InterteK Product Analysis and Summary Report

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The analysis, summary and report that follows is based on information recorded and certified by Intertek Testing Services NA, Inc. of Courtland, New York according to ASHRE Standard 37-1988.

The descriptive qualifying terms PRE and POST are applied to the test run identifiers. The qualifier PRE applies to tests that were run before the treatment of the air conditioner compressor units with ZEC Lubrication's AC-XL formula, while the qualifier POST applies to tests that were run after the AC-XL formula treatments were completed.

> ***Note:*** *AC-XL is the current brand name of the formula used in the test. The test was run under a previous brand but the formula is the same as the current ZEC Lubrication AC-XL product.*

I. PURPOSE

To test the effectiveness of the AC-XL oil additive formula on a 12 year old LENNOX 20 ton Roof Top Air Conditioner according to ASHRAE 37-1988, an American National Standard published by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.(ASHRAE).

To acquire data and cursory analysis of resulting information collected by a certified independent testing facility while conforming to the requirements of the ASHRAE Standard. Data for both PRE and POST tests including cycling information must further document and validate changes to:

- Average cooling capacity
- Compressor run times
- Energy consumption

The tests were conducted by Intertek Testing Services NA, Inc. of Cortland, NY. Data analysis with limited graphics was provided by Intertek.

Intertek is the only third party independent test laboratory certified by both the Air Conditioning and Refrigeration Institute and the American Society of Heating and Refrigeration Engineers (ASHRAE) to provide testing and performance verification.

II. EQUIPMENT AND MATERIALS

12 year old LENNOX 20 ton Roof Top Air Conditioner
Model Number: GC516-2753-2353G
Serial Number: 5992K01892
AC-XL formula concentrated lubricant and metal conditioner - 20 ounces

After 12 years of continuous operation, the unit was removed from the roof top of a large retail store and transported to Intertek Testing Laboratories for evaluation.

The extensive instrumentation and dedicated test cell facilities of Intertek Testing Services are not equaled in the United States. The Cortland, NY facility is the only lab in the Intertek organization that is equipped to handle a unit larger than 10 ton capacity.

III. PROCEDURE

According to standard operating procedures of Intertek Testing Services, the air and line filters were replaced and the system evacuated and charged with new refrigerant before the PRE test was run.

> ***Note:*** *The decision to replace air and line filters on in-service equipment is not a requirement of the AC-XL Installation Procedure. The decision to replace any part on in-service equipment should only be made by a competent service technician.*

The unit was connected to the data monitoring and data recording devices as required by the Standard, PRE treatment cycling tests were conducted. Data was recorded, validated and certified.

Following the PRE treatment cycling test, 20 ounces of the AC-XL formula was added by qualified technicians, according to the Direction of Use published by the manufacturer. 10 ounces of refrigerant oil was removed from each of the 2 compressors and replaced with 10 ounces each of the AC-XL formula.

> ***Note:*** *For in-place application of AC-XL, the decision to remove refrigerant should be made by the competent air conditioning technician servicing the equipment. Charge of the system should be maintained to the requirements of the equipment manufacturer, which may not always have a need to remove refrigerant.*

Upon treatment with the AC-XL formula, the unit was allowed to run for 2 weeks to allow the compressors and the heat exchanger coils to be thoroughly treated by AC-XL. Data monitoring and recording systems were not connected during this period.

The unit was reconnected to the monitoring system as used in the PRE treatment cycling tests. PRE and POST treatment testing conditions were established as provided in the ARI/ASHRAE Standard. Post treatment data was recorded, validated and certified.

Data analysis and limited graphics were supplied by Intertek along with the extensive data resulting from the test procedures.

IV. TEST DATA

The raw data obtained by Intertek during the conductance of these tests is contained in 2 EXCEL spreadsheets with multiple pages. The volume of data is too great to be included as a part of this summary.

V. OBSERVATIONS

To understand the message and meaning of the data analysis presentation, it is important to define the terms of reference used in the preparation of this report.

DB: Dry Bulb temperature -normal thermometer reading in degrees F

WB: Wet Bulb temperature -represents humidity content in degrees F Btu: British Thermal Unit -a standard measurement of energy (Heat)

Btu/lb: British Thermal Unit per Pound -energy content per pound of air

Btu/h: British Thermal Unit per Hour -energy rate per hour of air (Capacity)

kW: Kilowatt -the rate of electrical power usage during a defined time frame

kWh: Kilowatt hour -the cumulative total of electrical power usage

Inlet: Represents unconditioned air parameters going into unit

Outlet: Represents conditioned air parameters leaving unit

Enthalpy: Heat content of one pound of air at corresponding given wet bulb temperature

Capacity: The rate, expressed in Btu/h, at which the equipment removes heat from the air passing through it under specified conditions of operation.

Cycling: While air conditioning unit is running, a thermostat in a space receiving the cooled output is allowed to control the unit driving the air through the unit. The time unit is ON and OFF is timed and recorded at high resolution levels. All other parameters of testing procedures are metered and recorded for comparison.

The tests required by ASHRAE 37-1988 are quite restrictive. Some of the tests were run for 3 hours while others were for 2 or 4 hours in duration. The number of monitored parameters is very time consuming to understand and even more difficult to explain to people who are not very engineering oriented. The data analysis was standardized for 2 hour segments both PRE and POST to make comparisons stable and credible. The data parameters were grouped and averaged per cycle and the number of cycles per analysis period.

The purpose in conducting a PRE treatment and POST treatment comparative analysis of the equipment in a controlled environment and at an industry certified testing facility was to record data sufficient to either challenge or validate representations and claims made by the manufacturer of the AC-XL formula.

The ASHRAE Handbook 1988 -"Effects on Heat Transfer" states: "Oil fouling of the heat transfer surfaces of air conditioning and refrigeration systems will cause a loss of ABOUT 7% efficiency the first year and 2% per year the following years." To expand that further:

100.0% Beginning Efficiency 93.0% First Year less 7%

91.1% Second Year less 2%

89.3% Third Year less 2%

87.5% Fourth Year less 2%

85.8% Fifth Year less 2%

84.1% Sixth Year less 2%

82.4% Seventh Year less 2%

80.7% Eighth Year less 2%

79.1% Ninth Year less 2%

77.5% Tenth Year less 2%

76.0% Eleventh Year less 2%

If the AC-XL formula can eliminate the oil fouling problem, the air conditioning system would experience a rather large increase in efficiency resulting in substantial capacity gains.

A detailed analysis of the Intertek PRE and POST certified data confirms a substantial increased operating efficiency of the equipment after the equipment had been treated with the AC-XL formula.

The following findings were integrated into the Data Analysis Presentation:

A single "averaged" cycle representing the dry bulb and wet bulb condition was generated along with the corresponding enthalpy, likewise all other data parameters were processed the same.

The cycle times are normalized to 00:00.0 (minutes:seconds).

The averaged compressor ON time for the POST treatment is 6:00.0 minutes.
The averaged compressor OFF time for the POST treatment is 8:11.3 minutes.
The averaged cycle rate time for the POST treatment is 14:11.3 minutes.

The averaged compressor ON time for the PRE treatment is 5:38.2 minutes.
The averaged compressor OFF time for the PRE treatment is 4.16.4 minutes.
The averaged cycle rate time for the PRE treatment is 9:54.55 minutes.

Although the room conditions were held as close to each other as possible for the PRE and POST tests, a slight difference was noticed and calculated as:

POST Inlet Room Load = -2.81 Btu/lb in 8.11.3 min = -82.36 Btu/lb/h
PRE Inlet Room Load = -1.05 Btu/lb in 4.16.4 min = -81.08 Btu/lb/h.
POST minus PRE Room Load = 1.28 Btu/lb/h.
POST minus PRE Room Load = 1.58% Difference

V. CONCLUSIONS

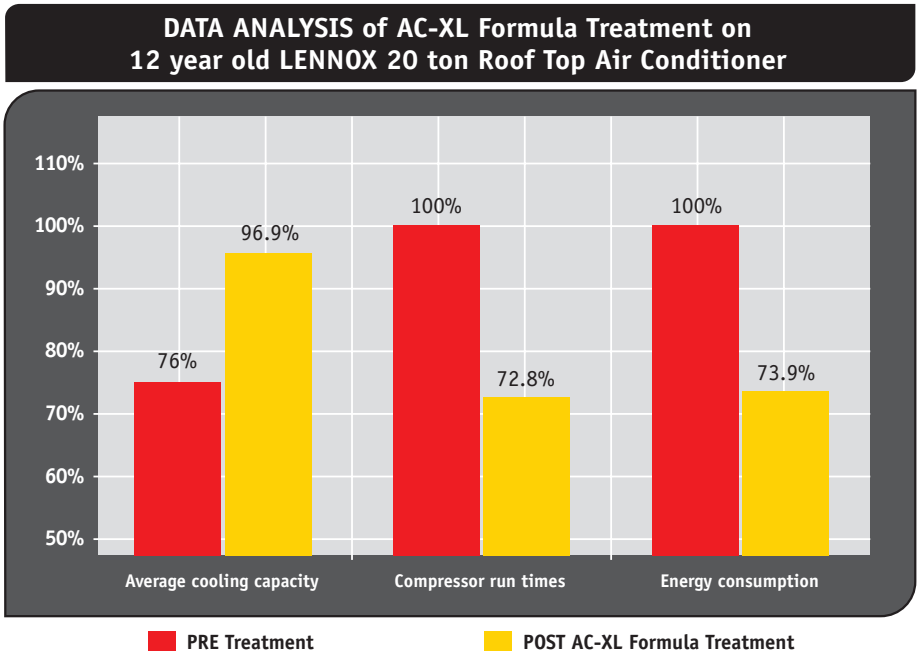
The following results were presented in the Data Analysis Presentation:

Cooling capacity increased by 67.62 Btu/lb/h representing a 27.5% increase in cooling capacity.

The cycle rate was lengthened from 9:54.55 minutes to 14:11.3 minutes. The cycle number reduced from 5.5 cycles per hour to 4.0 cycles per hour or a 27.2% decrease in start cycles.

The kW draw reduced from 18.3 kW/h to 13.51 kW/h per cycle, presenting a 26.1% decrease in power requirements.

The cooling capacity increase validates the claims of the ability of the AC-XL formula to substantially reduce the oil fouling problem in air conditioning systems. That ability makes it possible to almost return to original operating condition of a system of considerable age. Applying the AC-XL formula to new devices should prevent the oil fouling condition from eroding the efficiency of that device over time.



An AC-XL formula treated air conditioner should not only be able to cool more space, but run less time while doing it. The smaller number of cycles with longer cycle rates demonstrate a highly desirable trait. The less a unit has to run to do a given task costs less to operate.

The decrease in power requirements documented by the test data analysis clearly provides a reasonable R.O.I.

Individual results will vary according to the billing methods employed by your regional service provider.

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