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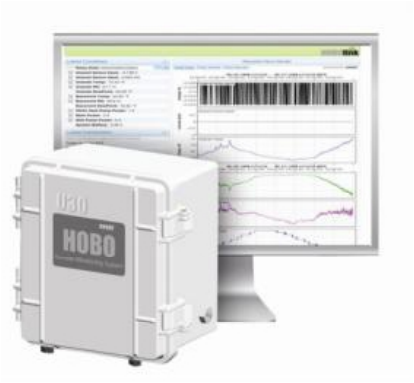
Cooler Performance Evaluation & Analysis

Crystal Valley Foods

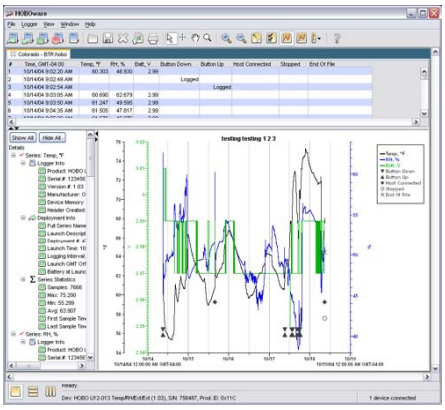
A Division of Cooseman's Produce Worldwide

Miami, Florida

Performance Evaluation June 26, 2012 - July 16, 2012



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 Cold-Plus™**
- **Measure Post Installation Performance**
- **Determine Percentage of Performance Improvement**

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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 **Cold Plus**™ 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 **Cold Plus**™ .

Method of Evaluation: Roland Engineering collected the data required to compare two sets of conditions, one set ***before*** we add **Cold Plus**™ 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 **Cold Plus**™ 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.

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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 **Cold Plus**™.

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 **Cold Plus**™ 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 Cold Plus increases the "pool boiling effect" and lowers the boiling point of the refrigerant, adding to the capacity.

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Cooler Performance Evaluation Summary

Date Completed: July 16, 2012

Refrigerant:	**R-22**
Oil Charge:	**140 oz.**
Cold Plus Added:	**16.5oz**

Before Treatment:

Average Temperature Drop #6	**0.923**
Average Temperature Drop #3	**0.481**
Relative Performance: (#6 delta T / #3 delta T)	**1.91**

After Treatment

Average Temperature Drop #6	**0.732**
Average Temperature Drop #3	**0.31**
Relative Performance: (#6 delta T / #3 delta T)	**2.35**

Conclusion

Relative performance after divided by relative performance before

Rpa / Rba =	**1.230366**
Performance Improvement:	**.23 (or 23%)**

Raw Data Downloaded from HoboLink Server

Note: The data involves hundreds of pages therefore a few sample pages are included in this report for illustration purposes.