



1717 Arlingate Lane
Columbus, Ohio 43228

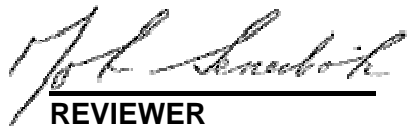
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SKY GREEN ENERGY
Date: June 29, 2015

Report No.: 102164230COL-001
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Test Report For:
SKY GREEN ENERGY
ALLTEMP L
PERFORMANCE TEST
REFRIGERANT INFUSED WITH ADDITIVE

Tyler Eaton <Signature on File>
ENGINEER


REVIEWER

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Objective

The objective of this evaluation is to compare the saturation pressure vs temperature curves of Alltemp L with that of standard R-134a. Additionally a gravimetric residue analysis is intended to show that the infused Halo-Alkene Complex additive remains with the R-134a and does not remain behind as a residue following evaporation.

Accuracy Needed Pressure: +/- 1psig
Temperature: +/- 1°C
Mass: +/- 0.005g

Parameters

The following parameters are controlled

Value	Description	Units	Method	MU @95% K=2
Temperature	Temperature of the Liquid Refrigerant	Deg C	Temperature Controller	0.31°F
Air Content	Air Content of Compressed Gas	% Volume	Analysis per AHRI 700	0.07% Volume

The following parameters are monitored

Value	Description	Units	Method	MU @95% K=2
Temperature	Temperature of the Liquid Refrigerant	Deg C	Temperature Data Logger	0.31°F
Pressure	Vapor Pressure of Refrigerant	Psig	Digital Pressure Gauge	0.06psig
Time	Time to achieve thermal equilibrium	s	Stopwatch	3.5spd
Mass	Mass of refrigerant	g	Balance	0.18%
Mass	Mass of Residue	g	Analytical Balance	0.04%
Air Content	Gas Chromatograph	%	AHRI 700 Appendix C	0.07% volume
Residue Content	Residual Residue	% mass	AHRI 700 Appendix C	0.005% mass

Sample Acquisition

Sample #	Description	Serial #	Purchase Location	Date	Condition
COL1506101431-001	Alltemp L	N/A	Provided by Sky Green energy	6/12/15	New

Hypothesis I

Alltemp L will show an equivalent saturation pressure vs temperature curve in the range of 25°C (77°F) to 100°C (212°F) compared to standard R-134a.

Hypothesis II

The residue remaining following evaporation of the Alltemp L will still comply with AHRI 700 specification <0.01% mass

Equipment list						
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#	Equipment Description	Manufacturer's Name / Model # / Serial #	Intertek Asset #	Calibration Date	Calibration Due	Range Used
1	Balance	Ohaus/GT4100/2068	CE1030	8/20/14	8/20/15	0-1000g
2	Analytical Balance	Ohaus/AP210S/N79924	CE1017	8/20/14	8/20/15	0-210g
3	Stopwatch	Extech/42270/NA	CE1183	11/13/14	11/13/15	0-120s
4	Temperature Data Logger	Omega/HH500P/131002805	CE2373	3/20/14	3/20/15	25°C to 100°C
5	Pressure Gauge	Omega/DPG5600B-3KG	E509	2/3/15	2/3/16	75psig to 600psig
6	Pressure Vessel	Autoclave	CE2224	For Reference Only	N/A	N/A
7	Gas Chromatograph	Varian	CE1095	Verify Before Use	Verify Before Use	0.1% to 5% Volume

PROCEDURE:

Pressure vs Temperature Evaluation

A pressure vessel was evacuated to a pressure of < 100 microns and charged to 80% of capacity at 95°C as calculated by NIST Refprop with AHRI 700 compliant R-134a to act as a control. The system was allowed to stabilize at 25°C for a minimum of 2 hours. Following the equilibrium period, the pressure was measured and recorded to the nearest 1psig. Next the temperature of the system was increased by 10°C and once again following a minimum of a 2 hour equilibrium period the pressure was measured and recorded to the nearest 1 psig. This process was repeated for increasing 10°C intervals to a maximum of 95°C (5°C below the expected saturation temperature). Each time the pressure was measured and recorded to 1psig following a minimum of a 2 hour equilibrium period,.

Gravimetric volatile residue analysis

100g of each sample was added to a pre weighed Goetz bulb and evaporated in a 60°C water bath. This process was repeated 5 times allowing a total composite sample of 500g of sample to be evaporated. Following the fifth evaporation, the Goetz tube was reweighed to the 0.0001g and the mass difference recorded.

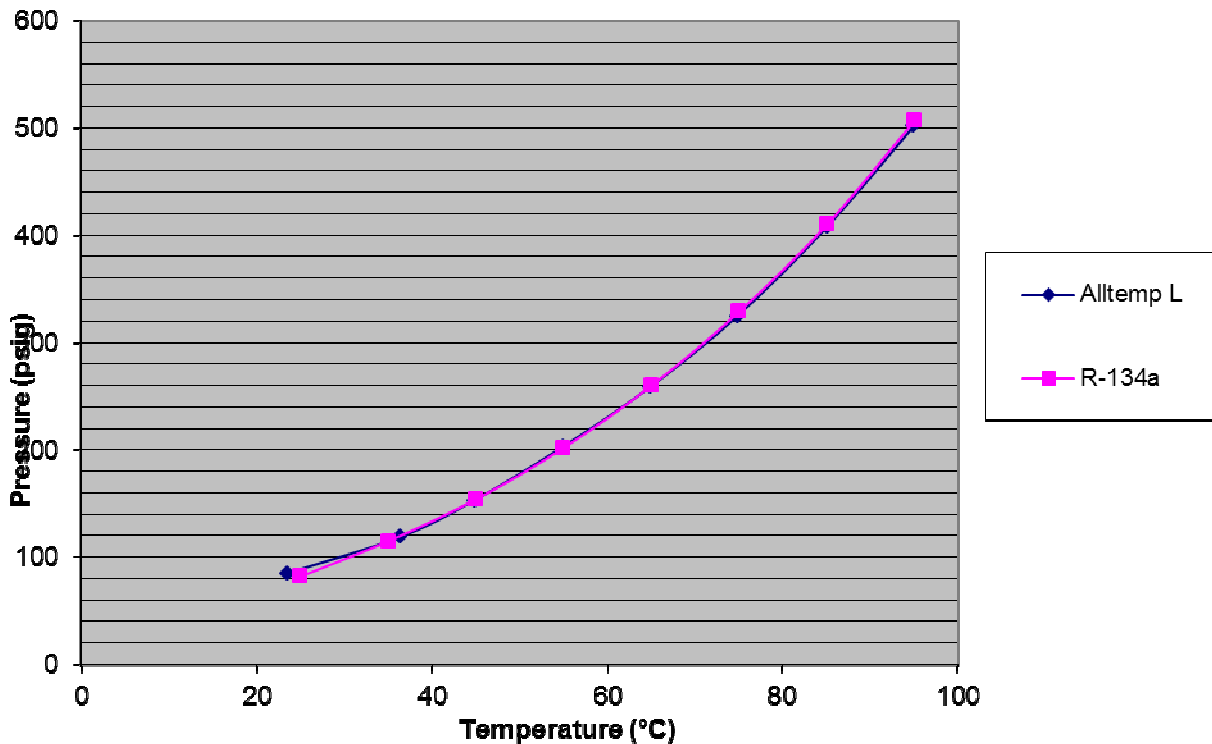
Testing was conducted at :
INTERTEK
 1717 Arlingate Lane
 Columbus Ohio 43228

Sample ID	Refrigerant Description	Temperature (°C)	Pressure (psig)	Control	Temperature (°C)	Pressure (psig)
COL1506101431-001	Alltemp L	23.5	85	R-134a	25	82
COL1506101431-001	Alltemp L	36.4	119	R-134a	35	115
COL1506101431-001	Alltemp L	44.8	153	R-134a	45	154
COL1506101431-001	Alltemp L	54.9	203	R-134a	55	202
COL1506101431-001	Alltemp L	64.9	259	R-134a	65	260
COL1506101431-001	Alltemp L	74.8	325	R-134a	75	329
COL1506101431-001	Alltemp L	85	408	R-134a	85	410
COL1506101431-001	Alltemp L	94.9	502	R-134a	95	507

- Air content of Alltemp L compressed gas was < 1.5% volume as tested per AHRI 700
- Pressures for R-134a control were determined by NIST Refprop Version 9.1

Residue following evaporation: <0.01 (% mass)

Pressure vs Temperature



Conclusion

Based on the data collected the Hypothesis I is **ACCEPTED**: Alltemp L did demonstrate an equivalent saturation temperature vs pressure curve over the range of 25°C (77°F) to 100°C (212°F) compared to standard R-134a.

Based on the data collected the Hypothesis II is **ACCEPTED**: The residue remaining following evaporation of Alltemp L will still comply with AHRI 700 specification < 0.01% mass