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RENDERED TO
Redi Controls Inc.
755 E. Main Street
Greenwood, IN 46143

Final Report of Performance Testing of a
York Model #OT A5 A3-Od CTC, 100 ton R-11 Chiller.

General

This report gives a description and results of two Site Field Tests requested by Redi Controls Inc. and performed by Intertek ETL Semko, (ITS), of Columbus, OH. Authorization for the testing was by Redi Controls Inc. Purchase Order No. 5203MBK3148, dated April 21, 2003. The testing was coordinated through Mr. Mark Key, representing Redi Controls Inc., Michael Hilterbrand, Senior Service Manager representing Choice Mechanical Services Inc., and Norm Chastain, Assistant Director (MSD) Perry Township Schools representing Mary Bryan Elementary School. The testing was conducted before and after Redi-Controls Inc. removed lubricant (OIL) from the system. The initial testing was performed on May 7, 2003. The subsequent testing was performed on June 20, 2003 by Mr. Michael Shows, representing Intertek Testing Services.

Redi Controls identified a 100 ton York chiller located in the mechanical room at Mary Bryan Elementary School, 4355 East Stop 11 Road, Indianapolis, Indiana 46237. This unit had been identified as not providing adequate cooling and tested by a third party as having in excess of 20 percent lubricant (OIL) in the refrigerant charge. The appearance of the facility was clean and the chiller (Photo 1) appeared well maintained.

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The testing was witnessed in part by Mr. Michael Hilterbrand – Senior Manager Choice Mechanical, Rick Bennett – Service Technician Choice Mechanical, and Mark Key – Redi Controls.

The results contained herein are for technical evaluation only and are applicable only to the specific test specimen referenced within the report.

Photo 1 – 100 ton York chiller at Mary Bryan Elementary School



Description of Test

Power input, cooler and condenser water temperatures, and water flow rates were measured by ITS field installed calibrated instrumentation. Additionally the water pressure drop was measured. The instrumentation and data collection were in accordance with ASHRAE 30. The test data collected and the test performance results are contained on the following pages.

Instrumentation

Pressure Gauges

Pressure gauges were used to measure pressure (PSIG) at the points entering and leaving the chiller on the cooler and condenser water lines.

1. Entering Cooler
2. Leaving Cooler
3. Entering Condenser
4. Leaving Condenser

Power

Power measurements were made at the line side of the terminal blocks for unit input power. All power measurements were made with a Yokogawa WT 130 Digital Power Meter Model 253503, Serial # 27BW3293 M. These included Line Voltage, Amperes, and kilowatts.

Temperatures

Temperatures were measured at manufacturer's design temperature measurement points entering and leaving the condenser and cooler. All temperatures were measured with a Hart Scientific 1529 4 channel RTD measurement device Model # 1529-R, Serial # A13068. This unit used Emerson high accuracy platinum RTDs.

Water Flow

Water flow rates were taken on the leaving cooler and leaving condenser lines. Water flow rates were measured using a Controlotron flow meter using 1011 PIPS-D2 Transducers Serial # E0202A/B.

Testing

The test plan involved running an initial capacity measurement on May 07, 2003. The results of this test are found on Table 1. Redi Controls would then install a device (OAM-Purger) to remove lubricant (OIL) from the system. At the end of this period (estimated at approximately 30 days) a second capacity measurement would be made. This second measurement was not completed until June 20, 2003 due to scheduling issues with Intertek personnel. The results of this test are found on Table 2.

Results

Since this was a field test at an elementary school, it was not possible to achieve and maintain the standard rating condition of 55 °F entering and 45 °F leaving water temperature. During the initial test on May 07, 2003, the chiller was found incapable of achieving the standard rating condition without assistance from a second chiller at the facility. During the subsequent testing conducted on June 20, 2003, the chiller ramped down past the rating point too fast for the needed stability for RTD measurement.

In spite of these difficulties, the unit performance increased significantly between May 07, 2003 and June 20, 2003. On the evaporator side of the unit the measured tonnage increased from 75.2 tons to 92.8 tons. This was a measured increase of over 17 tons, which is a 19% increase in capacity. By taking this measure in concert with the power usage the kilowatts per ton was calculated for both tests. There was a significant increase in kw/ton produced by the unit. The measurement increased from 0.5834 kw/ton to 0.4708 kw/ton. The rate per ton of cooling decreased 19% (nearly 20% decrease in energy usage).

This does not take into account the amount of additional cost associated with the operation of a second chiller if the first chiller is unable to handle the load.

Two refrigerant analysis tests taken by a third party after the OAM-Purger installation and operation showed a significant decrease in lubricant (OIL), reaching nearly a trace amount of oil in the refrigerant charge (1.35% on 7/28/03 and 0.88% on 8/21/03).

The complete results of the testing are provided on the following pages.

Tests Performed By:

Michael Shows
Engineering Manager



Table 1. Results of May 7, 2003 Testing

Reading No.:	1	2	3	Avg.
Time:	15:55	15:59	16:06	11:00
Entering Cooler, °F	61.96	61.90	61.99	61.95
Leaving Cooler, °F	52.14	52.39	52.01	52.18
Δ T	9.82	9.51	9.98	9.77
Leaving Condenser, °F	88.82	88.62	88.82	88.75
Entering Condenser, °F	77.85	77.96	78.78	78.20
Δ T	10.97	10.66	10.04	10.56
<u>Electrical Measurements:</u>				
<u>Volts:</u>				
Phase A-B	461.20	463.50	463.30	462.67
Phase C-A	463.50	463.80	464.80	464.03
<u>Amps:</u>				
Phase A	97.90	97.40	97.30	97.53
Phase C	98.50	96.90	97.00	97.47
Power Input, kW	44.00	43.50	44.10	43.87
Cooler Flow Rate, GPM	182.70	185.20	186.10	184.67
Cooler Water Pressure Drop, Ft of H ₂ O	5.00	5.00	5.00	5.00
ITS Unit BTU/hr				12.47
<u>ITS Calculated Tons:</u>				75.17
<u>ITS Calculated kW/Ton</u>				0.584

**Table 2. Results of June 20, 2003 Testing**

Reading No.:	1	2	3	Avg.
Time:	15:53	15:55	15:57	6:00
Entering Cooler, °F	62.42	60.35	58.81	60.53
Leaving Cooler, °F	50.22	48.45	46.73	48.47
Δ T	12.20	11.90	12.08	12.06
Leaving Condenser, °F	91.57	90.26	89.14	90.32
Entering Condenser, °F	78.30	76.99	75.69	76.99
Δ T	13.27	13.27	13.45	13.33
<u>Electrical Measurements:</u>				
<u>Volts:</u>				
Phase A-B	468.80	469.30	467.80	468.63
Phase C-A	466.20	465.80	465.30	465.77
<u>Amps:</u>				
Phase A	95.70	96.20	96.20	96.03
Phase C	96.00	96.10	96.10	96.07
Power Input, kW	43.50	43.50	43.50	43.50
Cooler Flow Rate, GPM	182.70	185.20	186.10	184.67
Cooler Water Pressure Drop, Ft of H ₂ O	5.00	5.00	5.00	5.00
ITS Unit BTU/hr				12.37
<u>ITS Calculated Tons:</u>				92.80
<u>ITS Calculated kW/Ton</u>				0.469