Stericraft, LLC.

Miraco

Misr Refrigeration and Air Conditioning Mfg

# Cold-Plus™ Refrigerant Enhancer Proof of Performance Test and ROI

7/22/2014

Engineer's report of data collected from a 20-ton air conditioner at Miraco in Cairo, Egypt to show the energy savings after the installation of the Cold-Plus™ Refrigerant Enhancer.

## Executive Summary

This test study was completed in July 2014 to evaluate energy savings resulting from adding the Cold-Plus™ refrigerant enhancer to an 8-year-old 20-ton Carrier air conditioner. The unit is an outdoor system that supplies air to the manufacturing facility.

The energy usage was logged using a HOBO U12 4-Channel External Data Logger device for 7 days prior to injecting the Cold-Plus™ and for 14 days after. The metered data, in conjunction with the system calculations, show an estimated savings of 21.5% for the unit tested.

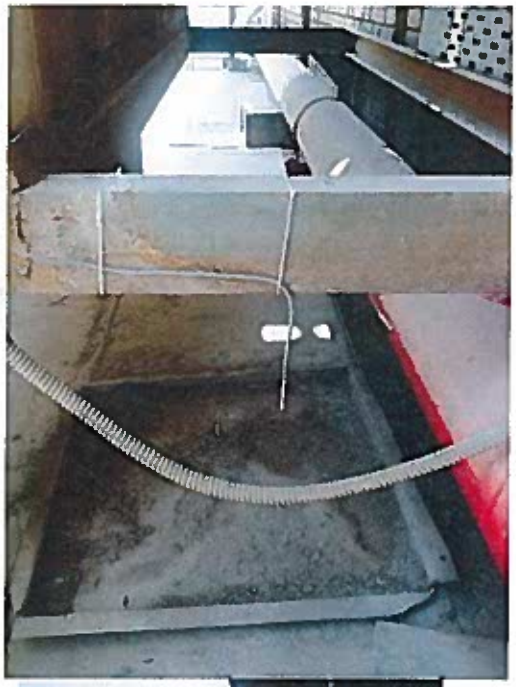
## Background

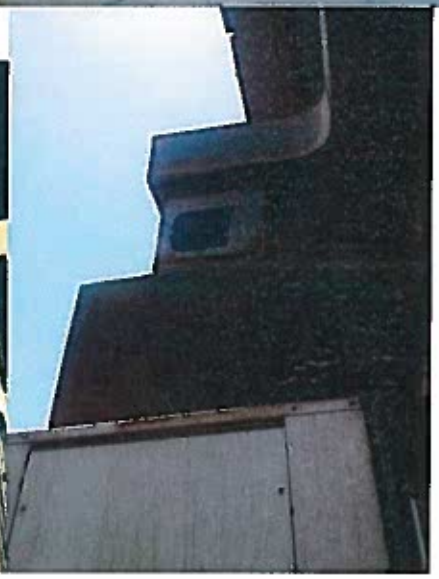
This test study was done at the Miraco manufacturing facility in Cairo, Egypt. In 1992, Miraco signed a joint venture agreement with Carrier Corporation. Since then has become the largest heating, ventilation and air conditioning company in Africa. Today there are two factories, all with the latest manufacturing technology, and a total working space of 90,000 m2. From a small dream in 1976, the production capacity has now expanded to over 400,00 boxes per year and a total workforce of more than 1,400 dedicated employees. Miraco Carrier holds a prominent place in the Egyptian Market and is well known for quality manufacturing, distribution, HVAC contracting, commercial refrigeration, and service divisions. It is the largest dealership network in the country as well as the largest service organization.

## Metering

Pre-installation metering took place from 6/16/2014 to 6/23/2014. After the treatment was installed, the post-metering occurred from 6/23/2014 to 7/7/2014. The treatment can take a week or more to fully circulate through the system. To ensure that the treatment had plenty of time to be fully integrated into the system and scheduling conflicts, the first 7 days post installation were not used for analysis.

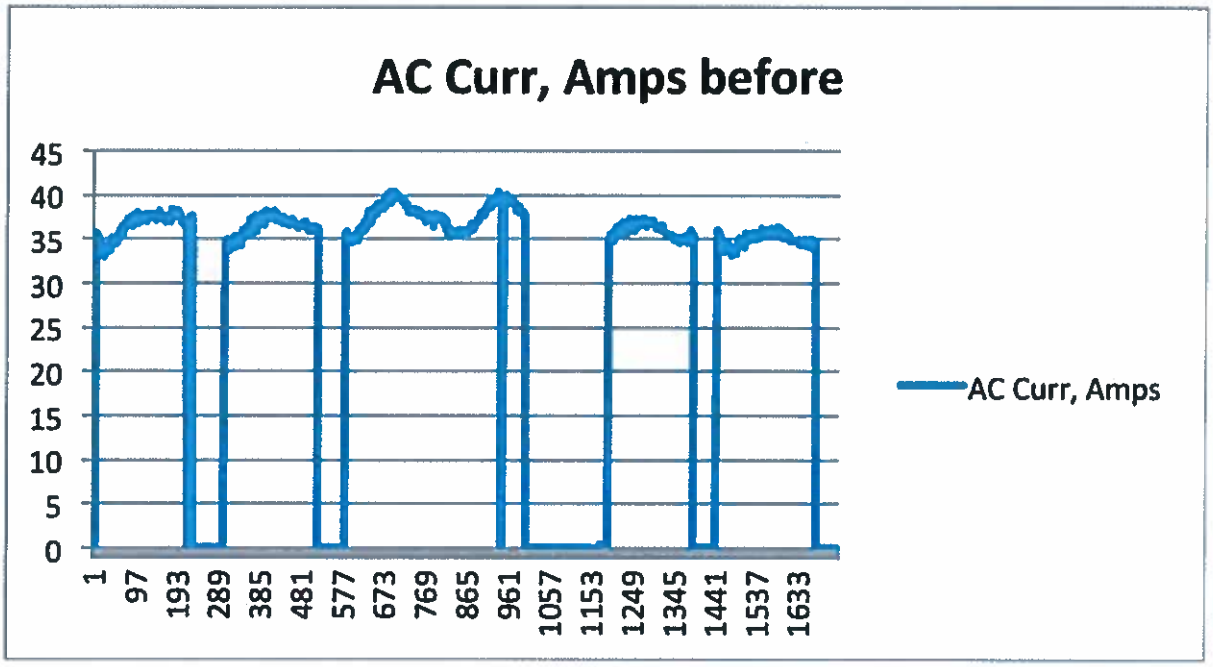
The parameters used that were metered were ambient air temperature, discharge air, and amp draw utilizing two separate amp clamps.





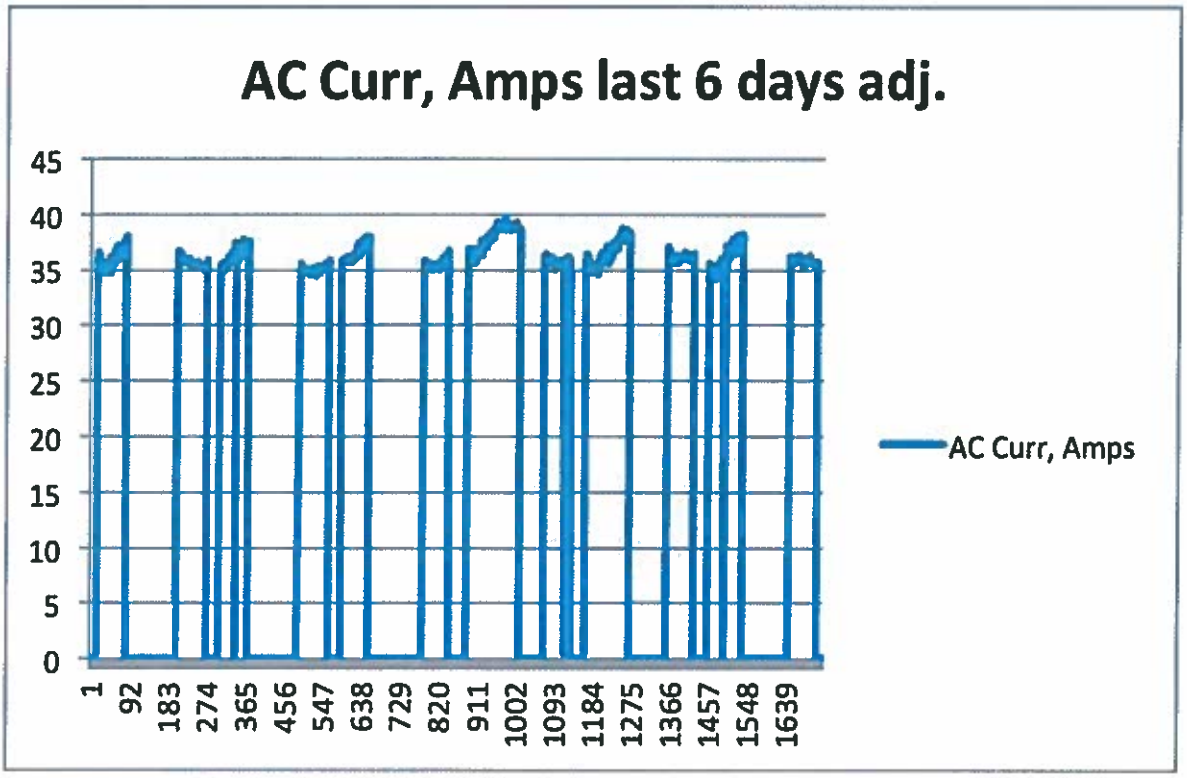
## Results

These are the results for the test information contained in the HOBO file pulled from the data collected. The file contains data collected on 5-minute intervals for ambient temperature, supply air and amps. The supply air is not useful since there is no return air to use for comparisons. Since the Cold-Plus™ was installed on June 23rd at some unknown time it was simpler to eliminate the 23rd from the data. The other data eliminated was for July 4th. The compressor did not run in that 24-hour period so I eliminated the data from the comparison. What we have as far as format are 6 twenty-four hour periods before installation of Cold-Plus™ and 6 days after injection.




This is the data for before injection. You will note that the system starts and runs almost continuously until it reaches the set point where it cycles off until the ambient rise causes it to turn on and repeat the cycle. This is characterized in the graph. Run amperages are from 34 to 41 amps.

The next data set is from the last 6 days of the test and eliminating July 4th since no compressor activity was noted on that day. So what we have for data comparison here is the last 7 days of the test minus the 4th of July.




You can clearly see a different pattern here after the Cold-Plus™ injection, the unit cycles when the thermostat setting has been met and spends considerably more time with the compressor not running.

In order to see the effect statistically we will use averages for the data sets to make a comparison.

| | Amb Temp, °F | SA Temp, °F | Avg AC Curr, Amps | Comp On |
|---|---|---|---|---|
| 6 days Prior | 86.207 | 62.534 | 27.207 | 74.2% |
| Adjusted last 6 days | 87.035 | 74.081 | 18.963 | 52.2% |
| Efficiency increase | | | **30.3%** | **22.0%** |

What we see here is for basically the same average temperatures the compressor run time was reduced by 22.0% and the average amps were reduced by 30.3%. If you look at the graph above you will see that not only was the run time less but the running amps were also reduced when the compressor was operating.

Another analysis of the performance of the compressor units based on the test data can be deduced by using the Delta T, which when comparing the post 6 day period against the base line 6 day period will prove the overall improvement.

6 days prior: Delta T/I = (86.207 - 62.534)/27.207 = 0.8701

Adjusted last 6 days: Delta T/I = (87.035 - 79.081)/18.963 = 0.68311

% Improvement is (0.8701 - 0.68311)/0.8701 = 0.215 = 21.5% improvement.

When using the delta T calculation the cooling energy was reduced by 21.5% during the adjusted 6 days, or that for the same load, the delta T was reduced by 21.5%.

With an overall increase in efficiency of 21.5% the results of this test would fall into the high range of efficiency increases in prior testing.

Dr. P.E. Jenkins, Ph.D., P.E.
7/22/14