

Case Study

HMX-PCU-F economically provides 100% fresh cool air to a world class snack manufacturing company

Background

This is a case study of 100% fresh air conditioning for a world class snack food manufacturing plant located in North India. This is one of the four state-of-the-art plants owned by a leading company that is engaged in the manufacturing of food and food ingredients for local as well as international markets.

Challenges

To guarantee product freshness and crispness, the 4,000 ft² manufacturing facility of this company needs a temperature of 28±2°C with 50-55% RH to be maintained at all times. Also, it is absolutely necessary to induct 100% fresh air at all times to dissipate the fumes and odour generated during the process. To do this, an initial heat load calculation showed that the total air volume required was around 14,000 CFM with a cooling capacity of 88 TR. The company management decided to look at various available options for pre-cooling of fresh air to reduce the operating expense.

Solution

After evaluating various available treated/pre-cooling fresh air technologies such as heat wheels, energy recovery ventilators, heat recovery ventilators, heat pipes, etc, a decision was made in favour of the HMX-PCU-F as it appeared to be the most efficient solution.

The HMX-PCU-F is an excellent way to supply cooled fresh air to improve indoor air quality while simultaneously reducing tonnage of an installed air conditioning system. PCU-F uses HMX's patented heat exchanger DAMA (Dry Air Moist Air) to pre-cool the fresh air being supplied to air conditioned spaces or air handling units. DAMA works on the principle of Indirect Evaporative Cooling (IEC) for sensible cooling of the primary air using water and a secondary stream of fresh air. This in turn reduces the tonnage (TR) requirement for a project, and saves a large amount of energy that is otherwise required to condition the ambient air. The primary air is cooled without adding moisture to it and in the process the dry bulb temperature and the enthalpy of the fresh air are reduced substantially.

The PCU-F may be equipped with a refrigerant-based DX (direct expansion) or CHW (chilled water) coil for cooling and dehumidification. As the HMX-PCU-F primarily works on the principle of indirect evaporative cooling (IEC), it eliminates the need for a complicated return air system. Here the air is passed only once through the conditioned space due to which there is zero contamination. Positive pressure is maintained inside the room and hence a separate exhaust system is also not required. Apart from using energy efficient IEC technology for pre-cooling fresh air, the HMX-PCU-F uses Variable Frequency Drives (VFD) in the supply air fan, further saving energy.

Convinced with the PCU-F's fit to this application, the company decided to go in for 3 x 8,000 CFM HMX-PCU-F with a 24 TR refrigerant based direct expansion (DX) coil in-built in every unit. The DX coil performs the task of cooling and dehumidifying the fresh air to the desired conditions after it has been sensibly pre-cooled by DAMA. Another distinct highlight of this project was the use of fabric ducting which not only simplified the installation and maintenance, but also improved the aesthetics of the facility.



Result

The management is quite happy with the results. The HMX-PCU-F has helped to maintain the desired temperature and RH conditions at the manufacturing plant leading to improved efficiency.

During summer when the wet bulb depression (WBD) is high, HMX's DAMA helps to save 45% of the cooling capacity. In monsoon, the cooling coil requirement becomes higher as the WBD reduces, but with use of VFDs optimum air flow is maintained in the factory leading to controlled relative humidity with reduced power consumption.

It is seen that by varying the air quantity supplied by the PCU-F in the manufacturing space, it is possible to control the relative humidity while remaining within a temperature band of 26°C to 30°C at all times. The table below shows at a glance the tonnage and power savings achieved with the HMX-PCU-F.

	Conventional TFA (Treated Fresh Air unit)	HMX-PCU-F	SAVINGS
Tonnage consumed annually for 10 hours operation each day from calculations based on US DOE software (TR-h)	369.361 (TR-h)	287, 5321 (TR-h)	81799 (TR-h)
Total annual power consumption based on 1.2 kW/TR for TFA and 1.24 kW/TR for HMX-PCU-F (kWh)	443, 233 (kWh)	356,576 (kWh)	86,656 (kWh)
Annual electricity charges assuming 10 hr working each day and Rs. 8/kWh (Rs.)	Rs. 3,545,856	Rs. 2,852,615	Rs. 693,251

“ We have installed the HMX-PCU-F in the month of June 2014. The critical monsoon season has passed and the HMX-PCU-F was able to maintain desired temperatures with slight RH variations. We are happy with the performance and power and monetary savings effected through the HMX-PCU-F till date. ”

– Manager



HMX-PCU-F at the site