raise RESTORE 1030

Cooler Performance Evaluation & Analysis

Crystal Valley Foods
A Division of Cooseman's Produce Worldwide
Miami, Florida

Performance Evaluation June 26, 2012 - July 16, 2012

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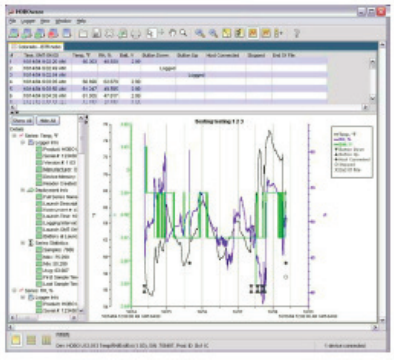
Project Details

Location	Crystal Valley Distribution Facility, Miami, Florida
Equipment	Larkin 25 Ton Refrigeration Unit
	Model Number and SN faded
Compressor	Copeland 4RM 250 Unit #6
	CV Numbering System 4DH3-250E-TSK200
Purpose	• Establish Baseline Performance
	• Install RESTORE1030™
	• Measure Post Installation Performance
	• Determine Percentage of Performance Improvement



Cooler Performance Evaluation Method

Supporting the HVAC industry with innovations and ideas
Cooler Performance Evaluation Method

THEORY: All refrigeration systems that have oil lubricated compressors, i.e. reciprocating, scroll, screw or vane type, move large amounts of oil throughout their entire piping system. From the very day a new system starts running, oil fouling reduces the efficiency of the system, causing it to use more energy than is needed. The RESTORE1030™ product treats the insides of the copper tubing, reducing the oil fouling of the refrigeration system. This reduction of oil fouling will increase the heat transferring ability of the system, allowing it to do the same work, with less energy. Savings of 20% are typical for "direct expansion" type systems treated with RESTORE1030™.

Method of Evaluation: Roland Engineering collected the data required to compare two sets of conditions, one set before we add RESTORE1030™ to the system and one set after the product is added and time had gone by for the product to take effect. This application had two parallel systems running in the same space. To best compare the performance, we measured the temperature drop across the evaporators of these two systems, 24 hours a day for the entire test period.

Our premise was that if we compared the relative performance before the product was added, and then use the same two to compare the performance after, the relative increase would represent the effect of RESTORE1030™ being added to the one system.

Many factors affect the load or work that these two system might perform.

- product moving in and out of the freezer (this facility is a large produce distribution facility)
- varied mass or weight in the cooler at any one time
- varied moisture content in the product
- varied temperature of the product moving in and out
- doors being opened and closed
- ambient conditions, temperature, sun, rain etc

As we collected data from the two side by side units, the assumption was that all these factors would affect each individual system the same, making the comparison valid. Data Logged

The Hobo data logging system collected eight channels of information.

(2) Return air temps on evaporator #6
(2) Supply air temps on evaporator #6
(2) Return air temps on evaporator #3
(2) Supply air temps on evaporator #3

Data was collected for eight days to establish the before treatment base line, and for ten days after the treatment. Data is taken from all eight sensors every minute and logged to the computer every 15 minutes, 24 hours a day.

CALCULATIONS: To establish performance of the refrigeration system we simply calculated the temperature drop across the evaporator, delta T. Every fifteen minutes, for the entire test, the average temp for all sensors was logged for both systems.

We exported this data to an Excel sheet and created columns with the data and did a simple calculation to subtract the return temp from the supply, resulting in the temp drop, or delta T. If the system is cooling, lowering the temp, the delta T is a positive number. To establish the relative performance in the before phase, we took all of the data points with positive values, (system is running) and totaled those values, dividing by the number or data points to product the average temp drop.

From the data we can see that the #6 system has more strength than the #3. The ratio of the work done by each is 1.91, the #6 system is doing 1.91 times the work of the #3 system. (assuming that the air flow over both is the same) This number establishes the relative ability of each system before being treated with RESTORE1030™.

From the data collect for the ten day after the treatment we can see that this relative number increases. Averaging the last 200 data logged periods, the relative performance of #6 to #3 is 2.35, dividing the relative performance (after/before) we get a 23% greater performance after the RESTORE1030™ has taken affect in the system.

CONCLUSION: Observing two parallel refrigeration systems in the same work space, we saw that making one change to the system, increased the relative performance of the treated system by 23% over the untreated system.

Oil fouling is a known issue in the operation of an oil refrigeration cycle. Any product that reduces this build up of oil inside the tube would have a positive effect on the systems operation. ASHRAE research (new letter 11-24-2005) says this can be as much as 14% loss in efficiency in the first three years of refrigeration equipments life. Along with reducing fouling, the addition of RESTORE1030™ increases the "pool boiling effect" and lowers the boiling point of the refrigerant, adding to the capacity.

Longevity of Solution

There is only one product that can realistically promise a long term solution to "oil-fouling". That is because only one product uses a polymer bond to prevent future "oil-fouling". The strength of the polymer bond is sufficient to keep the polymer bonded to the metal surfaces for the life of the unit. All other products are based on van der Waals forces holding polarized particles on the metallic surfaces, which will provide temporary relief from "oil-fouling" at best.

Effectiveness of the Solution

Removing oil fouling and improving heat transfer is only one aspect of improving efficiency in a/c and refrigeration units. The approach taken by RESTORE1030™ using a patent pending polymer that permanently bonds to all metal surfaces within the system provides benefits other than the removal of oil fouling.

Testing by ETL labs on a new 3 ton split unit show the evaporator coil produced 3 degree colder temperatures after the addition of RESTORE1030™. The addition of the polymer allows the annular flow of the refrigerant to occur further into the coil and create colder evaporator temperatures. Refrigerant flow was also increased.

Additional benefits of friction reduction occur throughout the system. The molecular structure of the polymer provides friction reduction within the compressor, particularly within reciprocating compressors. There is also friction reduction within scroll and other non-reciprocating units but to a lesser degree since they inherently have less friction by design. This friction reduction shows in the amp draw of the compressor during the first minute of operation.

The argument can be made that by increasing the efficiency of the system through use of RESTORE1030™ you will see reduced KWH consumption and increased life of the compressor.