Tips – Evaporative Cooling Technologies

SUCCESS STORIES

- A dedicated outside air supply cooling unit utilizing the indirect evaporative cooling technology was installed at a commercial building in place of a roof top unit (RTU). Field testing performed by AESC showed that the unit was 75% more efficient than a comparatively sized RTU, running at the efficiency of 0.3 kW per ton. The unit was able to save as much as 70% in energy consumption and 30% in peak kW.
- Evaporative retrofit components utilizing the direct evaporative condenser air pre-cooling technology were installed on existing RTUs of a commercial building. AESC performed field testing and showed that the evaporative retrofit components greatly increased the performance of RTUs during low humidity and high temperature conditions. At 95°F outdoor air temperature, RTU power was reduced approximately 15%, capacity was increased by several percent, and efficiency was raised over 20%.
- Integrated direct and indirect combined evaporative coolers were installed on existing RTUs of a large retail box store. Field testing conducted by AESC found that the integrated evaporative coolers increased the capacity of the RTU by increasing the efficiency of the refrigeration cycle and by lowering the cooling capacity needed to cool outside air. Overall, the integrated evaporative cooler was able to reduce energy consumption by 15% and peak demand kW by 35%.

REFERENCES

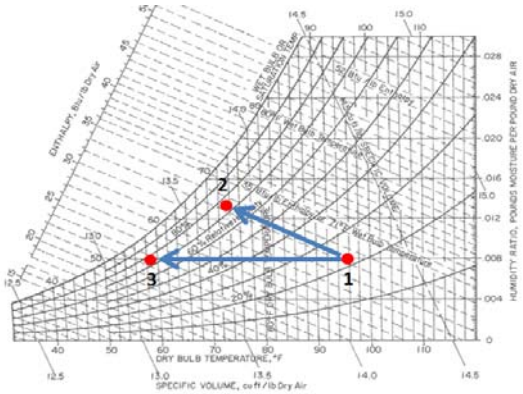
Evaporative Retrofit Components for Roof Top Packaged Air-conditioning Units
http://www.etcc-ca.com/reports/evaporative-retrofit-components-roof-top-packaged-air-conditioning-units

CONTACT

AESC, Inc.
Balfour Court, Suite 213
Carlsbad, California 92008
email: acorradini@aesc-inc.com
phone: 760-931-2641 ext.114
web: www.aesc-inc.com

What is Evaporative Cooling Technology?

When air contacts water, some of the liquid water evaporates to a gaseous state in the air stream. In this process, heat is removed from the air stream and added to the water as it evaporates, and thus the air becomes cool and moist. This heat transfer through the evaporation of water is the basis of evaporative cooling technologies, which is illustrated in the psychrometric chart below.



- Point 1 indicates the ambient air condition.
- Path 1 – 2 highlights the air temperature and humidity changes that occur through direct evaporative cooling.
- Path 1 – 3 highlights the air temperature changes that occur through indirect evaporative cooling.
- The technology is most effective when outside air is dry and hot.

AESC tested three types of products that employed evaporative cooling technologies:

- Indirect evaporative cooler for outside air: Entering outside air is cooled without gaining moisture by passing through the dry side of an evaporative cooling heat exchanger. Energy savings are achieved by reduced cooling load on the compressor(s) from evaporatively pre-cooled supply air.
- Direct evaporative condenser air pre-cooler: Entering outside air is cooled by direct evaporation of water before entering the condenser coil. Savings are achieved by increased vapor compression cycle efficiency due to entering evaporatively cooled condenser air temperature.
- Integrated combination of direct and indirect evaporative coolers: Outside air is cooled through the direct evaporation of water before entering the condenser coil while make-up air is indirectly pre-cooled through the heat exchanger.

In all cases, the above products can be added onto existing roof top units (RTU). The indirect evaporative cooler for outside air can also be installed as a stand-alone system, replacing an existing RTU. The table below summarizes the highlights of evaporative cooling technologies.

Pros	Cons
• The evaporative cooling technologies not only save energy and reduce cost to the customer, but also help the utilities to lower their peak demands • Increased capacity allows building owner to reduce the quantity or size of RTUs • Reduced discharge pressure on the high side of refrigeration cycle increases the equipment life • The evaporative media in front of the coil reduces typical contamination and clogging, lowering the maintenance cost for the coils • Supply air temperature can approach dew point temperature using indirect cooling technology	• Only effective in relatively dry and high temperature climates. • If stand-alone indirect evaporative cooler is installed, a whole air distribution system may need to be modified because the required airflow is increased. • High initial cost • Consumes water • Increases required maintenance