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TEST REPORT

PROJECT NO.: G101465075

ISSUE DATE: 12/31/13

REPORT NO. 101465075COL-001
RENDERED TO

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GENERAL:

This report gives the results of the evaluation of HVAC additives identified by MaxR100 as Products #9611, #9666, and #9667 per ANSI/ASHRAE 97 Issue: 2007/06/27 Sealed Glass Tube Method to Test the Chemical Stability of Material for Use within Refrigerant Systems. Test conditions were 14 day exposure at 175°C +/-5°C. Property evaluations were conducted by the following procedures. TAN per ASTM D974, Refrigerant Breakdown per AHRI 700, and Dissolved Metals per ASTM D5185. This investigation was authorized by Signed Quote #500497278. The samples were provided by MaxR100 in "Good Condition" and received on 12/9/13. The samples were assigned the unique identification numbers COL1312101554-001, COL1312101554-002, and COL1312101554-003 and were tested at Intertek Columbus facility at 1717 Arlingate Lane, Columbus, OH 43228, USA between 12/9/2013 and 12/30/2013.

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ASHRAE 97 TEST DESCRIPTION:

1. Glass tubes were cleaned with lab grade soap and water, then rinsed with ASTM II water and acetone, placed into an oven to evaporate solvent then removed to let cool.
2. Syringes were rinsed with toluene first, then acetone. Placed into an oven to evaporate the solvent and then removed to cool.
3. Metals were prepared by first sanding or polishing them to remove oxidation and expose a fresh metallic surface, then rinsed with Toluene to remove contaminants and allowed to dry.
4. Lubricant mixtures were prepared.
5. One coupon of each metal was placed in each of their respective glass tubes.
6. The syringe was flushed with the respective lubricant.
7. 1.0mL of the lubricant was added to each tube
8. After the proper amount of lubricant was added to the tube, it was constricted. (See ASHRAE 97 procedures, Section 5 under Constricting Glass Tubes Prior to Filling with Refrigerant)
9. The constricted tubes were placed in one of the ports of the manifold.
10. The manifold was evacuated to less than 200 millitorr.
11. The manifold was flushed with the refrigerant prior to filling the tubes.
12. A metal beaker was placed under each glass tube.
13. The beaker was filled with liquid nitrogen, to freeze the refrigerant as it is added.
14. The pressure of refrigerant to add to the tube was calculated using the ideal gas law.
15. The vacuum was closed off to the manifold.
16. The manifold was then filled with the refrigerant.
17. The sample port valve was opened to add the proper pressure of refrigerant.
18. After the proper amount of refrigerant was added and frozen, the manifold was re-evacuated
19. The sample port valves were then opened to pull out and non-condensable gases.
20. When the vacuum was below 200 millitorr, the tubes were cut and sealed (see ASHRAE 97 procedures on cutting /sealing the tubes for a detailed procedure)
21. All glass tubes including the control tubes were placed in a metal holders and then in an oven at 175°C for 14 days.
22. After 14 days samples were removed from the oven, allowed to cool to room temperature, and then analyzed.
23. Dissolved metals were analyzed by ICP-AES per ASTM D5185-09
24. TAN was analyzed per Modified ASTM D974-08, modification due to small sample size.
25. Refrigerant Breakdown was analyzed per AHRI 700-2011 and Appendix C &D-2008

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Sample Tube	Lubricant Volume (ml)	Refrigerant Volume (ml)
134a CNT1	1.0	1.0
134a CNT2	1.0	1.0
134a CNT3	1.0	1.0
134a T1	1.0	1.0
134a T2	1.0	1.0
134a T3	1.0	1.0
22 CNT1	1.0	1.0
22 CNT2	1.0	1.0
22 CNT3	1.0	1.0
22 T1	1.0	1.0
22 T2	1.0	1.0
22 T3	1.0	1.0

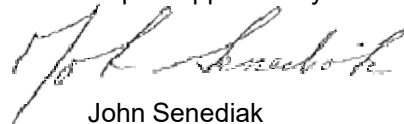
CONCLUSION: This report concludes the evaluation of MaxR100 Products #9611, #9666, and #9667 per ANSI/ASHRAE 97 Issue: 2007/06/27 Sealed Glass Tube Method to Test the Chemical Stability of Material for Use within Refrigerant Systems. The results from this evaluation are outlined in the following tables.

Test Performed by:



Karen Gramke
Lab Technician II
Analytical Laboratory

Report Approved by:



John Senediak
Senior Chemist
Analytical Laboratory

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Table 1
Calibrated Equipment

Item	Equipment Type	Equipment #	Cal. Due Date
1	Digital Manometer	CE2332	11/19/14
2	Manifold	CE2223	Initial Calibration
3	R-134A	MC121389742	N/A
4	Syringe	N/A	Reference Only
5	Oven	CE2349	9/11/14
6	Digital Thermometer	CE2357	12/2/14
7	Gas Chromatograph	CE1104	Verify Before Use
8	ICP	CE2100	Verify Before Use
19	Analytical Balance	CE1017	8/20/14
10	Burette	CE2032	Initial Calibration
11	Balance	CE1017	8/20/14
12	KOH	Lot#13013TE	n/a
13	Indicator	Lot#122094	5/2014
14	Toluene	Lot#127736	n/a
15	IPA	Lot#C359064	n/a
16	Temperature/Humidity	E227	3/13/14
17	Digital Thermometer	CE2015	9/11/14
18	Oven	CE2277	9/23/14
19	Data Logger	CE2138	11/27/13*
20	R-22	RMSG121389744	N/A
21	GC	CE1100A	Verify Before Use

*Temperature was verified with CE 2015 due to expired calibration of CE2138 Data Logger.

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Table 2
Results, Visual Inspections

Tube ID	Refrigerant	Visual Inspection, liquid phase	Visual Inspection Cu Coupon	Visual Inspection Al Coupon	Visual Inspection Steel Coupon	Observations
134a CNT 1	R-134a	1a	0	0	0	Liquid was slightly discolored and immiscible with no precipitate. All metals were shiny with no tarnish.
134a T1-001 #9666	R-134a	1a, 1b	0	0	0	Liquid was slightly discolored and immiscible with no precipitate. All metals were shiny and untarnished.
134a T1-002 #9667	R-134a	1a, 1b	0	0	0	Liquid was slightly discolored and immiscible with no precipitate. All metals were shiny and untarnished.
R-22 CNT 1	R-22	0	0	0	0	Liquid was clear, miscible, and colorless with no precipitate. All metals were shiny with no tarnish.
R-22 T1-003 #9611	R-22	1a	0	0	0	Liquid was clear, miscible, and slightly yellow with no precipitate. All metals were shiny with no tarnish.

Liquid Phase Visual Inspection Legend

10 =No change 11a = Slight darkening 11b = Cloudy 1a 12a = Moderate darkening 12b = Cloudy 2a
13a = Extreme darkening 13b = Cloudy 3a 14a = Opaque

Steel Coupon Visual Inspection Legend

10 =No change 11 = Slight darkening 12 = Slight discoloration 13 = Moderate copper plating 14 = Heavy copper plating

Copper and Aluminum Visual Inspection Legend

10 =No change 11 = Slight tarnish 12 = Slight corrosion 13 = Moderate corrosion 14 = Heavy corrosion

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Table 3
Change in Chemical Properties of Refrigerant and Lubricant

Tube ID	Refrigerant	Total Acid Number (mgKOH/g)	Refrigerant Decomposition (mass%)	Dissolved Al (ppm)	Dissolved Cu (ppm)	Dissolved Fe (ppm)
134a T1 001-#9666	R-134a	0.29-0.45*	N/A	N/A	N/A	N/A
134a T1 002-#9667	R-134a	0.29-0.67*	N/A	N/A	N/A	N/A
R-22 T1 003-#9611	R-22	<0.01	<0.05	<1	<1	<1

*These values are reported as a range based on the analysis of multiple samples. Values for test samples were lower than those of the control indicating a favorable outcome for SAE J2670 criteria.

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PHOTOS



R-134a cnt v 001



R-134a cnt v 002



R-22 cnt v 003

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