Heat Pipe Systems

SPACE-DERIVED HEAT PUMPS OFFER RESTAURANT CHAINS AN ANSWER TO HUMIDITY PROBLEMS

In the early days of the space program, NASA encountered a problem: the Sun-facing surfaces of a non-rotating spacecraft became excessively hot while surfaces not exposed to the Sun became very cold. Since that situation could cause failure of electronic systems, NASA teamed with Los Alamos Scientific Laboratory to find a solution. The highly effective answer they found was a simple heat transfer mechanism called the heat pipe.

The heat pipe is a sealed tube containing a small amount of liquid refrigerant. In a multiple heat pipe system, each pipe is inclined so that the refrigerant flows by gravity to the lower end. The low end is an evaporator, the high end a condenser. When the refrigerant flows to the low end, it evaporates and absorbs heat in the process. The low density vapor then rises to the high end, where it releases heat and condenses into a liquid to repeat the cycle. This technology provides a system that alternately cools and heats without use of energy or any moving parts.

Successful space use of heat pipes over two decades underlined the Earth-use potential of the technology and, in the 1980s, NASA initiated an effort to promote its broader use. The Southern Technology Applications Center, Gainesville, Florida and the Florida Solar Energy Center teamed with a commercial firm to develop a prototype heat pipe system for terrestrial use. Subsequently a number of other organizations joined NASA in a broad program to refine the technology, demonstrate it and commercialize it; among the participants are Edison Electric Institute, Florida Power Corporation, Georgia Power Company, Alabama Power Company, Mississippi Power Company, Wisconsin Electric Power Company and Carrier Corporation. Several supermarket chains participated in heat pipe air conditioning/dehumidification demonstrations in six states.

More recent demonstrations have involved fast food chains such as Burger King Corporation, Miami, Florida and Taco Bell Corporation, Irvine, California. Fast food restaurants have special problems in areas of high humidity because of cooking processes, customer load and code requirements concerning the rate of movement of outside air to the building's interior. Extremely humid interior conditions cause restaurant fixtures and building materials to deteriorate at an accelerated rate due to interior water condensation; they also result in increased costs of

energy and repair or replacement of equipment.

Under the sponsorship of Edison Electric Institute, Florida Power conducted a heat pipe dehumidification research project for Burger King with the assistance of Tropic-Kool Engineering Corporation, Largo, Florida. Heat Pipe Technology, Alachua, Florida supplied and installed the heat pipes.

A Burger King restaurant in Clearwater was selected as the pilot project site. Florida Power engineers set up test equipment to track temperature, humidity, condensate flow and power consumption.

After six months an analysis of the data showed a 30 percent improvement in the moisture removed by the air conditioners, a 10 percent decrease in relative humidity, and a 17 percent reduction in HVAC power consumption, all due to the work of the heat pipes.

In another project at an Atlanta (Georgia) Burger King, Georgia Power recorded similar results with power consumption reduced by a very impressive 28.6 percent. In the ***far left photo***, a Tropic-Kool technician is removing the existing HVAC system at the Atlanta Burger King; in the ***adjacent photo***, the heat pipe system is being installed; ***below left***, the HVAC system is being reinstalled atop the heat pipe unit.

Says Alan Robart, director of construction for Burger King's Real Estate Division, "After many successful, utility-funded tests in several parts of the country, Burger King is developing a program that may make heat pipes standard in its restaurants."

Taco Bell Corporation similarly found heat pipes the answer to problems with high humidity. Tropic-Kool Engineering proposed a demonstration of what heat pipes could do to increase the latent capacity of air conditioners.

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A Taco Bell restaurant in St. Petersburg, Florida was selected as the test site. Tropic-Kool secured the cooperation of Edison Electric Institute and Florida Power for monitoring the project. Heat Pipe Technology designed and installed a heat pipe system (***above***). An analysis showed a 25 to 30 percent reduction in humidity levels and a 38 percent increase in condensate flow levels. After a further series of tests in a number of U.S.locations, Taco Bell now specifies that all new restaurants in the southeastern United States will be equipped with heat pipe systems. •