CASE STUDIES

# HERTZ INVESTMENT GROUP

Chiller

May 10, 2012

Mr. Robert Schloegel
Hertz Investment Group, LLC
909 Poydras Street
Suite 2195
New Orleans, LA, 70112

Dear Mr. Schloegel,

Thank you for the opportunity to conduct a Proof of Performance with the installation of IceCOLD® into a 100 Ton Carrier chiller located at 909 Poydras Street in New Orleans. We also would like to thank Brad Rice for his time and involvement with this project and who was a pleasure to work with.

Using a defined protocol methodology, we conducted the Proof of Performance to illustrate the savings Hertz will garner as a result of introducing IceCOLD® in chiller and package units. Based upon the data we have gathered, we are pleased to report that after the installation of the product, the chiller is now using on average 15.5% LESS power and has reduced the supply temperature by 1.75 °F and the compressor does not need to run as often or as long in order to meet and hold thermostat set point.

The following report outlines the methodology, results of the Proof of Performance, efficiency improvement and ultimate savings obtained.

## METHODOLOGY

**Purpose:**
Establish a baseline for power consumption, chilled water in and chilled water out (delta temperatures) under normal operating conditions of the Carrier chiller. Measure the difference between cost of operating the unit before IceCOLD® and after IceCOLD® to determine efficiency improvement and expected energy savings.

Equipment: Carrier – 100 Ton
Use: Comfort Cooling (Chiller)
IceCOLD® Installed: 133 ounces on April 9, 2012.

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As the system being treated had two chillers in operation (working in a lead-lag design) during the testing period, it was extremely important to measure both chillers to understand their performance and energy usage. While we only installed IceCOLD® in one of the two chillers in operation, the design nature of the two meant that the lead unit would "lean on" the lag unit for back up when heat load became too much or the maximum capacity of the chiller was being reached. Given the nature of this roll over design, it was critical to measure both units to see how the inclusion of IceCOLD® would affect both the treated unit and the untreated unit.

When IceCOLD® is installed in chiller, that chiller becomes much more efficient. This efficiency arises from improved heat exchange, improved lubricity in the compressor and cooler chilled water both IN and OUT of the chiller. The presence of IceCOLD® allows the unit to cool the space more efficiently which in turn provides the lead-treated chiller with more capacity to take on additional heat load before it requires support from the lag or secondary unit. In the case of a lead/lag design, the lead unit takes a primary role in cooling the space until the load becomes too demanding, wherein the secondary or lag chiller comes online to support the cooling efforts. However, if the lead unit can handle the additional load without resorting to additional support from the lag or secondary chiller it will do so. In the case of the Hertz chillers, this is precisely what occurred. The presence of IceCOLD® eliminated the oil fouling which in turn improved heat exchange; lowered the chilled water temperature due to improved refrigeration evaporation. The benefits of IceCOLD® provided the lead chiller with the ability to take on a high heat load as seen in the post performance data. The treated chiller took on an added 31% capacity and used additional power to do so. When the untreated lag or secondary chiller finally came online to provide additional cooling capacity, it used 65% less power than in baseline. In short, the secondary chiller worked 65% less and used 65% less power as a result of the lead chiller being treated with IceCOLD®. The empirically identical baseline and post days of 7 CDD's where all conditions were almost identical in the baseline period as in the post installation period clearly shows a 31% increase in capacity of cooling from the treated primary chiller with the secondary lag unit using 65% less power to support the cooling efforts.

As noted below, the treated unit was able to increase capacity by 31% more as it is now more efficient with the lag unit reducing its workload by 65%. This change in behavior led to a 15% reduction in overall operating cost for both units.

| | | | | |
|---|---|---|---|---|
| CH3 Base (Untreated) | 63348.75 | | | |
| CH3 Post (Untreated) | 21888.72 | 41460.03 | 65.45 | % LESS |
| | | | | |
| CH2 Base (Treated) | 51766.85 | | | |
| CH2 Post (Treated) | 75859.42 | -24092.6 | -31.76 | % MORE |

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In the second comparison set of data we saw 15% hotter conditions in the post period increasing from 11 cooling degree days (CDD's) to 13 CDD's. (See discussion below under Normalization for Changes in Ambient Temperature regarding cooling degree days) In this scenario, the treated unit increased in production by only 2% with the lag unit reducing its workload by 5%. Clearly the treated unit continues to take on more load as it is now able to do so due to improved heat exchange in the coils along with cooler refrigerant. The increase in heat load was recognized by the lead-treated unit and as a result it turned over to the lag unit more quickly. It's interesting to note that despite the 15% increase in post heat load, the unit only used an additional 2% power consumption to cool the space. This successful behavior comes from the increased efficiency of the lead-treated unit.

**Tools Utilized:**

U12 Data Logger (Onset Computer)

2 Temperature / Relative Humidity Sensors

4 AMP Probes (1 logger and 2 AMP sensors per chiller)

**Probe Placement:** (Only the treated chiller was measured for temperature changes)

Channel 1: AMP Probe (lower amp reading) placed on the line side voltage on the Chiller for both chillers
Channel 2: Temp/RH probe (lower temp reading) placed on the chilled water IN
Channel 3: Temp/RH probe (higher temp reading) placed on the chilled water OUT.

**Units Measured:**
Amperage: Current draw on the L1 (overall amp draw on both chillers) compressor unit
Temperature/Relative Humidity: On the return and supply chilled water

**Volume of IceCOLD® Installed:**
After confirming manufacturer specifications regarding quantity of compressor oil and using a standard formula of ten percent (10%) of the oil charge, 133 ounces were installed on April 9, 2012. In many cases due to age, nature of design an additional quantity of IceCOLD® is added over the 10% to improve efficiency, eliminate the oil fouling and provide additional support to the compressor lubricity.

**Units Measured:**
AMP: Amount of electricity needed to operate system Temperature: Supply and return chilled water temperatures.

**Normalization for Changes in Ambient Temperature:**
The website resource www.wunderground.com was used to obtain official weather station temperatures in New Orleans and cooling degree days (CDD) as standards of heat load. A CDD is a formula for how hot it is on any given day relative to a base temperature over a 24 hour period. A CDD in short means that an air conditioning system will turn on to cool space and is therefore a measure of work, energy consumed. It is derived from a ratio between the high temperature and the low temperature, against a standard of 65 °F. The

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higher the number of CDD's, the harder a cooling system has to work to cool the space. For example, if the high for the day is 90 °F and the low is 65 °F; add both numbers together = 155 °F; divide by 2 =

77.5 °F; now subtract 65 °F from 77.5 °F and you have 12.5 CDD's. 12.5 CDD's means there were many times during the day where the temperature was over 65 °F and required cooling systems to use power to provide air conditions.

As this is a comfort cooling chiller with second and third lag units provide the additional cooling for the building when the maximum capacity for each unit is reached, it was the intention of the analyst to find at least ONE day wherein the CDD's and humidity were as similar as possible to show empirical findings and therefore accuracy in savings. We were fortunate to find one day in the baseline period and one day in the post period wherein the same number of CDD's on both those days which were also on the same day of the week (Monday). The Monday comparison between base and post provided exactly 7 CDD's on both baseline and post installation date along with extremely close humidity levels and maximum temperatures. In other words, we were able to measure "apples to apples" in pre and post periods – a Monday during which the heat load on the building was identical.

| | | | | |
|---|---|---|---|---|
| Post Amp Total | 144256.5 | 13 | CDD | |
| | 11096.66 | | | |
| | | | Summary | |
| Baseline | 146248.5 | 11 | CDD | |
| | 13295.32 | | | |
| | | | | |
| Change | 1991.936 | Less | Amps | |
| | -2 | More | CDD's | |
| | | | | |
| Percent | 1.362022 | % | Less Amps | |
| | -18.1818 | | Increase in Heat | |
| | | | | |
| BY CDD | 2198.659 | | | |
| | 16.5371 | % | Less per CDD | |

**16.5% Less Power per CDD overall**

Interesting Note: There was an increase in heat load from 11 CDD's in base to 13 CDDs in post.

Despite a 2 CDD or 15% increase in heat load the unit saw a reduction in overall Amps of 1992.

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**Overall Savings: 16% LESS AMPS per CDD**

(See Excel spreadsheet attached)

**Temperatures Improvements:**
Only Chiller 2 was treated with IceCOLD®. As such only this chiller had temperature probes to measure the improvement in chilled water IN and OUT of the unit.

Chilled Water In: 1.75 °F
Chilled Water Out: 1.06 °F

| Chilled Water | | | |
|---|---|---|---|
| Baseline | OUT | IN | |
| 3/26/12 | 57.59 | 61.78 | °F |
| | | | |
| 4/25/12 | 55.84 | 60.72 | °F |
| | | | |
| | 1.75 | 1.06 | °F |

The chiller is now able to supply cooler water to the facility and as such not only cools the space faster; turns off the compressor more quickly but is also is able to keep the space cooler for longer.

**Reduction of 15% First Comparison and 16% on Second Comparison = 15.5%**

**15.5% Improvement**

**PERFORMANCE IMPROVEMENT**
The chiller treated is now using on average 15.5% LESS power and has reduced the supply temperature by 1.75 °F. The compressor does not need to run as often or as long in order to meet and hold thermostat set point.

**15.5% Less power was required for cooling of the space post installation of IceCOLD®**

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