units. The sum was 11.63 kW.

The combined air flow in the raised position was within 213 CFM of the airflow in the lower position. Correcting for the slight variance of airflow increased the consumption to 11.86 kW. The combined consumption saving was 20.9% with the fans in the lower position. (**See graph to the right)**.



Redundant Unit Control Strategy Energy Consumption (Warm Back-up):

The data center utilized N+2 redundancy and tests were conducted to identify if any energy savings were possible by changing the strategy for operating the back-up units. Three tests were conducted. The first test identified the consumption of the four duty units operating and the two back-up units off. This is a standard practice in data center operation.



The second test had five units operate at reduced speeds and the sixth unit off. The third test had all six units operating at reduced speeds. Once again the BMS was used to maintain a constant static pressure in the raised floor. With full air flow operating, the static pressure set point was 0.03" w.c..

The combined consumption of the four units operating to maintain 0.03" w.c. on the raised floor was 20 kW. The combined consumption of five units to maintain 0.03" w.c. on the raised floor was 13 kW.

The combined consumption of six units to maintain 0.03" w.c. on the raised floor was 9 kW. **(See Graph above left).**

Conclusion:

Based on the data from both tests, the design team's idea, along with ClimateWorx's design and application of the plenum fan below the computer room air conditioning unit, resulted in a **20.9% energy saving** to the financial institution. Warm Back-up strategy had a **56% energy saving**.