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Sealed Tube Comparisons of the Compatibility of Desiccants with Refrigerants and Lubricants

Final Report

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I. Abstract

Continuing environmental concerns mandate replacement of CFC's with alternate refrigeration fluids. Until now, relatively little testing had been reported in the literature for compatibility of desiccants in these new working fluids. Using bench scale test methods generally accepted throughout the industry today, this work provides data necessary to assess the compatibility of virtually all of the currently used desiccant types - both bead and molded core, with thirteen refrigerant/lubricant combinations. The desiccants have been tested by exposure to refrigerant and lubricant in sealed, glass tubes in accordance with ASHRAE/ANSI Standard 97-1989. After aging, the liquid phase was evaluated for acid anion formation, change in color, and presence of halide ions, the gas phase was analyzed for refrigerant decomposition by gas chromatography, and the desiccants were evaluated for changes in crush strength and for retention of acids and halide ions. Metal catalysts, also present in the sealed tubes, were visually examined for corrosion, copper plating, and appearance changes.

II. Scope

This project determines the compatibility of sixteen desiccants in thirteen refrigerant/lubricant combinations using bench-scale sealed tube tests. There are eight desiccant categories, as shown in Table II.1. In each category samples have been obtained from two suppliers to yield a total of sixteen desiccants. There are ten refrigerants and four lubricants combined to give the thirteen combinations shown in Table II.2. The tests are conducted with two levels of moisture - less than fifty parts per million moisture and at one thousand parts per million moisture.

Table II.1. Desiccants Under Study

1. 4A Molecular Sieve
2. 3A Molecular Sieve
3. Alumina
4. Silica Gel
5. Core type with Carbon
   - 10 to 25% molecular sieve type 3A
   - Alumina
   - 5 to 15% carbon
   - 10 to 20% phosphate binder
6. Core type with Carbon
   - 10 to 25% molecular sieve type 4A
   - Alumina
   - 5 to 15% carbon
   - 10 to 20% phosphate binder
7. Core Type without Carbon
   - 15 to 30% molecular sieve type 3A
   - Alumina
   - 10 to 20% phosphate binder
8. Core Type without Carbon
   - 15 to 30% molecular sieve type 4A
   - Alumina
   - 10 to 20% phosphate binder

Table II.2. Refrigerant/Lubricant Combinations Under Study

1. R-11 with naphthenic mineral oil
2. R-12 with naphthenic mineral oil
3. R-22 with naphthenic mineral oil
4. R-123 with naphthenic mineral oil
5. R-134a with penta erythritol mixed acid polyolester lubricant
6. R-134a with penta erythritol branched acid polyolester lubricant
7. R-152a with alkylbenzene lubricant
8. R-32 with penta erythritol mixed acid polyolester lubricant
9. R-32 with penta erythritol branched acid polyolester lubricant
10. R-124 with alkylbenzene lubricant
11. R-125 with penta erythritol mixed acid polyolester lubricant
12. R125 with penta erythritol branched acid polyolester lubricant
13. R143a with penta erythritol branched acid polyolester lubricant

III. Methodology

A. Sample Preparation

The test tubes were cleaned by rinsing first with deionized water, followed by two rinses with methanol and one rinse with toluene. The tubes were then dried at 175°C. Cleaned tubes were kept dry in desiccators prior to use.

Lubricants were tested for moisture and dried by evacuation to below 50ppm prior to use. Refrigerants were tested for moisture content prior to use. Those high in moisture were rejected and replaced. No attempts were made to dry the refrigerants on-site.

The metal catalyst coupons were prepared by punching 3.3x19.3mm coupons from thin sheet. The coupons were held together by aluminum wire such that the steel and copper were separated by the aluminum. These prepared coupons were thoroughly cleaned and kept dry prior use.

The desiccant samples were activated at 260°C (500°F) for four hours prior to sealing in the tubes. Desiccant samples in bead form were weighed to within one bead of 0.5 gram. Core type desiccants were cut into small pellets prior to drying. Three, or more, pellets were chosen and weighed to yield the specified 0.5 gram.

B. Tube Preparation and Aging

First, the desiccant and metal catalysts coupon were placed in the tube. A small wad of glass wool was inserted on top of the desiccant to keep the lubricant and desiccant from violently boiling from the tube when later opened for analysis. The tube was then necked down to a size through which a standard cannula could fit. Next the 1.0 cc of lubricant was added accurately using a syringe and cannula. The tube was then evacuated to 30 microns followed by accurate charging with refrigerant, and moisture if required, using a calibrated gas handling system. Finally, the tube neck was sealed

and annealed. This procedure minimizes oil contamination of the seal area, and most importantly, produces a minimally stressed glass seal which can better withstand the high pressure encountered at the aging temperature. Three tubes were made for each moisture condition, desiccant, and refrigerant/lubricant combination.

The sealed tubes were placed in drilled holes in large aluminum blocks which were heated in air circulating ovens for 28 days. The aluminum blocks served two purposes. The first was safety. Had any tube broken at elevated temperature, the aluminum block would contain the pieces. Secondly, the large mass of the blocks provided stable temperature environments for the tubes during the aging period. Tubes containing R-11 and R-123 were aged at 105°C. Tubes containing any of the other refrigerants were aged at 149°C. Initial tests with R-11 and R-123 at 149°C resulted in nearly complete decomposition of the refrigerants producing extremely high pressures and black tar from what had been clear mineral oil.

C. Analysis

1. Visual Inspection

Visual inspections were made on each tube after fourteen days and after 28 days of aging. The lubricant in each tube was compared to standard liquid color references, which give a numerical value for the amount of color change from water white to jet black. Similarly, changes in presence of solid particulates, and formation of copper plating was noted and scaled numerically. Also noted and recorded was the appearance of the metal catalysts and the desiccant. For permanent record, the tubes were video taped after aging.

2. Refrigerant Decomposition

GC analyses were performed on a Gow-Mac Series 550P Thermal Conductivity Detector instrument using a Poropak "Q" column of 2.44 m (8') length. Gas samples were injected through a six-way Valco gas sample valve. Aged sealed tubes to be analyzed were connected to the gas handling manifold with a "tube breaker" assembly. After freezing of the tube contents in liquid nitrogen, the tube tips (scratched with a sharp file) were broken off. The tubes were then warmed slowly and all volatile tube contents were expanded into the manifold, which has a free volume of 1058 ml (64.4 in^3). A sample of gas from this volume was injected through the sample valve into the GC column. The vapor pressure of the gas sample normally was in the 100 to 200 millitorr range, depending on the vapor pressure of the test refrigerant.

The column was operated under the following conditions:

Column and injector temperatures: 120^oC
Detector temperature: 200^oC
Detector current: 150 mA
Carrier gas: Helium
Gas flow rate: 27 ml/min.
Sample size: 500 microliter

GC results, i.e. peak retention times, peak areas, and peak heights for each measurable peak in a chromatogram, were obtained on an AI 450 Digital integrator from Dionex. GC elution peaks of

known identities have been reported by their chemical designations, while those unknown to us have been referred to by their peak retention times. Percent decomposition was calculated by peak area ratios. This method assumes the detector has equivalent sensitivity to all the species of interest. Additional peaks appeared in some chromatograms from decomposition of the lubricant - species such as CO and CO_2. These species were not considered as refrigerant decomposition products and not included in calculations of percent refrigerant decomposition. It is evident that many of the refrigerant decomposition products have retention times very close to those for non-condensible gases and for CO_2. In these cases the estimate of refrigerant decomposition was grossly underestimated. However, relative refrigerant decomposition can be obtained from halide concentrations in the lubricant and desiccant.

3. Lubricant Total Acid Number

The total acid number was determined for the lubricant in one tube from each group of three. The procedure used follows that for ASTM 664. The method was modified to accommodate the small 1cc sample size from the sealed tubes by reducing the alcoholic KOH titrant concentration from 0.1 Normal to 0.01 Normal. This yielded sufficient sensitivity to determine acid numbers down to 0.1 with the 1cc sample size.

4. Halide Ions and Acid Anions

Anion concentrations were determined for the tube liquid phase and desiccant by ion chromatography (IC). After aging, the liquid and vapor phase of one tube was separated from the desiccant. The desiccant was washed with hexane. This hexane wash was added to the liquid phase from the tube, which was then extracted in 30cc of deionized water for 24 hours. The washed desiccant was extracted in another 30cc of deionized water. The aqueous phases from these two extractions were then analyzed by IC for fluoride ion, chloride ion, organic anions (such as formate, acetate, butyrate) and inorganic anions (such as nitrate, sulfate). Concentrations of the various anions were obtained by calibrating the ion chromatograph with standard solutions so that the peak area was proportional to the anion concentration.

In the development of this method, acidic and basic aqueous solutions were studied as extractants. Both caused degradation of some unaged lubricants producing the very same acid anions that are produced by aging. Also, methanol was tried as an extractant, but this produced severe interference in the IC chromatogram. Methanol elutes from the IC column in a very broad peak covering most of the time period that the anions of interest elute.

The only reason for considering alternate extractants was for cases where water would not effectively extract the anions of interest. To determine if water was an effective extractant. A sample of lubricant was doped with hexanoic acid. The doped lubricant was extracted with deionized water and the aqueous phase from the extraction was analyzed for hexanoate anion. The method yielded a concentration representing 85% of the total hexanoic acid that was originally added to the lubricant. Of the anions of interest in this study, hexanoic acid is one of the least water-soluble and least sensitive anions to the IC detector. Based on these results, deionized water was considered to be satisfactory for extraction of these samples.

5. Desiccant Crush Strength

Desiccant crush strength was determined on freshly activated material and then on material that had been aged. The change in crush strength was of most importance. For bead type materials, the crush strength was determined for at least ten individual beads, with the average and ~95% confidence (2δ) limits reported. For core type desiccants fewer pieces were used in each tube. Consequently, the statistical data is not as good as that for the bead desiccants. The method utilized a digital force gauge which displayed peak force achieved while the specimen was slowly pressed between two parallel plates. It is recognized that this technique is limited. It does not distinguish between two close contenders for instance. It does, however, point out gross losses in structural integrity of the desiccant, which could possibly render it a system contaminant.

D. Distribution of Tests Between Sealed Tubes

Table III.1 below shows which of the analyses was conducted on each of the three tubes in a group. The reasoning behind this distribution resulted from the nature of the tests and the condition of the specimens after the tests. For example, the test for Total Acid Number, shown for tube #3 in the table below, completely consumed the tube contents. Thus, no other analyses could be performed with the contents of this tube.

Table III.1. Distribution of Tests Between Sealed Tubes.

Test	Tube #1	Tube #2	Tube #3
Visual Inspection	✓	✓	✓
Desiccant Crush Strength	✓		
GC Refrigerant Decomposition	✓		
Lubricant Total Acid Number			✓
Liquid Phase Halide Ion/Acid Anion		✓	
Desiccant Halide Ion/Acid Anion		✓	

IV. Data For As-Received Materials

A. Desiccants

As mentioned above, there were 8 categories of desiccants studied in this work. In each category one sample from two suppliers was obtained. Table IV.1 lists the desiccants obtained along with the manufacturer's published contents, and the desiccant code letter that is used throughout this report to identify the various desiccants.

After completion of some of the preliminary tests to develop methods for this work, it was discovered that many of the desiccants contained appreciable levels of fluoride and chloride ion. Consequently, each desiccant was tested for anion concentration in the "as-received" state. Table IV.1 includes the anion concentrations found for each desiccant. This information is repeated in the "Summary Test Results" tables in Section V below.

Table IV.1 Desiccant Specifications

Code	Desiccant Type	Published Contents		Anions Found		Crush Strength
A	4A Molecular Sieve	4A zeolite $MgAl(SiO_2)$ 23-15% Quartz	75-85% 2-0%	Fluoride Chloride Heptanoate Sulfate	190 ppm 15 ppm 1740 ppm 160 ppm	17.3 lbs
E	4A Molecular Sieve	AL_2O_3 Na_2O SiO_2 MgO	<30% <30% <50% <5%	Fluoride Chloride Heptanoate Sulfate	10 ppm 11 ppm 430 ppm 100 ppm	30.9 lbs
F	3A Molecular Sieve	3A zeolite $MgAl(SiO_2)$ 23-15% Quartz	75-85% 2-0%	Fluoride Chloride Heptanoate Sulfate	160 ppm 23 ppm 1260 ppm 410 ppm	20.0 lbs
H	3A Molecular Sieve	AL_2O_3 K_2O Na_2O SiO_2 MgO	<40% <15% <30% <50% <5%	Fluoride Chloride Heptanoate Sulfate	18 ppm 4 ppm 184 ppm 260 ppm	34.6 lbs
I	Alumina	AL_2O_3 Fe_2O_3 Na_2O SiO_2	93.6% 0.02% 0.35% 0.02%	Fluoride Chloride Formate Acetate	2 ppm 59 ppm 110 ppm 3760 ppm	11.9 lbs
J	Alumina	AL_2O_3 Fe_2O_3 Na_2O SiO_2	90+% <0.1% <0.6% <0.2%	Fluoride Chloride Formate Acetate Heptanoate Sulfate	7 ppm 56 ppm 64 ppm 91 ppm 240 ppm 17 ppm	22.6 lbs
K	Silica Gel	$SiO_2.xH_2O$	>95%	Fluoride Chloride Sulfate	3 ppm 14 ppm 47 ppm	76.4 lbs
L	Silica Gel	$SiO_2.xH_2O$	>95%	Fluoride Chloride Sulfate	14 ppm 22 ppm 860 ppm	22.9 lbs
M	Core type with Carbon and 3A molecular sieve	3A zeolite Carbon Phosphate Binder	22% 4% 17%	Fluoride Chloride Sulfate	9 ppm 71 ppm 427 ppm	4.9 lbs
N	Core type with Carbon and 3A molecular sieve	3A zeolite Carbon Phosphate Binder	9% 19% 27%	Fluoride Chloride Sulfate	8 ppm 110 ppm 672 ppm	4.9 lbs
T	Core type with Carbon and 4A molecular sieve	4A zeolite Carbon Phosphate Binder	19% 28% 19%	Fluoride Chloride Sulfate	22 ppm 98 ppm 768 ppm	7.3 lbs
V	Core type with Carbon and 4A molecular sieve	4A zeolite Carbon Phosphate Binder	8% 26% 15%	Fluoride Chloride Sulfate	4 ppm 110 ppm 1,388 ppm	6.3 lbs
W	Core Type No Carbon and 3A molecular sieve	3A zeolite Phosphate Binder	10% 18%	Fluoride Chloride Sulfate	13 ppm 85 ppm 92 ppm	4.0 lbs
X	Core Type No Carbon and 3A molecular sieve	3A zeolite Phosphate Binder	20% 15%	Fluoride Chloride Sulfate	1 ppm 48 ppm 168 ppm	6.8 lbs
Y	Core Type No Carbon and 4A molecular sieve	4A zeolite Phosphate Binder	15% 13%	Fluoride Chloride Sulfate	14 ppm 71 ppm 126 ppm	6.1 lbs
Z	Core Type No Carbon and 4A molecular sieve	4A zeolite Phosphate Binder	17% 13%	Fluoride Chloride Sulfate	45 ppm 54 ppm 223 ppm	3.8 lbs

B. Refrigerants

As-received refrigerants were tested for moisture content by Karl-Fisher titration and for impurities by Gas Chromatography. Table IV.2 lists the refrigerants with their moisture content and the GC detected impurity peak-area percents and retention times, if any. "NCG" indicates all non-condensible gases.

Table IV.2 As-Received Refrigerant Properties

		GC Peaks	
Refrigerant	Moisture Content	Peaks Found	Peak Area Percents
R-11	5 ppm	0.37 NCG 9.20 R-11	1.1% 98.9%
R-12	<1 ppm	0.32 min NCG 1.98 min R-12	0.5% 99.5%
R-22	<1 ppm	0.33 NCG 1.52 R-22	0.2% 99.8%
R-32	2 ppm	0.37 NCG 0.73 R-32 1.43 Unkn	0.2% 99.4% 0.4%
R-123	36 ppm	0.37 NCG 13.35 R-123	0.8% 99.2%
R-124	16 ppm	1.25 R-134a 2.78 R-124	0.1% 99.9%
R-125	<1 ppm	0.38 NCG 1.05 R-125	0.1% 99.9%
R-134a	8 ppm	0.33 NCG 1.28 R-134a	0.2% 99.8%
R-143a	46 ppm	0.35 NCG 1.05 R-143a 1.55 Unkn	0.1% 99.7% 0.2%
R-152a	4 ppm	0.35 NCG 1.37 R-152a	0.2% 99.8%

C. Lubricants

Lubricants were tested for acid number, ion concentration, and moisture content. These properties are listed in table IV.3 below for the four lubricants used in this work. All lubricants were dried to less than 30 ppm moisture before using. The moisture values listed below are for the lubricants "as-received". Moisture content was determined by Karl-Fischer titration.

Table IV.3 Lubricant Properties

Lubricant	Moisture Content	Total Acid Number	Species Found
Naphthenic Mineral Oil	18 ppm	<0.1	Tin 9 ppm Phosphorus 14 ppm Zinc 2 ppm
Alkylbenzene	51 ppm	<0.1	Aluminum 1 ppm Lead 1 ppm
penta erythritol mixed acid polyolester	366 ppm	<0.1	Tin 9 ppm Phosphorus 17 ppm Antimony 13 ppm Pentanoate 4 ppm
penta erythritol branched acid polyolester	162 ppm	0.1	Acetate 0.07 ppm Formate 0.005 ppm Pentanoate 0.6 ppm

V. Test Results

Test results are tabulated in appendices at the end of this report. The results are organized by desiccant type in individual appendices which are identified with the same letter designations used throughout this report. In short the results for desiccant "E" are in appendix "E", and those for desiccant "T" are in appendix "T". In each appendix there is a one page summary sheet with statistical data on the crush strength, ppm concentrations of each organic acid anion found, and peak areas and retention times for each GC peak found. Please read the "Code Key For Test Results" for information necessary to decipher the data in the "Summary Test Results" tables. Following are brief, "overall", comments for each of the eight desiccant types.

4A Molecular Sieve (See Appendices A and E)

Both desiccants performed the same in ability to contain the various anions. Desiccant A, however, started out with a significantly higher concentration of fluoride ion, and consequently, shows higher concentrations after aging. The crush strength for sample E was almost twice that of sample A, and this difference remained in effect after aging in the various environments. Crush strength was reduced the most after aging in R-32. Both desiccants contained high levels of fluoride ion and

organic anions after aging in R-32. Both desiccants contained high levels of chloride ion after aging with R-22.

3A Molecular Sieve (See Appendices F and H)
Sample F started out with higher fluoride ion content than did sample H. This difference persisted after aging in the various environments. Sample F allowed higher levels (40-50 ppm) of fluoride ion in the liquid phase for R-12 and R-22 than did any of the other molecular sieve desiccants. Crush strength for sample H was double that for sample F. Both desiccants contained high concentrations of chloride ion after aging with R-22. Both of these 3A molecular sieves showed high reactivity with R-32. The evidence for this is consistent in total acid number, and anion analysis results.

Alumina (See Appendices I and J)
The surprisingly low crush strength for sample I is due to the small bead size for the sample. Whereas the other bead desiccants are nominal 1/8" in diameter, this material is only 1/16" diameter. These desiccants also caused high reactivity with R-32.

Silica Gel (See Appendices K and L)
These materials, when new, had low concentrations of anions. The difference in crush strength for the two materials (at 76 and 23 pounds) was the highest for any desiccant type. When aged with R-134a, these desiccants released high concentrations of organic acid anions to the lubricant.

3A Core with Carbon (See Appendices M and N)
These desiccants retained most of the fluoride and chloride ion concentration produced in the aging environment. The fraction of organic anion released to the lubricants compared to that retained was quite high for both desiccants in many refrigerants. Total acid numbers were high for cases where the desiccant was aged in R-134a, R-32 and R-125. Corrosion of the steel coupon was just about universal for these desiccants, and white gel-like solids formed in some cases. Darkening of the desiccant was also common.

4A Core with Carbon (See Appendices T and V)
As with the desiccants M and N above, these desiccants retained most of the fluoride and chloride ion concentration produced in the aging environment. The fraction of organic anion released to the lubricants compared to that retained was again quite high for both desiccants in many refrigerants. Total Acid Numbers were high when aged in R-134a and R-32. And again, corrosion of the steel coupon was almost universal.

3A Core without Carbon (See Appendices W and X)
Levels of fluoride and chloride produced in the presence of these desiccants were high with some refrigerants - especially R-22 and R-32. Lubricant acid numbers were again very high when R-32 was present. Also acid numbers were high for R-134a and R-125. The POE lubricants produced high levels of organic anions in the presence of these desiccants. Crush strengths of these desiccants were not reduced after aging in any of the environments. Steel corrosion was also prevalent for these desiccants.

4A Core without Carbon (See Appendices Y and Z)
Results for these desiccants were similar to those for the other core desiccants. Halide ion concentrations were again high for cases involving R-32 and R-22. Steel corrosion was high for these desiccants. And again, acid numbers were high for cases with R134a and R-125 and very high when R-32 was present. Also, the POE lubricants produced very high levels of organic anions when aged in the presence of these desiccants.

Video Tapes
Four video tapes with combined length of approximately eight hours were produced during the course of this investigation. The tapes show the condition of the tube contents after aging and before analysis. Attempts were made to reveal the color of the lubricant, the color of the desiccant, the surface appearance of the metals and the presence of any solid residues after aging. The tapes are arranged by refrigerant/lubricant combination. Each tube, or pair of tubes, was taped for one minute. following the order used throughout this report (Desiccant A, E, F, H, I, J, K, L, M, N, T, V, W, X, Y, and Z). The tapes are standard VHS with NTIS format, playable on any domestic video cassette recorder. These tapes are available upon request on a loan basis from the ***Air-Conditioning and Refrigeration Technology Institute***.

VI. Conclusions

Following are some general trends in the data that developed during the course of this investigation.

1. The addition of 1000 ppm moisture to the sealed tubes produced no significant difference in the test results, as compared to those tests conducted with only 50 ppm moisture.

2. For the molecular sieve desiccants, comparison of the anion analyses of the liquid and solid phases reveals that the desiccant solid phase contains most of the fluoride and chloride. This trend does not hold for all cases when the alumina and silica gel desiccants were present either alone or as part of a core desiccant.

3. The desiccants do not perform as well in retaining the organic anions as they do for the inorganic anions. For refrigerants R-134a, R-152a, R-32, R-125 and R-143a, the concentration of organic anion in the liquid is sometimes higher than that in the desiccants.

4. All of these desiccants contained chloride and fluoride ions when received. Sulfate ion was also present on most of the desiccants. Other anions detected on new desiccants were acetate, formate, and an unknown organic anion, which is possibly heptanoate.

5. For most refrigerants, the bead desiccant crush strengths were reduced by about 20% after aging. The addition of 1000 ppm moisture to the environment caused no greater change in crush strength than that observed for the desiccants aged at 50 ppm moisture. R-32 caused significant reductions in crush strength for all of the bead desiccants except for the alumina samples. There was no loss in crush strength for the core desiccants.

6. All of the desiccants tested show high reactivity when aged with R-32. Increased total acid number, high refrigerant decomposition, high fluoride ion concentrations, and organic anion concentrations all attest to this.

7. Steel corrosion is prevalent when the core type desiccants are aged with POE lubricants.

8. In consideration of all of these results, it should be noted that the aging was conducted at 149°C. In most actual applications, desiccants are located in the refrigerant systems where temperatures rarely reach 100°C. Thus, many of the reactions seen here may not occur in actual systems operating at much lower temperatures.

Compliance with Agreement

The tasks specified in the Work Statement for this project have been completed. 16 desiccants (2 samples for each of 8 desiccant types) have been exposed to 10 refrigerants and 4 lubricants (13 refrigerant/lubricant combinations) and two mositure levels for 30 days at 149°C in triplicate sealed glass tubes. This yielded a total of 416 material combinations and 1248 sealed tubes. After aging the tube contents were analyzed with four methods to reveal changes in the desiccants, refrigerants, lubricants, and metals. The collective results of these analyses are presented in sixteen Summary Results tables - one for each desiccant. Supporting each Summary Results table are three tables that list all of the crush strength data, every gas chromatography peak, and every ion chromatography peak observed during this investigation. In all there are over 16,500 data points presented in the 64 data tables.

Principal Investigator Effort

Dr. Jay E. Field, the principal investigator, applied 35% of his time during the course of this investigation, obtaining materials, directing research technicians, organizing and summarizing results, preparing presentations, and writing reports.

Code Key For Summary Test Results Tables

Liquid Color

Colors follow ASTM Standard D1500. However, 8 mm internal diameter is much less than that specified. Therefore, colors "0" through "2" appear the same. The first number listed is the color before aging and the second number is the color after aging.

- 2.0 Water clear
- 2.5 Very Faint Yellow
- 3.0 Pale Yellow
- 3.5 Light Yellow
- 4.0 Yellow
- 4.5 Yellow-Orange
- 5.0 Light Orange
- 5.5 Orange
- 6.0 Orange-Brown
- 6.5 Brown
- 7.0 Dark Brown
- 7.5 Brown-Black
- 8.0 Black

Desiccant Color

- 0 No change
- 1 Darker
- 2 Very Dark
- 3 Black

Copper Plating

- 0 none
- 1 spots on edges
- 2 edges covered
- 3 spots on surface
- 4 Partially coated surface
- 5 Fully coated surface

Solids Formation

- 0 None
- 1 small amount
- 2 medium amount
- 3 heavy amount

Steel Corrosion

- 0 None
- 1 Spot darkening
- 2 Complete darkening
- 3 Pitting or coating

Crush Strength

The value entered is the average Crush Strength in pounds.

GC % Refrigerant Reacted

Based on peak area ratios for largest decomposition product detected.

Total Acid Number

mg of KOH per gram of oil.

F ion in Liquid

The ppm by weight for the concentration of F ion in the liquid phase from the aged tube.

F ion on Desiccant

ppm based on weight of desiccant.

Cl ion in Liquid

The ppm by weight for the concentration of Cl ion in the liquid phase from the aged tube.

Cl ion on Desiccant

ppm based on weight of desiccant.

Organic Acid in Liquid

Sum of the ppm results for all organic anions found in the liquid phase from the aged tube

Organic Acid on Desiccant

Sum of the ppm results for all organic anions found based on the desiccant weight.

Appendix A

Desiccant A: 4Å Molecular Sieve

Table A.1. Summary Test Results

Desiccant; A - 4Å Molecular Sieve

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid In Liquid (ppm)	Org Acid on Desic (ppm)
A-New	None	2.5	0	-	-	-	17.3	-	-	-	190	-	15	-	0
	50 ppm Moisture														
A-11	R11/mineral oil	3.5	2	0	0	2	9.3	0.0	0.2	4	130	63	140	41	24
A-12	R12/mineral oil	4.0	1	0	0	0	13.3	0.00	<0.1	4	670	28	1,560	4	570
A-13	R22/mineral oil	3.5	2	0	0	1	17.0	0.00	<0.1	6	3,680	370	50,000	0	7,750
A-14	R123/mineral oil	4.5	1	0	0	0	16.7	0.88	<0.1	1	230	48	720	4	8
A-15	R134a/ mixed ester	2.5	1	0	0	0	14.7	0.00	0.5	0	85	0	0	2,310	9,120
A-16	R134a/branched ester	2.5	0	0	0	0	17.4	0.00	0.4	0	92	3	32	1,240	6,090
A-17	R152a/alkylbenzene	4.0	2	0	0	0	5.7	1.24	<0.1	2	3,140	0	0	2,210	1,300
A-18	R32/mixed ester	3.0	2	0	0	1	9.2	0.55	5.6	4	5,340	5	18	11,630	6,070
A-19	R32/branched ester	2.5	0	0	0	0	8.6	0.20	1.2	6	6,960	6	19	4,460	13,800
A-20	R124/alkylbenzene	3.0	0	0	0	0	15.6	0.41	<0.1	1	160	9	120	6	3,070
A-21	R125/mixed ester	2.5	0	0	0	0	12.3	0.00	<0.1	1	130	4	15	1,840	11,500
A-22	R125/branched ester	2.5	0	0	0	0	12.6	0.00	0.1	1	100	3	18	730	8,080
A-23	R143a/branched ester	2.5	0	0	0	0	12.1	0.00	0.3	0	75	5	50	810	4,510
	1000 ppm Moisture														
A-41	R11/mineral oil	4.5	2	0	0	2	14.0	0.00	0.1	4	330	64	2,540	15	66
A-42	R12/mineral oil	4.0	1	0	0	0	13.1	0.00	0.1	2	1,240	21	1,390	10	820
A-43	R22/mineral oil	3.5	2	0	0	1	20.1	0.00	<0.1	12	3,830	570	51,700	0	7,870
A-44	R123/mineral oil	4.5	1	0	0	0	14.6	0.68	<0.1	1	260	23	840	4	31
A-45	R134a/ mixed ester	2.5	1	0	0	0	11.1	0.00	0.5	0	84	0	11	1,950	8,880
A-46	R134a/branched ester	2.5	0	0	0	0	12.8	0.00	0.3	0	74	1	32	430	6,390
A-47	R152a/alkylbenzene	4.0	2	0	0	0	4.8	1.30	0.2	1	2,420	0	36	2,060	1,210
A-48	R32/mixed ester	3.0	2	0	0	1	8.8	0.42	4.6	0	5,840	3	18	12,410	6,800
A-49	R32/branched ester	2.5	0	0	0	0	7.2	0.48	1.4	6	4,130	0	32	3,360	17,900
A-50	R124/alkylbenzene	3.0	0	0	0	0	14.4	0.35	<0.1	1	280	11	110	18	2,860
A-51	R125/mixed ester	3.0	0	0	0	0	13.1	0.00	<0.1	1	80	6	25	2,760	6,700
A-52	R125/branched ester	2.5	0	0	0	0	11.0	0.00	0.1	1	110	6	17	1,300	9,000
A-53	R143a/branched ester	2.5	0	0	0	0	9.8	0.00	0.6	0	95	8	35	2,030	10,200

Table A.2. Crush Strength Test Results

Desiccant: A - 4Å Molecular Sieve

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
A-New	None	13.0	17.3	25.9	14.4	16.4	13.6	17.7	21.0	15.5	18.6	10.0	17.3	3.9	25.1	9.6
						50 ppm Moisture										
A-11	R11/mineral oil	10.2	10.6	13.1	8	4.9	10.9	9.8	9.9	8.7	6.8	10.0	9.3	2.3	13.9	4.7
A-12	R12/mineral oil	14.5	15.9	12.1	10.8	12.9	11.4	12.6	16.4	10.8	15.1	10.0	13.3	2.1	17.4	9.1
A-13	R22/mineral oil	16.9	13.6	14.5	16	21.6	13.8	14.8	29.9	14.2	14.2	10.0	17.0	5.1	27.2	6.7
A-14	R123/mineral oil	28.0	18.7	11.7	15.3	14.9	22.5	16.4	11.5	13.7	14.0	10.0	16.7	5.2	27.0	6.4
A-15	R134a/ mixed ester	14.4	20.2	10.2	13	16.1	11.8	14.5	20.4	13.4	13.4	10.0	14.7	3.3	21.4	8.1
A-16	R134a/branched ester	18.5	12.1	18.5	19.9	15.7	16.7	24.0	18.7	13.5	16.5	10.0	17.4	3.4	24.1	10.7
A-17	R152a/alkylbenzene	8.9	2.7	3.1	7.5	7.0	6.7	3.5	5.0	6.9	6.1	10.0	5.7	2.1	9.9	1.6
A-18	R32/mixed ester	13.5	6.0	9.7	9.9	6.6	8.3	9.4	7.3	9.8	11.4	10.0	9.2	2.3	13.7	4.7
A-19	R32/branched ester	9.4	4.3	8.5	6	11.8	10.5	7.4	8.8	11.2	8.2	10.0	8.6	2.3	13.2	4.0
A-20	R124/alkylbenzene	14.0	18.3	24.2	10.6	21.0	12.0	11.9	14.0	17.4	12.9	10.0	15.6	4.4	24.5	6.7
A-21	R125/mixed ester	11.6	18.8	14.8	11.2	11.7	13.8	11.8	11.0	13.3	5.1	10.0	12.3	3.5	19.2	5.4
A-22	R125/branched ester	10.7	15.2	11.3	12.3	10.1	10.8	15.1	10.7	13.7	15.9	10.0	12.6	2.2	17.0	8.2
A-23	R143a/branched ester	14.5	7.9	13.0	14.3	12.1	15.3	7.0	12.6	12.6	11.8	10.0	12.1	2.7	17.5	6.7
						1000 ppm Moisture										
A-41	R11/mineral oil	17.6	14.1	11.9	14.3	17.0	11.0	11.3	12.9	16.2	14.0	10.0	14.0	2.3	18.7	9.4
A-42	R12/mineral oil	13.5	13.3	9.6	16.2	10.1	9.1	10.8	14.6	25.4	8.1	10.0	13.1	5.1	23.2	2.9
A-43	R22/mineral oil	18.8	15.6	18.3	18.2	18.5	28.8	24.1	25.2	16.4	16.8	10.0	20.1	4.4	28.9	11.3
A-44	R123/mineral oil	23.1	13.9	10.2	16.5	17.6	13.7	13.4	14.0	11.5	12.4	10.0	14.6	3.7	22.0	7.3
A-45	R134a/ mixed ester	11.1	8.1	9.0	6.8	8.4	9.7	13.1	13.2	15.1	16.3	10.0	11.1	3.2	17.5	4.7
A-46	R134a/branched ester	9.6	16.4	18.7	10.5	16.1	13.1	8.5	12.8	10.5	11.8	10.0	12.8	3.3	19.4	6.2
A-47	R152a/alkylbenzene	4.6	6.4	3.8	1.8	3.9	8.3	3.9	6.5	4.9	4.0	10.0	4.8	1.8	8.5	1.2
A-48	R32/mixed ester	6.7	9.2	8.8	7.1	8.8	9.0	8.5	12.3	9.7	8.0	10.0	8.8	1.5	11.9	5.7
A-49	R32/branched ester	6.8	5.8	6.6	12.9	7.7	8.0	5.2	3.1	7.0	8.8	10.0	7.2	2.6	12.3	2.1
A-50	R124/alkylbenzene	15.7	18.4	17.8	16	15.9	11.4	9.3	15.6	14.7	9.2	10.0	14.4	3.3	21.0	7.8
A-51	R125/mixed ester	5.5	10.4	13.7	17.5	13.0	16.6	20.8	14.3	11.6	8.0	10.0	13.1	4.5	22.2	4.0
A-52	R125/branched ester	8.5	10.3	11.3	11.7	17.0	9.2	13.2	10.1	6.9	11.4	10.0	11.0	2.8	16.5	5.4
A-53	R143a/branched ester	12.3	12.5	8.6	9.9	9.8	12.1	6.8	7.9	8.1	10.3	10.0	9.8	2.0	13.8	5.8

Table A.3. Acid Anion Analysis

Desiccant: A - 4Å Molecular Sieve

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
A-New	None																				163		1
	50 ppm Moisture																						
A-11	R11/mineral oil		24											41							114		
A-12	R12/mineral oil	4	575																		145	1	1
A-13	R22/mineral oil		7,746																		132		
A-14	R123/mineral oil	4	8																		46		
A-15	R134a/ mixed ester	12	13	16						2,279	7,750				1,353						71		
A-16	R134a/branched ester	181	362	9	74				89	1,047	3,099				2,469						165		1
A-17	R152a/alkylbenzene	30		540											668	1,638	628				102	1	1
A-18	R32/mixed ester	4,539	4,312	25						6,992	1,495			74	259						266		
A-19	R32/branched ester	3,051	7,239							1,406	5,905				627						403		1
A-20	R124/alkylbenzene	6	19												3,052						133		
A-21	R125/mixed ester	4	48	13		20				1,805	7,184				4,312						126		
A-22	R125/branched ester		163	6	34		58	117		608	3,958				3,871						101		1
A-23	R143a/branched ester	30	99	23	105		50			753	2,794				358		1,109			4	130		1
	1000 ppm Moisture																						
A-41	R11/mineral oil		66	15																	137		1
A-42	R12/mineral oil	4	821	6																	139	1	1
A-43	R22/mineral oil		7,866																		208		
A-44	R123/mineral oil	1	31	3																	144		
A-45	R134a/ mixed ester	8	14							1,944	7,353				1,510						129		
A-46	R134a/branched ester	25	333	15	70		56			366	3,854			25	2,079						145	1	1
A-47	R152a/alkylbenzene	19		562									1,213			1,482					112	1	1
A-48	R32/mixed ester	3,905	4,532	169						8,249	1,970			92	294						301		1
A-49	R32/branched ester	2,563	4,733				7,756			797	4,572				879						589		1
A-50	R124/alkylbenzene	18	28												2,836						117		
A-51	R125/mixed ester	7	49	11	77	22				2,716	6,570										176		1
A-52	R125/branched ester	41	186	7	24		80			1,252	5,271				3,436						87		1
A-53	R143a/branched ester	63	204	13		19				1,819	4,853			119	5,157						104		1

Table A.4. Gas Chromatography Analysis

Desiccant: A - 4Å Molecular Sieve

		GC Peak Areas																
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>		2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.10
	50 ppm Moisture																		
A-11	R11/mineral oil	260,433										531							
A-12	R12/mineral oil		273,689									2,303							
A-13	R22/mineral oil			315,660								14,835	2,069						
A-14	R123/mineral oil					340,444						375							3,007
A-15	R134a/ mixed ester								272,202			1,179							
A-16	R134a/branched ester								291,010			525							
A-17	R152a/alkylbenzene										257,600	1,139	1,457	3,195					
A-18	R32/mixed ester				323,272							575	10,916		1,010	767			
A-19	R32/branched ester				316,953							1,297	7,286		638				
A-20	R124/alkylbenzene						287,669		1,186			405							
A-21	R125/mixed ester							273,740				2,211							
A-22	R125/branched ester							272,534				813							
A-23	R143a/branched ester									138,765		296							
	1000 ppm Moisture																		
A-41	R11/mineral oil	276,311										14,174							
A-42	R12/mineral oil		256,698									5,869							
A-43	R22/mineral oil			316,485								13,055	1,971						
A-44	R123/mineral oil					343,100						407							2,337
A-45	R134a/ mixed ester								264,100			3,169							
A-46	R134a/branched ester			148,444								306							
A-47	R152a/alkylbenzene										248,622	1,113	1,245	3,244					
A-48	R32/mixed ester				330,639							1,749	12,183		864	513			
A-49	R32/branched ester				275,755							3,473	7,288		1,328				
A-50	R124/alkylbenzene						291,424		1,022			473							
A-51	R125/mixed ester							138,549				2,288							
A-52	R125/branched ester							139,283				429							
A-53	R143a/branched ester									143,364		219							

Appendix E

Desiccant E: 4Å Molecular Sieve

Table E.1. Summary Test Results

Desiccant; E - 4Å Molecular Sieve

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
E-New	None	2.5	0	-	-	-	30.9	-	-	-	10	-	11	-	0
	50 ppm Moisture														
E-11	R11/mineral oil	3.5	2	0	0	0	12.2	0.00	<0.1	3	130	110	1,570	0	28
E-12	R12/mineral oil	3.5	1	0	0	0	27.0	0.00	<0.1	1	440	18	660	3	272
E-13	R22/mineral oil	4.0	2	0	0	1	27.4	0.12	<0.1	2	6,230	340	49,900	0	6,920
E-14	R123/mineral oil	3.5	0	0	0	0	35.6	0.00	<0.1	1	54	24	390	1	12
E-15	R134a/ mixed ester	2.5	1	0	0	0	21.9	0.00	<0.1	0	91	0	14	480	2,130
E-16	R134a/branched ester	2.5	0	0	0	0	23.2	0.00	<0.1	0	630	2	64	89	4,280
E-17	R152a/alkylbenzene	4.5	2	0	0	1	23.7	3.42	3.0	3	5,590	0	0	3,320	1,880
E-18	R32/mixed ester	3.0	2	0	0	1	21.0	0.35	4.7	0	5,270	0	0	10,000	5,170
E-19	R32/branched ester	2.5	0	0	0	0	17.7	0.40	1.5	14	7,810	0	0	7,480	18,700
E-20	R124/alkylbenzene	2.5	0	0	0	0	25.2	0.16	<0.1	2	83	6	43	4	24
E-21	R125/mixed ester	2.5	0	0	0	0	22.0	0.00	0.1	1	4	5	17	685	1,250
E-22	R125/branched ester	2.5	0	0	0	0	25.5	0.00	<0.1	0	2	2	13	100	1,220
E-23	R143a/branched ester	2.5	0	0	0	0	17.8	0.00	0.2	0	7	9	16	850	490
	1000 ppm Moisture														
E-41	R11/mineral oil	4.5	2	0	0	1	29.1	0.00	0.1	23	210	150	230	5	28
E-42	R12/mineral oil	3.0	1	0	0	0	23.6	0.00	<0.1	1	570	18	720	19	220
E-43	R22/mineral oil	2.5	2	0	0	1	33.8	0.00	<0.1	1	5,820	87	51,600	0	8,530
E-44	R123/mineral oil	3.0	1	0	0	0	27.7	0.22	0.7	1	57	20	490	1	5
E-45	R134a/ mixed ester	2.5	1	0	0	1	25.8	0.00	0.2	0	84	0	0	150	1,690
E-46	R134a/branched ester	2.5	0	0	0	0	23.0	0.00	0.3	3	28	6	10	350	510
E-47	R152a/alkylbenzene	4.5	2	0	0	2	20.1	2.20	2.0	8	6,670	0	14	2,770	1,160
E-48	R32/mixed ester	3.0	2	0	0	1	17.2	0.48	5.1	0	4,970	0	0	14,260	5,130
E-49	R32/branched ester	2.5	0	0	0	0	18.4	0.32	1.5	18	7,000	0	0	7,330	9,250
E-50	R124/alkylbenzene	2.5	0	0	0	0	30.6	0.29	<0.1	3	55	9	39	19	200
E-51	R125/mixed ester	3.0	0	0	0	0	24.3	0.00	<0.1	1	2	2	54	230	1,400
E-52	R125/branched ester	2.5	0	0	0	0	22.9	0.13	0.1	0	2	5	12	180	1,420
E-53	R143a/branched ester	2.5	0	0	0	0	19.2	0.00	<0.1	0	400	8	57	170	3,520

Table E.2. Crush Strength Test Results

Desiccant: E - 4Å Molecular Sieve

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
E-New	None	25.3	20.5	26.8	23.2	26.4	45.6	46.2	35.5	28.3	30.9	10.0	30.9	8.9	48.7	13.1
						50 ppm Moisture										
E-11	R11/mineral oil	11.2	8.3	10.1	12.9	12.0	20.1	14.5	10.0	9.4	13.2	10.0	12.2	3.4	18.9	5.4
E-12	R12/mineral oil	38.7	27.2	20.5	10.6	28.6	34.4	31.3	16.8	38.4	23.1	10.0	27.0	9.3	45.5	8.4
E-13	R22/mineral oil	34.0	36.5	21.2	14	23.1	25.2	25.7	38.8	19.9	35.4	10.0	27.4	8.3	44.0	10.8
E-14	R123/mineral oil	40.6	50.0	37.9	35.9	37.0	40.2	35.3	28.9	23.7	26.9	10.0	35.6	7.6	50.9	20.4
E-15	R134a/ mixed ester	17.7	11.5	15.0	20.8	27.1	34.2	22.1	27.4	12.9	29.8	10.0	21.9	7.6	37.1	6.6
E-16	R134a/branched ester	26.6	16.1	20.0	35	26.2	26.3	23.0	21.8	16.9	19.9	10.0	23.2	5.6	34.4	12.0
E-17	R152a/alkylbenzene	26.7	26.9	29.4	13.9	26.9	17.6	19.0	13.7	31.9	30.8	10.0	23.7	7.0	37.6	9.8
E-18	R32/mixed ester	26.1	31.0	10.1	24.4	24.0	24.9	18.9	11.7	21.2	17.6	10.0	21.0	6.5	34.0	7.9
E-19	R32/branched ester	23.2	23.2	21.3	19.2	15.9	23.7	10.1	17.8	8.9	14.0	10.0	17.7	5.4	28.6	6.9
E-20	R124/alkylbenzene	21.9	10.0	19.6	28.8	38.2	30.8	35.4	19.5	22.8		9.0	25.2	8.9	43.0	7.5
E-21	R125/mixed ester	18.8	11.3	34.4	32.7	14.8	30.0	19.3	18.2	19.8	20.4	10.0	22.0	7.7	37.4	6.5
E-22	R125/branched ester	10.8	22.8	24.0	27	14.1	24.2	36.0	28.3	20.7	47.5	10.0	25.5	10.5	46.5	4.6
E-23	R143a/branched ester	19.2	11.7	24.9	20.5	20.1	16.7	8.1	15.8	16.7	24.0	10.0	17.8	5.2	28.1	7.4
						1000 ppm Moisture										
E-41	R11/mineral oil	37.9	62.1	31.2	21.7	24.7	20.9	24.6	18.9	26.1	22.9	10.0	29.1	12.8	54.8	3.4
E-42	R12/mineral oil	17.4	27.7	19.8	27.5	34.9	12.2	22.6	24.3	33.1	16.0	10.0	23.6	7.4	38.3	8.8
E-43	R22/mineral oil	20.8	33.9	55.2	21.7	41.2	44.4	16.0	35.2	40.5	28.8	10.0	33.8	12.2	58.1	9.5
E-44	R123/mineral oil	32.7	36.2	23.0	28.9	23.6	29.2	27.2	18.0	24.4	33.5	10.0	27.7	5.6	38.8	16.5
E-45	R134a/ mixed ester	26.9	31.6	25.7	20.5	30.0	25.1	24.1	27.8	27.7	18.2	10.0	25.8	4.1	33.9	17.6
E-46	R134a/branched ester	24.9	16.9	23.0	21.7	26.3	28.3	23.4	12.8	27.5	24.7	10.0	23.0	4.8	32.6	13.3
E-47	R152a/alkylbenzene	16.3	17.9	11.7	28.6	18.0	18.0	14.5	23.0	33.6	19.3	10.0	20.1	6.6	33.3	6.9
E-48	R32/mixed ester	19.4	19.2	20.4	17.2	17.5	15.8	10.5	17.1	18.7	15.8	10.0	17.2	2.8	22.7	11.6
E-49	R32/branched ester	13.7	20.2	25.1	13	17.8	17.5	27.4	15.5	19.5	14.7	10.0	18.4	4.8	28.0	8.9
E-50	R124/alkylbenzene	33.0	35.3	25.8	27.5	30.4	42.2	33.2	27.4	29.5	22.1	10.0	30.6	5.6	41.9	19.4
E-51	R125/mixed ester	15.4	29.1	30.1	22.3	18.4	25.5	25.9	20.4	24.4	31.8	10.0	24.3	5.3	34.9	13.8
E-52	R125/branched ester	21.7	28.4	20.7	18.3	14.1	25.1	28.4	22.7	27.0	22.3	10.0	22.9	4.6	32.0	13.7
E-53	R143a/branched ester	4.8	21.3	18.3	25.8	23.0	22.7	11.2	15.8	18.8	30.1	10.0	19.2	7.3	33.7	4.6

Table E.3. Acid Anion Analysis

Desiccant: E - 4Å Molecular Sieve

		Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
Code	System Fluids	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
E-New	None																				104		1
	50 ppm Moisture																						
E-11	R11/mineral oil	0	28																	0	153		1
E-12	R12/mineral oil	3	272																		134	1	1
E-13	R22/mineral oil		6,921																		163		
E-14	R123/mineral oil	1	12																		138		
E-15	R134a/ mixed ester	10	53							472	1,113				964						69		
E-16	R134a/branched ester	20	155	19					125	25	2,932			25			1,068				212	1	2
E-17	R152a/alkylbenzene	137		1,601						25	1,598					1,561	277				76	1	1
E-18	R32/mixed ester	9,722	4,010	229							1,159			71							114		
E-19	R32/branched ester	7,479	10,204								8,513										302		1
E-20	R124/alkylbenzene	4	24																				
E-21	R125/mixed ester	9	91	8	19	18				620	1,139										139	1	1
E-22	R125/branched ester	17	75	5	4		9			83	378				754						85		1
E-23	R143a/branched ester		81	11	32			462		378	373										49		1
	1000 ppm Moisture																						
E-41	R11/mineral oil	5	28																	3	46		1
E-42	R12/mineral oil	5	219	14																	125	1	1
E-43	R22/mineral oil		8,530																		314		
E-44	R123/mineral oil	1	5																		91		1
E-45	R134a/ mixed ester	3	51							151	1,305				330						71		
E-46	R134a/branched ester	92	38							255	248						223			4	60	1	
E-47	R152a/alkylbenzene	67		1,412						34			1,155			1,255					126	1	1
E-48	R32/mixed ester	6,354	3,142	211						7,697	1,992										149		
E-49	R32/branched ester	7,329	9,248																		115		
E-50	R124/alkylbenzene	8	21	11											178						54		
E-51	R125/mixed ester	3	80	6	167	9				212	1,149										112		1
E-52	R125/branched ester		79	5	6		5	10		170	430				898						64		1
E-53	R143a/branched ester	41	104	8	2,465					124	949										64		2

Table E.4. Gas Chromatography Analysis

E - 4Å Molecular Sieve

Code	Peak ID >> / Reten. Time >>	GC Peak Areas																	
		R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
			2.00	1.40	0.70	12.50	3.00	0.90	1.18		1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.10
	50 ppm Moisture																		
E-11	R11/mineral oil	312,711										846							
E-12	R12/mineral oil		294,866									965						2,462	
E-13	R22/mineral oil			273,565								17,644	1,152	315					
E-14	R123/mineral oil					339,035						361							
E-15	R134a/ mixed ester								260,388			3,133							
E-16	R134a/branched ester								285,659			601							
E-17	R152a/alkylbenzene										236,371	1,075	827	5,040			3,048		
E-18	R32/mixed ester				308,777							2,145	8,399		1,006	686			
E-19	R32/branched ester				313,795							1,977	5,138		606	522		138	
E-20	R124/alkylbenzene						278,763		454			452							
E-21	R125/mixed ester							129,907				6,473							
E-22	R125/branched ester							265,813				690							
E-23	R143a/branched ester									138,742		132							
	1000 ppm Moisture																		
E-41	R11/mineral oil	218,034										36,027							
E-42	R12/mineral oil		259,753									909							
E-43	R22/mineral oil			209,953								20,115	1,521						
E-44	R123/mineral oil					335,635							500						732
E-45	R134a/ mixed ester								261,706			1,913							
E-46	R134a/branched ester								186,446			32,773							
E-47	R152a/alkylbenzene										216,282	924	909	4,758					
E-48	R32/mixed ester				329,849							3,416	9,451		959	611			
E-49	R32/branched ester				313,297							1,581	4,827		1,004				
E-50	R124/alkylbenzene						281,378		817			1,132							
E-51	R125/mixed ester							140,532				283							
E-52	R125/branched ester							278,217				1,194				354			
E-53	R143a/branched ester									135,798		1,362							

Appendix F

Desiccant F: 3Å Molecular Sieve

Table F.1. Summary Test Results

Desiccant; F - 3Å Molecular Sieve

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
F-New	None	2.5	0	-	-	-	20.0	-	-	-	160	-	23	-	0
	50 ppm Moisture														
F-11	R11/mineral oil	5.5	2	0	0	0	17.5	0.16	<0.1	8	490	96	8,080	130	42
F-12	R12/mineral oil	4.5	1	0	0	0	18.0	0.13	1.3	41	1,580	130	6,500	17	820
F-13	R22/mineral oil	2.5	1	0	0	0	10.2	0.00	0.1	47	2,350	220	33,400	4	3,700
F-14	R123/mineral oil	3.5	0	0	0	0	21.7	0.38	<0.1	6	220	12	2,150	0	13
F-15	R134a/ mixed ester	2.5	1	0	0	0	16.1	0.00	0.3	0	130	0	19	740	10,950
F-16	R134a/branched ester	2.5	0	0	0	0	14.3	0.00	0.3	0	120	4	41	1,320	7,570
F-17	R152a/alkylbenzene	3.0	0	0	0	0	14.3	0.86	<0.1	3	2,610	13	33	300	1,990
F-18	R32/mixed ester	3.0	2	0	0	1	9.5	0.31	0.2	14	5,670	5	110	6,040	8,400
F-19	R32/branched ester	2.5	1	0	0	0	11.9	0.20	1.9	17	3,460	0	120	1,880	2,810
F-20	R124/alkylbenzene	2.5	1	0	0	0	20.3	0.00	<0.1	3	240	8	1,010	97	2,380
F-21	R125/mixed ester	2.5	1	0	0	0	13.8	0.00	0.3	0	70	2	22	570	6,920
F-22	R125/branched ester	2.5	1	0	0	0	11.8	0.00	<0.1	0	120	2	34	560	8,560
F-23	R143a/branched ester	2.5	1	0	0	1	12.7	0.00	<0.1	1	150	7	72	880	5,900
	1000 ppm Moisture														
F-41	R11/mineral oil	3.0	2	0	0	2	10.2	0.00	<0.1	1	75	43	690	75	8
F-42	R12/mineral oil	4.5	0	0	0	0	18.6	0.10	<0.1	52	1,390	76	5,770	26	820
F-43	R22/mineral oil	2.5	1	0	0	0	11.6	0.00	<0.1	25	1,810	92	21,000	0	1,910
F-44	R123/mineral oil	3.5	0	0	0	0	18.5	0.06	0.2	1	200	22	2,190	0	5
F-45	R134a/ mixed ester	2.5	1	0	0	1	13.8	0.00	0.2	0	120	0	26	1,210	11,410
F-46	R134a/branched ester	3.0	0	0	0	0	16.6	0.00	0.5	0	50	4	37	1,100	3,880
F-47	R152a/alkylbenzene	3.0	0	0	0	0	12.6	0.87	<0.1	12	2,370	15	47	710	920
F-48	R32/mixed ester	3.0	2	0	0	1	8.4	0.27	0.3	70	1,960	2	148	2,920	3,940
F-49	R32/branched ester	2.5	0	0	0	1	13.2	0.23	1.0	17	2,940	0	110	2,380	2,960
F-50	R124/alkylbenzene	2.5	1	0	0	0	20.5	0.28	<0.1	4	210	15	740	1	2,150
F-51	R125/mixed ester	2.5	1	0	0	1	10.7	0.00	0.4	2	270	9	87	1,290	17,700
F-52	R125/branched ester	2.5	1	0	0	0	12.8	0.00	0.1	1	110	8	22	1,240	8,320
F-53	R143a/branched ester	2.5	1	0	0	1	13.4	0.00	0.2	0	120	4	86	1,040	6,240

Table F.2. Crush Strength Test Results

Desiccant: F - 3Å Molecular Sieve

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
F-New	None	22.8	23.2	17.7	23.8	22.5	13.0	19.0	25.3	15.1	18.0	10.0	20.0	4.1	28.2	11.9
						50 ppm Moisture										
F-11	R11/mineral oil	13.7	14.3	15.7	18.8	15.7	18.4	19.7	19.1	21.9	17.3	10.0	17.5	2.6	22.6	12.3
F-12	R12/mineral oil	16.4	16.0	16.2	21.6	15.4	18.6	18.5	22.9	14.5	19.9	10.0	18.0	2.8	23.6	12.4
F-13	R22/mineral oil	10.4	9.7	12.6	8.8	10.8	14.3	8.0	12.8	8.4	5.7	10.0	10.2	2.6	15.3	5.0
F-14	R123/mineral oil	25.5	26.4	25.8	12.5	18.4	20.6	23.8	21.8	19.5	23.1	10.0	21.7	4.2	30.2	13.3
F-15	R134a/ mixed ester	19.8	19.2	16.7	17.6	15.4	8.5	14.6	16.3	13.0	19.6	10.0	16.1	3.5	23.0	9.1
F-16	R134a/branched ester	14.2	17.0	11.9	20	17.3	15.3	10.5	11.1	13.9	11.4	10.0	14.3	3.1	20.5	8.0
F-17	R152a/alkylbenzene	16.5	12.2	19.3	10.7	14.2	19.1	15.6	13.1	10.6	11.4	10.0	14.3	3.3	20.8	7.8
F-18	R32/mixed ester	7.6	9.1	13.8	12.6	7.2	9.0	8.4	11.0	5.5	10.3	10.0	9.5	2.5	14.5	4.4
F-19	R32/branched ester	15.1	10.9	11.8	16.3	9.1	12.5	15.1	7.2	13.1	7.6	10.0	11.9	3.2	18.2	5.5
F-20	R124/alkylbenzene	20.5	31.5	14.6	25	14.4	19.3	16.0	20.6	19.9	21.4	10.0	20.3	5.1	30.6	10.1
F-21	R125/mixed ester	17.1	10.6	16.8	10.5	11.4	12.3	12.4	14.3	19.4	13.1	10.0	13.8	3.0	19.9	7.7
F-22	R125/branched ester	8.2	8.8	6.7	11.7	13.9	8.9	17.5	11.4	19.9	10.6	10.0	11.8	4.2	20.2	3.3
F-23	R143a/branched ester	8.5	9.5	11.6	12.1	12.0	18.8	14.3	14.0	18.0	8.0	10.0	12.7	3.7	20.0	5.3
						1000 ppm Moisture										
F-41	R11/mineral oil	13.7	12.3	7.7	12	8.6	10.7	9.3	11.6	4.7	11.6	10.0	10.2	2.7	15.6	4.9
F-42	R12/mineral oil	14.8	21.1	14.7	19.8	16.6	23.2	25.4	14.6	16.6	19.4	10.0	18.6	3.8	26.2	11.0
F-43	R22/mineral oil	6.5	15.1	14.1	11.5	9.1	14.3	13.1	10.6	7.3	14.1	10.0	11.6	3.1	17.8	5.4
F-44	R123/mineral oil	13.2	21.6	23.1	12.8	23.1	19.4	24.7	13.8	18.4	15.1	10.0	18.5	4.5	27.6	9.4
F-45	R134a/ mixed ester	12.9	9.4	17.9	13.2	13.8	13.5	19.8	9.1	14.3	13.8	10.0	13.8	3.3	20.3	7.2
F-46	R134a/branched ester	15.2	19.2	15.9	20.6	21.8	10.5	21.7	17.4	14.3	9.1	10.0	16.6	4.4	25.5	7.7
F-47	R152a/alkylbenzene	5.1	15.4	12.2	13.3	12.1	12.6	14.2	14.9	11.6	14.3	10.0	12.6	2.9	18.4	6.7
F-48	R32/mixed ester	7.6	9.6	9.9	9.2	7.4	6.5	9.0	8.3	6.9	9.9	10.0	8.4	1.3	11.0	5.9
F-49	R32/branched ester	13.6	16.2	12.0	13.3	17.7	9.8	9.1	11.5	14.4	14.6	10.0	13.2	2.7	18.6	7.8
F-50	R124/alkylbenzene	26.3	21.7	26.1	15.6	19.9	25.8	23.2	12.5	19.5	14.3	10.0	20.5	5.1	30.6	10.4
F-51	R125/mixed ester	13.7	11.1	10.5	17.6	13.0	11.2	4.6	7.1	12.1	6.4	10.0	10.7	3.8	18.4	3.0
F-52	R125/branched ester	11.9	11.3	17.8	13.4	9.4	10.8	17.2	8.4	12.0	16.0	10.0	12.8	3.2	19.3	6.4
F-53	R143a/branched ester	13.7	15.9	8.8	18.8	9.6	11.0	19.4	9.8	13.1	13.7	10.0	13.4	3.7	20.9	5.9

Table F.3. Acid Anion Analysis

Desiccant: F - 3Å Molecular Sieve

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
F-New	None																				415		1
	50 ppm Moisture																						
F-11	R11/mineral oil	68	42	61																19	379		
F-12	R12/mineral oil	17	818																	8	414	1	1
F-13	R22/mineral oil	4	3,703																		333		
F-14	R123/mineral oil	0	13																	0	434		1
F-15	R134a/ mixed ester		7							739	9,889				1,052						394		
F-16	R134a/branched ester	165	419	22	92		73			1,067	4,652			69	2,334						475		1
F-17	R152a/alkylbenzene	3		66								116	713	113	1,277						65		
F-18	R32/mixed ester	6,038	8,047												349						203		
F-19	R32/branched ester	195	791	249						1,434	941				1,080						315		
F-20	R124/alkylbenzene	3	22	7							79			87	2,281						393		
F-21	R125/mixed ester	1	17	19						549	6,291		273				344				309		
F-22	R125/branched ester	16	184	8						536	5,635				2,738						69		
F-23	R143a/branched ester	141	186	8						735	5,711										424		2
	1000 ppm Moisture																						
F-41	R11/mineral oil		8	75																	325		1
F-42	R12/mineral oil	26	817																		419	1	1
F-43	R22/mineral oil		1,910																		352		
F-44	R123/mineral oil	0	5																		382		
F-45	R134a/ mixed ester		14							1,208	8,552		2,843								382		
F-46	R134a/branched ester	35	127	12						1,052	3,758										353		2
F-47	R152a/alkylbenzene	130		80								173	921			326					130	1	1
F-48	R32/mixed ester	2,165	3,548							757					396						147		
F-49	R32/branched ester	175	482	301						1,900	1,143				1,336						322		
F-50	R124/alkylbenzene	1	28												2,124						380		
F-51	R125/mixed ester	0	128			10				1,282	14,712				2,876					12	648	1	1
F-52	R125/branched ester							177	1,018	1,064	5,692				1,613						360		1
F-53	R143a/branched ester	24	240		76				43	1,020	5,878										429		2

Table F.4. Gas Chromatography Analysis

Desiccant: F - 3Å Molecular Sieve

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>		2.00	1.40	0.70		3.00	0.90	1.18		1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
F-11	R11/mineral oil	291,557										1,962							452
F-12	R12/mineral oil		257,556	330								1,910							
F-13	R22/mineral oil			207,242								5,908	8,814						
F-14	R123/mineral oil					324,459						258							1,222
F-15	R134a/ mixed ester								257,775			892							
F-16	R134a/branched ester								281,469			3,028							
F-17	R152a/alkylbenzene										292,469	990	198	2,506					
F-18	R32/mixed ester				321,852							1,032	7,584		1,001				
F-19	R32/branched ester				324,369							330	2,943		638				
F-20	R124/alkylbenzene						140,929												
F-21	R125/mixed ester							285,398				439							
F-22	R125/branched ester							264,359				425							
F-23	R143a/branched ester									139,906		197							
	1000 ppm Moisture																		
F-41	R11/mineral oil	231,315										33,036							
F-42	R12/mineral oil		262,288	253								2,329							
F-43	R22/mineral oil			340,706								6,466	1,569						
F-44	R123/mineral oil					337,633						153							202
F-45	R134a/ mixed ester								309,685			1,158							
F-46	R134a/branched ester								286,154			2,610							
F-47	R152a/alkylbenzene										298,861	9,634	302	2,615					
F-48	R32/mixed ester				235,710							709	4,406		640				
F-49	R32/branched ester				321,939							1,968	3,633		564				161
F-50	R124/alkylbenzene						285,305		799			251							
F-51	R125/mixed ester							141,995											
F-52	R125/branched ester							271,655				6,020							
F-53	R143a/branched ester									149,775		348							

Appendix H

Desiccant H: 3Å Molecular Sieve

Table H.1. Summary Test Results

Desiccant; H - 3Å Molecular Sieve

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	Fl ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
H-New	None	2.5	0	-	-	-	34.6	-	-	-	18	-	4	-	0
	50 ppm Moisture														
H-11	R11/mineral oil	4.5	2	0	0	1	23.6	0.00	<0.1	4	140	95	1,580	0	75
H-12	R12/mineral oil	3.5	1	0	0	0	24.4	0.00	<0.1	4	1,020	24	1,600	5	532
H-13	R22/mineral oil	3.0	0	0	0	1	24.2	0.00	<0.1	10	4,000	550	45,400	0	5,280
H-14	R123/mineral oil	3.5	1	0	0	0	31.1	0.88	<0.1	1	61	31	460	11	6
H-15	R134a/ mixed ester	2.5	1	0	0	0	18.6	0.00	0.8	0	18	0	11	1,490	3,970
H-16	R134a/branched ester	2.5	0	0	0	0	18.6	0.00	0.3	1	23	13	23	1,400	3,190
H-17	R152a/alkylbenzene	3.5	2	0	0	0	15.7	0.92	0.2	15	3,430	0	0	750	640
H-18	R32/mixed ester	3.0	2	0	0	0	15.6	0.69	0.4	1,280	8,530	0	0	11,400	9,650
H-19	R32/branched ester	2.5	0	0	0	0	16.4	0.41	0.2	16	8,530	0	0	5,700	10,600
H-20	R124/alkylbenzene	2.5	0	0	0	0	25.3	0.00	<0.1	2	110	6	170	41	580
H-21	R125/mixed ester	2.5	0	0	0	0	22.7	0.00	0.6	0	11	3	16	1,230	3,130
H-22	R125/branched ester	2.5	0	0	0	0	19.8	0.00	0.4	0	13	5	12	1,090	3,260
H-23	R143a/branched ester	2.5	0	0	0	0	15.7	0.00	<0.1	1	17	8	25	1,310	2,070
	1000 ppm Moisture														
H-41	R11/mineral oil	4.5	2	0	0	0	26.0	0.00	0.6	5	79	88	2,730	9	85
H-42	R12/mineral oil	3.5	1	0	0	0	24.5	0.00	<0.1	2	430	21	750	13	500
H-43	R22/mineral oil	3.0	0	0	0	1	15.2	0.00	<0.1	4	3,480	350	32,800	0	5,120
H-44	R123/mineral oil	3.5	1	0	0	0	29.7	0.00	0.3	1	63	26	410	0	11
H-45	R134a/ mixed ester	2.5	1	0	0	1	20.6	0.00	0.7	0	12	0	0	1,760	3,380
H-46	R134a/branched ester	2.5	0	0	0	0	15.2	0.00	0.6	0	19	12	16	1,740	3,080
H-47	R152a/alkylbenzene	3.5	2	0	0	0	17.4	0.81	<0.1	14	2,180	0	9	2,390	330
H-48	R32/mixed ester	2.5	2	0	0	1	15.2	0.35	0.4	10	9,570	0	0	12,000	12,400
H-49	R32/branched ester	2.5	0	0	0	0	17.2	0.00	<0.1	13	9,250	0	0	5,390	9,730
H-50	R124/alkylbenzene	2.5	0	0	0	0	30.3	0.00	0.2	4	87	8	140	110	640
H-51	R125/mixed ester	2.5	0	0	0	0	19.7	0.10	0.9	1	10	0	11	2,420	3,180
H-52	R125/branched ester	2.5	0	0	0	0	20.9	0.00	0.6	0	8	0	10	2,080	4,080
H-53	R143a/branched ester	2.5	0	0	0	0	15.9	0.00	0.6	1	60	13	51	1,030	3,300

Table H.2. Crush Strength Test Results

Desiccant: H - 3Å Molecular Sieve

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
H-new	None	43.2	43.6	35.6	38.5	34.6	29.4	36.4	42.5	25.5	16.4	10.0	34.6	8.7	51.9	17.2
						50 ppm Moisture										
H-11	R11/mineral oil	22.6	30.7	30.6	20	33.8	20.8	22.3	23.0	8.1	24.2	10.0	23.6	7.2	38.0	9.2
H-12	R12/mineral oil	26.4	29.6	35.3	32.7	15.0	28.7	19.4	11.2	17.8	27.5	10.0	24.4	8.0	40.4	8.3
H-13	R22/mineral oil	22.6	27.3	27.1	20.2	20.0	18.6	29.4	19.3	30.2	27.3	10.0	24.2	4.5	33.2	15.2
H-14	R123/mineral oil	34.9	19.6	27.0	40.5	29.9	44.5	37.9	19.0	31.4	26.1	10.0	31.1	8.5	48.1	14.1
H-15	R134a/ mixed ester	20.0	24.6	17.5	24.3	17.3	16.7	17.6	14.5	16.3	17.4	10.0	18.6	3.4	25.3	11.9
H-16	R134a/branched ester	22.3	19.2	28.4	16.7	21.7	17.2	19.3	11.1	13.5	16.6	10.0	18.6	4.9	28.3	8.9
H-17	R152a/alkylbenzene	17.7	16.4	17.0	15.3	12.7	16.3	16.0	16.3	17.6	11.2	10.0	15.7	2.1	19.9	11.4
H-18	R32/mixed ester	15.5	18.3	10.3	17.3	18.8	13.5	14.2	17.1	16.6	14.8	10.0	15.6	2.6	20.8	10.5
H-19	R32/branched ester	16.4	21.0	19.9	15.4	18.5	17.5	15.8	11.1	14.5	13.7	10.0	16.4	3.0	22.3	10.4
H-20	R124/alkylbenzene	23.9	28.5	25.5	19.4	20.8	24.6	28.7	28.5	28.0	24.9	10.0	25.3	3.3	31.8	18.7
H-21	R125/mixed ester	29.5	27.9	16.1	28.1	25.7	21.2	26.3	22.4	16.5	13.3	10.0	22.7	5.7	34.2	11.2
H-22	R125/branched ester	18.6	28.6	23.7	18.9	12.4	24.5	12.2	21.5	22.5	14.9	10.0	19.8	5.4	30.6	9.0
H-23	R143a/branched ester	16.8	13.5	17.5	10.3	11.6	17.3	23.0	17.7	10.5	18.4	10.0	15.7	4.1	23.8	7.5
						1000 ppm Moisture										
H-41	R11/mineral oil	40.6	29.8	23.0	28.4	25.6	24.0	20.4	25.4	13.2	29.2	10.0	26.0	7.1	40.1	11.8
H-42	R12/mineral oil	22.6	18.3	16.0	28.6	23.9	25.8	25.2	17.9	31.8	34.9	10.0	24.5	6.1	36.8	12.2
H-43	R22/mineral oil	29.7	14.9	23.4	15.1	21.0	13.7	9.5	10.2	8.9	6.0	10.0	15.2	7.4	30.1	0.4
H-44	R123/mineral oil	32.1	34.1	30.6	24.1	22.7	40.2	36.9	27.8	27.7	21.2	10.0	29.7	6.2	42.2	17.3
H-45	R134a/ mixed ester	23.0	24.4	11.3	17.3	25.8	21.9	17.7	19.2	20.5	25.1	10.0	20.6	4.4	29.5	11.8
H-46	R134a/branched ester	18.0	19.1	20.3	12.3	19.6	13.9	12.5	13.1	14.2	9.0	10.0	15.2	3.8	22.8	7.6
H-47	R152a/alkylbenzene	17.3	12.8	23.8	15.3	22.2	16.1	17.2	16.7	18.0	14.2	10.0	17.4	3.4	24.1	10.6
H-48	R32/mixed ester	17.3	16.2	14.9	11.9	20.6	18.0	9.2	13.2	14.9	15.5	10.0	15.2	3.2	21.6	8.7
H-49	R32/branched ester	22.4	21.4	17.2	18.4	12.9	15.5	14.7	17.0	16.4	15.6	10.0	17.2	2.9	23.0	11.3
H-50	R124/alkylbenzene	26.2	27.6	39.2	26.2	30.6	24.6	34.7	29.7	37.7	26.3	10.0	30.3	5.2	40.7	19.9
H-51	R125/mixed ester	28.7	23.9	15.1	23.4	22.8	13.3	25.0	20.9	11.7	11.9	10.0	19.7	6.1	31.9	7.4
H-52	R125/branched ester	29.7	24.0	20.2	22.6	19.8	15.3	18.5	21.4	22.4	15.5	10.0	20.9	4.2	29.4	12.5
H-53	R143a/branched ester	17.5	13.2	12.6	15.1	22.4	13.7	21.9	14.7	14.3	13.1	10.0	15.9	3.6	23.0	8.7

Table H.3. Acid Anion Analysis

Desiccant: H - 3Å Molecular Sieve

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
H-New	None																				260		1
	50 ppm Moisture																						
H-11	R11/mineral oil	0	75																	7	230		
H-12	R12/mineral oil	5	532																		249	1	1
H-13	R22/mineral oil		5,277																		1,438		
H-14	R123/mineral oil		6	11																	210		1
H-15	R134a/ mixed ester	9	65	16						1,469	3,190				716						208		
H-16	R134a/branched ester	172	384	43	51				53	1,185	1,844				863						247		1
H-17	R152a/alkylbenzene	11		312							294					431	350				195	1	1
H-18	R32/mixed ester	11,394	9,650																		186		
H-19	R32/branched ester	5,698	10,611																		346		1
H-20	R124/alkylbenzene	33	94	8											490						180		
H-21	R125/mixed ester	2	105	11	33	15				1,202	2,988										260		1
H-22	R125/branched ester		137	17	77		45	163		911	1,882				1,115						165		1
H-23	R143a/branched ester	173	130	26						1,110	1,937										145		2
	1000 ppm Moisture																						
H-41	R11/mineral oil		85	9																	149		
H-42	R12/mineral oil	5	496	8																	217	1	1
H-43	R22/mineral oil		5,032						84												197		1
H-44	R123/mineral oil	0	11																		198		1
H-45	R134a/ mixed ester	9	70							1,756	3,306										130		
H-46	R134a/branched ester	177	414	71	71				79	1,496	1,433				1,088						246		1
H-47	R152a/alkylbenzene	29		539								1,278	327			541					161		
H-48	R32/mixed ester	12,035	12,398																		186		
H-49	R32/branched ester	5,394	9,733																		287		1
H-50	R124/alkylbenzene	13	89											93	556						168		
H-51	R125/mixed ester	4	97	11		22				2,386	3,082										212		1
H-52	R125/branched ester			15				361	836	1,700	2,342				905						170		1
H-53	R143a/branched ester	45	198	29	74				61	957	2,509						463				238	1	1

Table H.4. Gas Chromatography Analysis

Desiccant: H - 3Å Molecular Sieve

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>		2.00	1.40	0.70		3.00	0.90	1.18		1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
H-11	R11/mineral oil	264,622										26,639							
H-12	R12/mineral oil		259,376									1,879							
H-13	R22/mineral oil			317,180								12,263	6,351						
H-14	R123/mineral oil					340,444						375							3,007
H-15	R134a/ mixed ester								268,629			536							
H-16	R134a/branched ester								289,741			806							
H-17	R152a/alkylbenzene										274,799	881	349	2,517					
H-18	R32/mixed ester				305,725							1,063	9,598		774	1,350			
H-19	R32/branched ester				308,232							390	7,842		545	714			
H-20	R124/alkylbenzene						155,352					134							
H-21	R125/mixed ester							234,064				266							
H-22	R125/branched ester							271,774				1,492							
H-23	R143a/branched ester									136,577		183							
	1000 ppm Moisture																		
H-41	R11/mineral oil	209,290										34,050							
H-42	R12/mineral oil		276,250									846							
H-43	R22/mineral oil			317,820								4,362	1,049						
H-44	R123/mineral oil					315,366						197							
H-45	R134a/ mixed ester								254,440			1,274							
H-46	R134a/branched ester								150,189			219							
H-47	R152a/alkylbenzene										286,565	918	294	2,307					
H-48	R32/mixed ester				337,060							617	10,174		1,164				
H-49	R32/branched ester				168,401							795	1,628						
H-50	R124/alkylbenzene						140,723					225							
H-51	R125/mixed ester							139,291				647							140
H-52	R125/branched ester							280,461				355							
H-53	R143a/branched ester									145,071		463							

Appendix I

Desiccant I: Alumina

Table I.1. Summary Test Results

Desiccant; I - Alumina

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
I-New	None	2.5	0	-	-	-	11.9	-	-	-	2	-	59	-	3,900
	50 ppm Moisture														
I-11	R11/mineral oil	2.5	0	0	0	0	12.0	0.00	0.1	1	1	77	3,960	11	800
I-12	R12/mineral oil	3.0	1	0	0	0	9.5	0.00	<0.1	3	10	21	4,630	4	1,550
I-13	R22/mineral oil	6.0	3	0	2	1	10.2	0.00	<0.1	1	9,600	220	20,300	7	5,800
I-14	R123/mineral oil	2.5	1	0	0	0	11.6	0.67	0.3	2	38	33	4,690	0	670
I-15	R134a/ mixed ester	2.5	0	0	0	0	10.7	0.00	3.1	0	0	0	20	4,970	33,900
I-16	R134a/branched ester	2.5	0	0	0	0	11.1	0.00	12.8	0	0	2	31	1,880	19,300
I-17	R152a/alkylbenzene	4.5	1	0	0	3	9.3	0.42	4.2	51	410	48	150	1,600	4,320
I-18	R32/mixed ester	7.5	2	0	3	3	14.3	5.30	>30	2,950	10,650	10	19	5,250	4,580
I-19	R32/branched ester	3.5	2	0	0	1	17.7	0.26	20.9	1,250	20,300	12	0	42,600	10,000
I-20	R124/alkylbenzene	2.5	0	0	0	0	12.8	0.08	<0.1	2	65	7	3,650	72	2,840
I-21	R125/mixed ester	3.0	0	0	0	1	9.3	0.00	1.0	0	0	3	36	3,470	29,800
I-22	R125/branched ester	2.5	0	0	0	1	22.7	0.00	2.0	0	4	4	39	2,320	27,100
I-23	R143a/branched ester	2.5	0	0	0	1	8.8	0.00	2.2	0	0	5	106	2,300	19,500
	1000 ppm Moisture														
I-41	R11/mineral oil	3.0	1	0	0	2	8.9	0.00	1.6	0	72	110	4,560	230	940
I-42	R12/mineral oil	3.0	1	0	0	0	12.3	0.00	0.1	2	12	45	4,060	80	970
I-43	R22/mineral oil	6.0	3	0	0	1	11.8	0.00	<0.1	9	6,520	740	19,300	76	3,230
I-44	R123/mineral oil	2.5	1	0	0	0	14.1	0.42	0.5	2	77	22	5,000	0	900
I-45	R134a/ mixed ester	2.5	0	0	0	2	12.2	0.06	3.8	0	0	4	22	5,060	28,100
I-46	R134a/branched ester	2.5	0	0	0	1	15.1	0.00	12.6	0	12	3	22	2,330	22,400
I-47	R152a/alkylbenzene	5.0	1	0	0	0	16.7	0.84	4.7	7	1,200	10	140	1,830	3,150
I-48	R32/mixed ester	6.0	1	0	0	1	19.6	2.87	>30	4,430	8,310	105	0	52,400	16,900
I-49	R32/branched ester	4.5	2	0	0	1	17.8	3.60	24.8	730	8,140	0	89	15,384	24,100
I-50	R124/alkylbenzene	2.5	0	0	0	0	17.7	0.06	0.1	7	10	28	2,610	30	9,290
I-51	R125/mixed ester	2.6	0	0	0	1	11.3	0.00	14.3	0	0	0	40	3,350	26,600
I-52	R125/branched ester	2.5	0	0	0	0	14.2	0.03	2.2	0	0	4	33	1,860	19,100
I-53	R143a/branched ester	2.5	0	0	0	1	9.3	0.00	3.5	5	160	4	220	4,870	27,600

Table I.2. Crush Strength Test Results

Desiccant: I - Alumina

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
I-New	None	16.3	11.8	15.3	11.8	9.5	10.2	7.6	9.8	8.3	18.2	10.0	11.9	3.6	19.0	4.7
						50 ppm Moisture										
I-11	R11/mineral oil	15.4	10.6	13.1	7.1	18.5	16.5	12.2	11.4	8.3	6.7	10.0	12.0	4.0	20.0	4.0
I-12	R12/mineral oil	18.0	6.2	11.6	11.5	5.2	8.2	13.9	6.8	3.6	9.5	10.0	9.5	4.4	18.2	0.7
I-13	R22/mineral oil	6.5	14.8	10.1	11.8	15.4	14.5	4.6	7.6	6.9	9.5	10.0	10.2	3.8	17.8	2.5
I-14	R123/mineral oil	8.0	8.4	22.4	6	16.8	11.4	10.6	9.2	11.8	11.0	10.0	11.6	4.8	21.1	2.0
I-15	R134a/ mixed ester	15.1	13.6	6.5	12.5	8.3	6.9	17.6	5.8	9.8	10.6	10.0	10.7	4.0	18.6	2.7
I-16	R134a/branched ester	11.9	18.4	8.0	9	5.4	10.3	13.8	11.1	11.8	11.4	10.0	11.1	3.5	18.1	4.2
I-17	R152a/alkylbenzene	6.5	7.3	7.2	9.2	8.4	13.3	11.0	10.4	9.1	10.9	10.0	9.3	2.1	13.5	5.1
I-18	R32/mixed ester	17.9	13.7	16.5	10.4	10.2	21.1	9.1	17.4	9.2	17.6	10.0	14.3	4.3	23.0	5.6
I-19	R32/branched ester	20.9	21.6	12.9	16.5	18.0	9.0	19.8	16.9	24.1		9.0	17.7	4.6	27.0	8.5
I-20	R124/alkylbenzene	13.6	12.1	8.4	17.4	18.7	8.8	14.7	11.1	10.4	12.3	10.0	12.8	3.4	19.6	5.9
I-21	R125/mixed ester	17.0	5.6	7.4	10.9	8.1	13.8	11.1	4.7	4.8	9.7	10.0	9.3	4.0	17.4	1.3
I-22	R125/branched ester	15.2	15.5	8.6	12.4	11.7	15.4	13.8	20.5	100.6	13.5	10.0	22.7	27.5	77.8	-32.4
I-23	R143a/branched ester	10.9	10.6	9.8	7.7	17.0	8.2	9.0	4.8	5.8	4.3	10.0	8.8	3.7	16.2	1.4
						1000 ppm Moisture										
I-41	R11/mineral oil	9.9	3.5	4.4	9.1	12.5	7.5	9.5	15.8	8.7	7.8	10.0	8.9	3.6	16.0	1.7
I-42	R12/mineral oil	23.0	12.6	20.1	11.5	4.7	10.9	10.8	8.3	8.9	12.4	10.0	12.3	5.4	23.2	1.5
I-43	R22/mineral oil	8.8	20.5	16.7	21.3	10.4	9.6	8.5	11.6	2.3	7.9	10.0	11.8	6.0	23.7	-0.2
I-44	R123/mineral oil	9.9	22.0	9.9	9.1	12.4	15.9	23.1	15.2	9.7	13.7	10.0	14.1	5.1	24.2	4.0
I-45	R134a/ mixed ester	12.5	11.8	10.1	11.4	13.6	8.7	12.5	8.4	18.5	14.9	10.0	12.2	3.0	18.2	6.2
I-46	R134a/branched ester	19.6	13.6	9.3	11.5	16.2	17.8	19.8	14.7	14.2	14.5	10.0	15.1	3.4	21.8	8.4
I-47	R152a/alkylbenzene	7.8	17.9	22.2	21.1	22.5	21.0	8.7	15.2	17.9	12.8	10.0	16.7	5.4	27.6	5.9
I-48	R32/mixed ester	16.2	17.8	15.6	21.9	22.4	16.7	21.5	32.2	14.6	17.5	10.0	19.6	5.2	30.1	9.2
I-49	R32/branched ester	16.1	30.1	17.0	22	28.5	18.4	14.1	10.1	14.0	7.2	10.0	17.8	7.4	32.5	3.0
I-50	R124/alkylbenzene	23.4	28.6	6.4	21.3	16.6	15.8	23.8	17.9	11.4	12.0	10.0	17.7	6.7	31.2	4.3
I-51	R125/mixed ester	20.1	5.1	16.5	14.3	9.3	10.5	9.5	7.2	10.9	9.5	10.0	11.3	4.5	20.2	2.3
I-52	R125/branched ester	28.5	13.4	14.8	12.2	9.3	8.0	15.5	15.2	11.8	13.3	10.0	14.2	5.6	25.4	3.0
I-53	R143a/branched ester	9.3	19.3	9.1	15.1	5.8	9.6	5.5	6.2	3.8		9.0	9.3	5.0	19.3	-0.7

Table I.3. Acid Anion Analysis

Desiccant: I - Alumina

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
I-New	None		113		3,759																		
	50 ppm Moisture																						
I-11	R11/mineral oil	5	436	6	363																0		
I-12	R12/mineral oil	4	891		655																	1	
I-13	R22/mineral oil	7	5,799																				1
I-14	R123/mineral oil	0	20		650																23		
I-15	R134a/ mixed ester		37		789					4,968	33,102												
I-16	R134a/branched ester	211	1,218	7	613			27		1,632	17,506										47	1	
I-17	R152a/alkylbenzene	153	23	1,252	1,921			8		29	64	160	1,799		515						26	1	1
I-18	R32/mixed ester	368								4,880	4,576										28	1	1
I-19	R32/branched ester	7,260		6,865						26,763	10,038	1,709											2
I-20	R124/alkylbenzene	2	1,147		1,692									70									1
I-21	R125/mixed ester	9	49		642					3,462	29,080											1	
I-22	R125/branched ester				183			564	5,675	1,760	21,199											1	
I-23	R143a/branched ester		860		356			540		1,765	18,248											1	
	1000 ppm Moisture																						
I-41	R11/mineral oil	15	287	73			653			145										4			
I-42	R12/mineral oil	3	694	6	275									70									
I-43	R22/mineral oil	6	3,227							70													
I-44	R123/mineral oil	0	23		876																14		
I-45	R134a/ mixed ester	149	268	17	185	15		24	54	4,627	27,594					230					36	1	
I-46	R134a/branched ester	162	1,113	16	811	29		62		2,057	20,467											1	
I-47	R152a/alkylbenzene	61	51	1,279	2,685							486	419									2	2
I-48	R32/mixed ester	3,627	2,120							48,747	14,744									52		3	3
I-49	R32/branched ester	2,260	6,074							13,124	12,339				5,737						44	1	
I-50	R124/alkylbenzene	19	930	11	497														7,868				
I-51	R125/mixed ester		33		916			39	132	3,313	25,532												
I-52	R125/branched ester	137	994		670	17				1,704	17,435											1	
I-53	R143a/branched ester	288	1,230	22	1,366	16				4,543	24,984									8		1	

Table I.4. Gas Chromatography Analysis

Desiccant: I - Alumina

Code	Peak ID >> / Reten. Time >>	GC Peak Areas																	
		R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
			2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
I-11	R11/mineral oil	143,343										28,627							
I-12	R12/mineral oil		277,017									2,001							
I-13	R22/mineral oil			268,204								1,636	24,257						
I-14	R123/mineral oil					316,017						172	60		2,116				
I-15	R134a/ mixed ester								281,314			158	656						
I-16	R134a/branched ester								208,724			27,448	454						
I-17	R152a/alkylbenzene										130,264	26,950	653	548					
I-18	R32/mixed ester				91,994							17,720	13,511		980	3,895			
I-19	R32/branched ester				210,409							6,822	6,643		547				
I-20	R124/alkylbenzene						267,135		202			319	877						
I-21	R125/mixed ester							139,144				1,674	363						
I-22	R125/branched ester							280,979				682	558						
I-23	R143a/branched ester									143,337		123	297						
	1000 ppm Moisture																		
I-41	R11/mineral oil	291,103										1,138							
I-42	R12/mineral oil		323,581									402							
I-43	R22/mineral oil			249,011								9,333	25,922						
I-44	R123/mineral oil					345,050						119			1,443				
I-45	R134a/ mixed ester								237,414	148		1,300	283						
I-46	R134a/branched ester								275,832			296	772						
I-47	R152a/alkylbenzene										132,877	28,454	770	1,119					
I-48	R32/mixed ester				54,841							12,633	14,884		182	1,394			
I-49	R32/branched ester				65,302							13,390	12,857		251	2,098			
I-50	R124/alkylbenzene						276,479		158			2,221	306						
I-51	R125/mixed ester							275,707				2,647	674						
I-52	R125/branched ester							202,784				2,306	402						62
I-53	R143a/branched ester									38,729		4,143	141						

Appendix J

Desiccant J: Alumina

Table J.1. Summary Test Results

Desiccant; J - Alumina

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
J-New	None	2.5	0	-	-	-	22.6	-	-	-	7	-	56	-	155
	50 ppm Moisture														
J-11	R11/mineral oil	2.5	1	0	0	0	22.3	0.00	<0.1	2	4	46	3,120	0	600
J-12	R12/mineral oil	3.5	0	0	0	0	33.4	0.00	<0.1	3	64	12	3,910	250	690
J-13	R22/mineral oil	6.0	3	0	0	1	22.2	0.00	<0.1	16	5,480	880	14,300	220	4,070
J-14	R123/mineral oil	2.5	0	0	0	0	20.7	0.48	<0.1	2	51	19	3,810	6	120
J-15	R134a/ mixed ester	2.5	0	0	0	1	21.4	0.00	2.1	0	0	3	11	3,990	19,600
J-16	R134a/branched ester	2.5	0	0	0	1	19.4	0.00	1.9	0	0	3	14	2,580	16,300
J-17	R152a/alkylbenzene	5.0	0	0	0	1	29.0	1.13	2.8	28	220	160	66	2,900	2,660
J-18	R32/mixed ester	7.5	3	0	3	3	25.1	1.34	>30	4,990	4,940	59	59	67,600	60,200
J-19	R32/branched ester	4.5	2	0	0	1	25.8	0.00	>30	1,060	9,530	0	26	15,800	12,700
J-20	R124/alkylbenzene	2.5	0	0	0	0	31.8	0.00	0.1	2	45	8	2,610	17	6,820
J-21	R125/mixed ester	2.5	0	0	0	1	21.8	0.00	7.2	0	0	0	27	2,690	15,200
J-22	R125/branched ester	2.5	0	0	0	1	24.4	0.00	2.1	0	0	3	0	2,110	13,300
J-23	R143a/branched ester	2.5	0	0	0	1	27.1	0.00	4.4	0	0	7	48	1,780	14,600
	1000 ppm Moisture														
J-41	R11/mineral oil	2.5	1	0	0	0	22.4	0.00	0.3	2	8	34	3,310	0	470
J-42	R12/mineral oil	3.0	0	0	0	0	30.5	0.00	<0.1	1	6	30	3,580	80	800
J-43	R22/mineral oil	5.5	2	3	0	2	17.2	0.48	<0.1	5	4,630	420	13,300	260	3,300
J-44	R123/mineral oil	2.5	0	0	0	0	20.5	0.57	<0.1	2	120	24	3,980	0	210
J-45	R134a/ mixed ester	2.5	0	0	0	1	16.6	0.06	2.8	0	0	0	22	5,050	22,400
J-46	R134a/branched ester	2.5	0	0	0	1	23.7	0.00	5.9	0	13	3	49	4,670	12,000
J-47	R152a/alkylbenzene	5.0	0	0	0	0	23.6	0.78	2.0	1	420	9	0	3,260	3,790
J-48	R32/mixed ester	7.5	3	0	3	3	25.0	1.60	>30	4,960	4,520	110	58	75,800	56,200
J-49	R32/branched ester	4.5	2	0	0	1	29.4	5.90	>30	1,300	11,900	0	70	23,600	44,600
J-50	R124/alkylbenzene	2.5	0	0	0	0	27.9	0.00	<0.1	2	35	7	2,470	93	7,000
J-51	R125/mixed ester	2.5	0	0	0	0	14.4	0.00	12.7	0	0	0	43	7,720	20,400
J-52	R125/branched ester	2.5	0	0	0	1	21.5	0.00	1.9	0	0	2	9	2,000	11,600
J-53	R143a/branched ester	2.5	0	0	0	1	24.4	0.06	4.2	0	3	4	15	1,970	15,400

Table J.2. Crush Strength Test Results

Desiccant: J - Alumina

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
J-New	None	27.8	23.6	26.2	23.7	23.8	31.2	17.5	24.8	14.8	12.4	10.0	22.6	5.9	34.4	10.8
						50 ppm Moisture										
J-11	R11/mineral oil	25.9	24.3	27.5	18.6	22.5	19.7	14.2	18.7	18.2	33.0	10.0	22.3	5.5	33.3	11.2
J-12	R12/mineral oil	38.6	31.8	24.6	39.1	26.3	40.8	32.6	32.1	38.1	30.0	10.0	33.4	5.6	44.6	22.2
J-13	R22/mineral oil	19.9	26.1	16.9	27.2	35.3	23.0	21.5	16.5	15.3	20.3	10.0	22.2	6.1	34.3	10.1
J-14	R123/mineral oil	30.3	26.5	30.9	20.5	25.2	17.4	15.8	10.8	15.0	14.2	10.0	20.7	7.1	34.9	6.4
J-15	R134a/ mixed ester	33.1	25.7	20.2	17.2	30.2	18.7	21.3	12.7	19.1	16.1	10.0	21.4	6.4	34.2	8.6
J-16	R134a/branched ester	20.6	12.8	21.5	24.6	21.7	24.2	13.8	20.4	18.9	15.9	10.0	19.4	4.1	27.6	11.3
J-17	R152a/alkylbenzene	27.4	28.7	14.1	30.3	19.8	24.8	37.1	45.4	42.2	20.5	10.0	29.0	10.1	49.1	8.9
J-18	R32/mixed ester	27.1	27.7	30.6	24.3	27.5	24.7	16.1	32.8	21.8	18.0	10.0	25.1	5.3	35.6	14.5
J-19	R32/branched ester	28.3	14.6	26.6	39	31.0	25.5	23.3	16.9	32.8	19.9	10.0	25.8	7.5	40.7	10.8
J-20	R124/alkylbenzene	44.3	35.0	30.4	25.9	29.4	31.5	28.4	43.8	26.4	22.9	10.0	31.8	7.2	46.3	17.3
J-21	R125/mixed ester	23.3	17.9	31.9	18.9	11.2	18.7	19.5	16.8	34.3	25.8	10.0	21.8	7.1	36.0	7.7
J-22	R125/branched ester	19.7	28.0	34.2	22.9	26.7	26.4	19.6	25.4	21.6	19.8	10.0	24.4	4.7	33.8	15.1
J-23	R143a/branched ester	19.5	37.9	34.0	30.1	26.2	20.2	19.3	25.2	27.8	31.1	10.0	27.1	6.3	39.8	14.5
						1000 ppm Moisture										
J-41	R11/mineral oil	18.2	17.6	17.4	21.4	20.1	23.4	32.8	25.3	28.0	20.2	10.0	22.4	5.0	32.5	12.4
J-42	R12/mineral oil	25.1	31.6	41.5	27.5	31.5	30.0	26.6	47.4	19.2	25.0	10.0	30.5	8.3	47.1	13.9
J-43	R22/mineral oil	11.4	10.7	14.0	19.5	29.3	23.4	15.1	16.0	16.1	16.3	10.0	17.2	5.6	28.4	5.9
J-44	R123/mineral oil	18.8	22.6	21.3	20.1	21.5	23.0	17.0	20.5	25.1	14.7	10.0	20.5	3.0	26.5	14.4
J-45	R134a/ mixed ester	14.9	15.1	15.7	12.7	15.8	19.2	14.5	15.6	25.6	16.5	10.0	16.6	3.6	23.7	9.4
J-46	R134a/branched ester	13.7	16.9	18.1	29	33.4	24.6	30.3	24.9	22.8	22.9	10.0	23.7	6.2	36.1	11.2
J-47	R152a/alkylbenzene	12.4	20.6	25.1	16.9	24.8	23.1	31.6	28.3	29.2	24.3	10.0	23.6	5.8	35.2	12.1
J-48	R32/mixed ester	15.7	18.9	36.2	22.7	25.4	24.2	29.0	22.3	31.3	24.1	10.0	25.0	6.0	36.9	13.1
J-49	R32/branched ester	19.6	30.0	32.5	41	18.9	34.4	20.6	42.4	31.7	22.5	10.0	29.4	8.7	46.7	12.0
J-50	R124/alkylbenzene	27.7	26.9	23.7	21.6	25.3	20.9	36.0	38.5	29.2	29.5	10.0	27.9	5.7	39.4	16.5
J-51	R125/mixed ester	21.4	14.4	17.6	11.8	8.2	10.0	20.3	17.2	11.7	11.2	10.0	14.4	4.5	23.4	5.3
J-52	R125/branched ester	21.9	22.7	16.7	16	21.1	29.6	23.4	19.6	22.9	21.4	10.0	21.5	3.8	29.1	13.9
J-53	R143a/branched ester	25.6	19.9	39.7	24.4	26.2	19.1	18.1	24.6	21.3	25.0	10.0	24.4	6.1	36.6	12.2

Table J.3. Acid Anion Analysis

Desiccant: J - Alumina

		Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
Code	System Fluids	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
J-New	None		64		91																17		1
	50 ppm Moisture																						
J-11	R11/mineral oil	0	533		64																		
J-12	R12/mineral oil	130	687	10										106									
J-13	R22/mineral oil	211	4,070	12																	22		
J-14	R123/mineral oil	1	35	5	81																25		3
J-15	R134a/ mixed ester	204	275		33		25	49	28	3,596	19,265					145					37	1	
J-16	R134a/branched ester	174	826	4	14	33				2,370	15,437											1	
J-17	R152a/alkylbenzene	34	18	1,445	1,709							1,426	929										
J-18	R32/mixed ester	3,966	2,208				39,645			63,651	18,328									76		1	2
J-19	R32/branched ester	5,179	4,407			3,517				6,268	6,698	842			1,333		231					1	3
J-20	R124/alkylbenzene	8	655	9			142												6,020			2	
J-21	R125/mixed ester		456		64					2,695	14,679										21		
J-22	R125/branched ester	78	650			14				2,014	12,642											1	
J-23	R143a/branched ester	90	706	6	17	20				1,667	13,855											1	1
	1000 ppm Moisture																						
J-41	R11/mineral oil	0	466																				1
J-42	R12/mineral oil	4	740	7	54									68									
J-43	R22/mineral oil	240	3,296	22																			
J-44	R123/mineral oil	0	26		187																	1	3
J-45	R134a/ mixed ester	16	294		40		40		53	5,039	22,011										41		
J-46	R134a/branched ester	203	477			7				4,458	11,571									5			1
J-47	R152a/alkylbenzene	13	76	1,368	2,624							1,884	1,091									2	2
J-48	R32/mixed ester	4,312	2,131		37,554					71,348	16,206			170	306					99		1	2
J-49	R32/branched ester	5,061	7,134	5,909						11,058	36,140	1,565	1,282									1	3
J-50	R124/alkylbenzene	8	647	12								73							6,328			1	
J-51	R125/mixed ester	9	51	3	55					7,706	20,343												
J-52	R125/branched ester	114	536	1		15				1,871	11,063										23	1	
J-53	R143a/branched ester	92	753		34	17				1,866	14,663											1	

Table J.4. Gas Chromatography Analysis

Desiccant: J - Alumina

Code	Peak ID >> / Reten. Time >>	GC Peak Areas																	
		R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn6
			2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
J-11	R11/mineral oil	277,181										478							
J-12	R12/mineral oil		316,353									454							
J-13	R22/mineral oil			234,699								10,990	21,031						
J-14	R123/mineral oil					317,495						146	58		1,533				
J-15	R134a/ mixed ester								139,558			115	315						
J-16	R134a/branched ester								216,437			30,226	435						
J-17	R152a/alkylbenzene										178,789	1,592	1,233	2,014					
J-18	R32/mixed ester				152,908							13,315	7,990		437	1,615			
J-19	R32/branched ester										130,968	1,596	15,757						
J-20	R124/alkylbenzene						136,652					1,471	118						
J-21	R125/mixed ester							263,265				1,729	889						
J-22	R125/branched ester							265,390				9,141	946						
J-23	R143a/branched ester									256,468		1,798	658						
	1000 ppm Moisture																		
J-41	R11/mineral oil	70,455										97,850							
J-42	R12/mineral oil		308,832									226							
J-43	R22/mineral oil			244,708								7,741	22,238						1,168
J-44	R123/mineral oil					310,104						122	244		1,782				
J-45	R134a/ mixed ester								145,262	81		217	375						
J-46	R134a/branched ester								219,374			27,807	559						
J-47	R152a/alkylbenzene										91,260	27,299	649	715					
J-48	R32/mixed ester				157,676							12,274	7,535		937	1,583			
J-49	R32/branched ester					47,477						19,093	9,083		234	2,570			
J-50	R124/alkylbenzene						135,706					349	116						
J-51	R125/mixed ester							293,115				478	754						
J-52	R125/branched ester							248,058				253	772						
J-53	R143a/branched ester									261,537		248	562	158					

Appendix K

Desiccant K: Silica Gel

Table K.1. Summary Test Results

Desiccant; K - Silica Gel

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
K-New	None	2.5	0	-	-	-	76.4	-	-	-	3	-	14	-	0
	50 ppm Moisture														
K-11	R11/mineral oil	3.0	3	0	0	1	90.0	0.00	<0.1	2	890	1,520	7,060	0	100
K-12	R12/mineral oil	2.5	0	0	0	0	50.8	0.00	<0.1	8	330	600	320	15	10
K-13	R22/mineral oil	2.5	1	0	0	2	61.9	0.00	0.1	2	1,290	330	660	0	390
K-14	R123/mineral oil	2.5	2	0	0	0	68.5	0.00	0.1	2	19	37	230	33	50
K-15	R134a/ mixed ester	2.5	1	0	0	2	85.3	0.00	21.1	0	0	0	0	24,000	20,900
K-16	R134a/branched ester	2.5	0	0	3	3	60.3	0.00	15.7	0	0	5	0	15,100	11,900
K-17	R152a/alkylbenzene	2.5	2	0	0	0	36.2	0.00	<0.1	68	7,660	0	4	760	0
K-18	R32/mixed ester	2.5	0	0	0	3	11.9	0.24	14.3	4	11	3	0	22,100	11,100
K-19	R32/branched ester	2.5	1	0	0	2	12.3	0.00	17.8	2	44	0	0	18,500	13,400
K-20	R124/alkylbenzene	2.5	0	1	0	2	74.1	0.00	<0.1	3	20	17	55	130	9
K-21	R125/mixed ester	3.0	1	0	0	3	66.9	0.00	12.2	0	0	13	11	18,400	24,400
K-22	R125/branched ester	2.5	1	0	1	1	97.9	0.00	13.6	0	22	7	0	19,200	14,200
K-23	R143a/branched ester	2.5	1	0	0	2	47.7	0.00	13.7	1	0	33	32	12,900	8,310
	1000 ppm Moisture														
K-41	R11/mineral oil	3.0	3	0	0	1	91.2	0.00	0.1	1	810	1,570	6,970	42	85
K-42	R12/mineral oil	2.5	2	0	0	1	86.1	0.00	<0.1	3	360	570	320	55	5
K-43	R22/mineral oil	2.5	0	0	0	1	66.5	0.00	<0.1	45	1,500	670	350	76	1,450
K-44	R123/mineral oil	2.5	2	0	0	0	45.2	0.16	<0.1	2	12	88	230	3	9
K-45	R134a/ mixed ester	2.5	0	0	1	2	9.8	0.00	16.5	0	0	5	11	17,600	18,600
K-46	R134a/branched ester	3.0	0	0	2	1	51.6	0.00	21.6	0	0	5	9	14,000	14,200
K-47	R152a/alkylbenzene	2.5	2	0	0	0	48.5	0.05	<0.1	22	3,460	5	0	830	300
K-48	R32/mixed ester	2.5	1	0	1	1	28.0	0.22	17.1	94	60	7	0	480	14,000
K-49	R32/branched ester	2.5	1	0	2	1	50.5	4.45	18.2	110	283	19	0	10,900	12,700
K-50	R124/alkylbenzene	2.5	0	0	0	0	75.6	0.13	0.1	14	49	28	72	17	69
K-51	R125/mixed ester	2.5	0	0	1	2	58.0	0.00	25.6	0	0	10	0	16,800	16,400
K-52	R125/branched ester	2.5	0	0	1	1	65.9	0.66	>30	0	0	6	0	11,500	19,100
K-53	R143a/branched ester	2.5	0	0	3	2	56.5	0.00	23.0	0	59	25	93	11,900	27,100

Table K.2. Crush Strength Test Results

Desiccant: K - Silica Gel

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
K-New	None	79.5	74.4	44.3	105.0	105.9	118.4	57.9	36.7	58.2	83.7	10.0	76.4	27.5	131.4	21.4
						50 ppm Moisture										
K-11	R11/mineral oil	63.2	83.8	59.5	95.1	118.0	82.6	111.8	88.8	82.4	114.3	10.0	90.0	20.2	130.4	49.5
K-12	R12/mineral oil	40.1	65.5	36.2	50.2	42.6	52.0	58.0	44.4	83.5	35.9	10.0	50.8	14.9	80.6	21.0
K-13	R22/mineral oil	87.6	60.5	48.7	60.1	24.1	59.6	98.5	58.7	74.7	46.1	10.0	61.9	21.2	104.2	19.5
K-14	R123/mineral oil	48.8	51.5	82.7	59.5	96.1	63.6	86.4	81.5	35.0	79.7	10.0	68.5	19.7	107.8	29.1
K-15	R134a/ mixed ester	95.8	105.0	30.2	113.5	59.0	75.4	69.6	106.6	104.1	93.7	10.0	85.3	26.3	138.0	32.6
K-16	R134a/branched ester	110.1	9.7	108.7	115.3	12.0	79.6	61.3	55.5	45.9	4.7	10.0	60.3	42.7	145.7	-25.2
K-17	R152a/alkylbenzene	66.3	49.2	12.4	19.3	66.3	17.8	10.1	76.4	21.6	22.9	10.0	36.2	25.5	87.3	-14.8
K-18	R32/mixed ester	10.8	7.3	14.5	11.3	7.0	19.8	14.5	18.4	8.5	6.9	10.0	11.9	4.7	21.4	2.4
K-19	R32/branched ester	8.5	11.5	6.1	14.1	22.2	11.1	8.7	14.3	16.5	10.2	10.0	12.3	4.7	21.6	3.0
K-20	R124/alkylbenzene	87.2	118.8	106.5	106.8	49.3	107.6	47.4	54.5	20.4	42.0	10.0	74.1	35.0	144.1	4.0
K-21	R125/mixed ester	10.6	17.1	108.9	115.2	95.5	89.4	90.6	69.1	13.6	59.2	10.0	66.9	40.2	147.3	-13.5
K-22	R125/branched ester	100.8	98.8	91.8	111.1	111.0	106.2	65.4	96.8	111.4	83.8	10.0	97.7	14.5	126.8	68.7
K-23	R143a/branched ester	35.4	15.2	90.8	60.8	11.6	30.9	83.7	45.2	60.6	42.3	10.0	47.7	26.5	100.6	-5.3
						1000 ppm Moisture										
K-41	R11/mineral oil	65.4	71.0	105.3	104.3	87.4	97.8	84.7	115.1	100.6	79.9	10.0	91.2	16.1	123.3	59.0
K-42	R12/mineral oil	89.5	64.8	81.5	95.8	63.1	95.6	72.9	108.8	94.5	94.3	10.0	86.1	15.0	116.1	56.1
K-43	R22/mineral oil	5.2	101.5	68.3	115	87.1	17.9	99.2	79.5	17.1	74.6	10.0	66.5	39.3	145.1	-12.0
K-44	R123/mineral oil	57.0	53.0	48.8	28.3	14.2	41.1	70.1	54.6	58.1	27.0	10.0	45.2	17.3	79.7	10.7
K-45	R134a/ mixed ester	20.3	14.9	11.0	10	5.4	5.5	10.3	7.4	6.4	7.1	10.0	9.8	4.7	19.3	0.4
K-46	R134a/branched ester	83.6	61.5	43.4	10.3	80.6	96.8	86.4	40.3	7.7	5.5	10.0	51.6	35.2	122.1	-18.8
K-47	R152a/alkylbenzene	75.1	77.3	34.4	24.7	28.1	56.1	44.1	60.5	62.3	22.6	10.0	48.5	20.6	89.6	7.4
K-48	R32/mixed ester	4.5	4.1	13.0	9.6	94.9	9.9	7.3	61.9	63.0	12.1	10.0	28.0	32.6	93.2	-37.1
K-49	R32/branched ester	7.0	96.6	20.0	113.6	102.4	4.9	114.1	20.0	20.0	6.2	10.0	50.5	49.0	148.4	-47.4
K-50	R124/alkylbenzene	103.6	69.5	87.9	55.8	66.7	76.5	63.6	98.2	54.1	80.0	10.0	75.6	16.9	109.5	41.7
K-51	R125/mixed ester	24.7	13.3	61.1	93.2	16.8	72.1	85.2	90.4	61.4	61.4	10.0	58.0	29.9	117.8	-1.9
K-52	R125/branched ester	65.2	80.3	84.4	86.3	69.6	7.1	67.9	65.8	44.1	87.9	10.0	65.9	24.5	114.9	16.9
K-53	R143a/branched ester	60.1	56.2	95.1	63.7	35.8	38.9	69.0	47.0	62.0	37.1	10.0	56.5	18.1	92.7	20.3

Table K.3. Acid Anion Analysis

Desiccant: K - Silica Gel

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
K-New	None																				47		
	50 ppm Moisture																						
K-11	R11/mineral oil	0	101																		77		
K-12	R12/mineral oil	15	10																		48	1	
K-13	R22/mineral oil		393																		67		
K-14	R123/mineral oil	9			18				32	24												1	2
K-15	R134a/ mixed ester	80	28		156	155				23,778	20,738											1	
K-16	R134a/branched ester	698	516	12	37	74				14,275	11,378										19	1	1
K-17	R152a/alkylbenzene	27		521												211					80	1	1
K-18	R32/mixed ester	83	30	50		67				21,918	11,046											1	
K-19	R32/branched ester							2,722	1,864	15,747	11,503												1
K-20	R124/alkylbenzene	4	9											121							76		
K-21	R125/mixed ester	10	44	11	93	30	96			18,301	24,124										9		
K-22	R125/branched ester		568	5		46		4,364		14,748	13,637												1
K-23	R143a/branched ester	730	417	86	88	108				11,963	7,806												2
	1000 ppm Moisture																						
K-41	R11/mineral oil	17	85	14		11														7	63		
K-42	R12/mineral oil	12	5	29						14										11	133		
K-43	R22/mineral oil	76	1,455																		66		
K-44	R123/mineral oil	3	9																	4	63		1
K-45	R134a/ mixed ester	165	320	41	76	41	71	31	23	17,322	18,127										102		
K-46	R134a/branched ester	793	902	52	39		52	197		12,717	13,154				90	244					45		1
K-47	R152a/alkylbenzene	15				325						491	304								70		
K-48	R32/mixed ester	20	48		71		46			461	13,819										13		
K-49	R32/branched ester	615	672			46				10,116	12,060	126										1	1
K-50	R124/alkylbenzene	17	15		54																38		
K-51	R125/mixed ester	38	24	35	225				66	16,773	16,063											1	
K-52	R125/branched ester	579	601	13		38				10,908	18,508												1
K-53	R143a/branched ester	615	1,039	17	456	59				11,240	22,878						2,701						

Table K.4. Gas Chromatography Analysis

Desiccant: K - Silica Gel

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>		2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.05	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
K-11	R11/mineral oil	185,817										32,649	376						
K-12	R12/mineral oil		247,806									1,126							
K-13	R22/mineral oil			300,296								422							
K-14	R123/mineral oil					314,855													
K-15	R134a/ mixed ester								268,287			249	42						
K-16	R134a/branched ester								273,748			252	204						
K-17	R152a/alkylbenzene										223,969	431							
K-18	R32/mixed ester				371,106							391	126		889				
K-19	R32/branched ester				182,434							464	145						
K-20	R124/alkylbenzene						267,574					224							
K-21	R125/mixed ester							140,329				222							
K-22	R125/branched ester							265,312				367	202						
K-23	R143a/branched ester									144,616		122							
	1000 ppm Moisture																		
K-41	R11/mineral oil	191,608										36,069	236						
K-42	R12/mineral oil		274,188									284							
K-43	R22/mineral oil			278,809								783							
K-44	R123/mineral oil					345,722						140							554
K-45	R134a/ mixed ester								148,332			154							
K-46	R134a/branched ester								203,204			38,106							
K-47	R152a/alkylbenzene										212,462	14,956		104					
K-48	R32/mixed ester				378,611							1,278			845				
K-49	R32/branched ester				49,294							17,368	8,282		340	1,855			
K-50	R124/alkylbenzene						254,024		336			220							
K-51	R125/mixed ester							340,195				295							
K-52	R125/branched ester							338,667				548	264		2,234				
K-53	R143a/branched ester									259,786		8,979							

Appendix L

Desiccant L: Silica Gel

Table L.1. Summary Test Results

Desiccant; L - Silica Gel

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
L-New	None	2.5	0	-	-	-	22.9	-	-	-	14	-	22	-	0
	50 ppm Moisture														
L-11	R11/mineral oil	3.0	3	0	0	1	12.5	0.12	0.9	2	1,040	2,050	6,600	0	100
L-12	R12/mineral oil	2.5	1	0	0	1	13.4	0.00	<0.1	0	290	350	190	4	0
L-13	R22/mineral oil	2.5	2	0	0	2	9.1	0.00	0.1	3	2,620	910	1,240	35	420
L-14	R123/mineral oil	2.5	2	0	0	0	36.3	0.00	<0.1	1	15	35	84	8	16
L-15	R134a/ mixed ester	2.5	0	0	2	1	6.7	0.00	19.5	1	0	8	0	17,800	12,600
L-16	R134a/branched ester	2.5	0	0	2	1	24.0	0.09	12.9	0	1	3	4	9,990	13,000
L-17	R152a/alkylbenzene	3.0	3	0	0	1	30.2	0.00	0.1	1430	4,550	28	0	550	9,180
L-18	R32/mixed ester	2.5	0	0	2	2	12.0	0.61	>30	63	600	5	0	19,100	25,600
L-19	R32/branched ester	2.5	1	0	2	1	10.4	0.00	21.7	120	640	14	0	11,400	10,800
L-20	R124/alkylbenzene	2.5	0	0	0	0	30.2	0.43	0.1	13	110	50	43	78	85
L-21	R125/mixed ester	2.7	0	0	2	1	12.9	0.00	>30	0	0	8	0	17,100	16,200
L-22	R125/branched ester	2.5	0	0	1	1	21.8	0.00	17.6	1	21	11	0	12,600	11,500
L-23	R143a/branched ester	2.5	0	0	1	1	16.1	0.00	22.1	8	8	44	21	11,400	2,970
	1000 ppm Moisture														
L-41	R11/mineral oil	2.5	3	0	0	1	26.0	0.00	0.1	4	1,210	1,730	10,570	0	53
L-42	R12/mineral oil	2.5	1	1	0	1	17.5	0.00	<0.1	0	490	5	1,600	200	22
L-43	R22/mineral oil	2.5	2	0	0	2	7.6	0.00	<0.1	4	1,640	470	1,000	200	720
L-44	R123/mineral oil	2.5	2	0	0	0	21.5	0.00	<0.1	1	16	56	60	1	25
L-45	R134a/ mixed ester	2.5	0	0	2	1	17.0	0.00	17.6	1	17	11	0	14,300	17,500
L-46	R134a/branched ester	2.5	0	0	1	2	11.8	0.00	17.3	0	1	4	6	11,600	9,560
L-47	R152a/alkylbenzene	3.0	2	0	2	0	25.0	0.00	0.1	710	3,610	7	11	380	0
L-48	R32/mixed ester	2.5	1	0	1	1	6.9	0.25	20.2	28	679	8	0	13,800	8,640
L-49	R32/branched ester	2.5	1	0	2	1	11.0	0.12	16.3	120	120	10	0	15,100	15,300
L-50	R124/alkylbenzene	2.5	0	0	0	0	17.9	0.07	<0.1	14	110	48	74	48	82
L-51	R125/mixed ester	2.5	0	0	2	1	35.7	0.00	21.9	0	0	0	0	20,900	16,800
L-52	R125/branched ester	2.5	0	0	1	2	24.2	0.00	15.5	0	0	8	0	13,900	11,800
L-53	R143a/branched ester	2.5	0	0	1	1	13.1	0.00	21.7	12	1	64	28	15,300	8,580

Table L.2. Crush Strength Test Results

Desiccant: L - Silica Gel

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
L-New	None	54.7	60.7	24.9	4.5	5.6	10.0	11.3	31.8	16.6	9.3	10.0	22.9	20.2	63.4	-17.5
						50 ppm Moisture										
L-11	R11/mineral oil	16.3	14.5	13.4	17.8	14.7	7.5	7.1	12.6	10.8	10.6	10.0	12.5	3.5	19.6	5.4
L-12	R12/mineral oil	15.2	19.1	9.6	14.7	10.1	8.7	14.6	15.4	9.3	17.6	10.0	13.4	3.7	20.9	6.0
L-13	R22/mineral oil	4.0	7.1	5.4	16.6	7.6	8.1	13.8	13.6	5.4	9.8	10.0	9.1	4.2	17.6	0.7
L-14	R123/mineral oil	50.7	96.8	66.3	12.6	10.9	13.2	44.4	10.9	17.1	39.6	10.0	36.3	29.1	94.4	-21.9
L-15	R134a/ mixed ester	8.5	5.0	5.1	3.6	4.7	3.9	12.7	12.6	5.5	5.0	10.0	6.7	3.4	13.5	-0.2
L-16	R134a/branched ester	17.1	23.6	72.4	22.2	7.4	21.6	8.5	19.2			8.0	24.0	20.5	65.0	-17.0
L-17	R152a/alkylbenzene	33.7	37.7	32.1	33	26.2	44.4	22.7	22.8	39.7	9.3	10.0	30.2	10.2	50.6	9.8
L-18	R32/mixed ester	15.4	10.5	14.1	15.3	17.9	7.9	8.2	7.0	11.8		9.0	12.0	3.9	19.8	4.3
L-19	R32/branched ester	11.5	11.5	9.9	8.9	11.1	9.9	7.1	9.9	13.5		9.0	10.4	1.8	14.0	6.7
L-20	R124/alkylbenzene	37.7	94.3	64.3	9.2	8.2	9.9	24.1	5.8	38.2	10.3	10.0	30.2	29.4	88.9	-28.5
L-21	R125/mixed ester	29.0	4.4	5.9	26.4	3.3	17.1	8.2	10.8	12.3	12.0	10.0	12.9	8.8	30.6	-4.7
L-22	R125/branched ester	19.3	50.9	11.8	52.8	13.6	6.0	10.6	28.8	7.8	16.6	10.0	21.8	17.1	56.0	-12.4
L-23	R143a/branched ester	7.2	24.9	6.3	12.2	13.9	10.5	10.0	31.2	20.4	23.9	10.0	16.1	8.5	33.0	-0.9
						1000 ppm Moisture										
L-41	R11/mineral oil	15.0	15.1	70.2	12.6	13.5	57.6	18.8	25.1	18.8	13.6	10.0	26.0	20.5	67.1	-15.0
L-42	R12/mineral oil	37.3	16.0	20.3	20.2	4.7	10.1	25.1	12.7	5.7	22.9	10.0	17.5	9.9	37.2	-2.2
L-43	R22/mineral oil	9.6	5.3	5.6	6.3	12.5	9.5	4.3	9.8	9.4	4.0	10.0	7.6	2.9	13.4	1.9
L-44	R123/mineral oil	14.5	12.7	17.8	24.9	22.8	11.8	9.7	47.1	27.8	26.1	10.0	21.5	11.1	43.7	-0.6
L-45	R134a/ mixed ester	24.9	7.3	15.6	11.7	26.9	33.3	16.5	6.4	9.2	18.5	10.0	17.0	9.0	35.0	-0.9
L-46	R134a/branched ester	12.2	10.0	18.0	10.1	10.7	5.8	10.5	7.4	22.8	10.2	10.0	11.8	5.0	21.8	1.7
L-47	R152a/alkylbenzene	20.3	11.1	11.4	81	8.6	22.2	32.8	27.5	8.3	26.7	10.0	25.0	21.5	68.0	-18.0
L-48	R32/mixed ester	5.6	5.3	7.0	6.4	9.8	9.8	3.4	9.9	6.8	5.1	10.0	6.9	2.3	11.4	2.4
L-49	R32/branched ester	9.1	8.1	8.3	10.7	14.2	6.8	17.7	13.3	12.2	9.4	10.0	11.0	3.4	17.7	4.3
L-50	R124/alkylbenzene	21.0	17.5	8.8	8.5	15.5	70.6	4.3	5.4	13.2	13.8	10.0	17.9	19.3	56.4	-20.7
L-51	R125/mixed ester	22.0	9.7	20.6	27.2	26.9	85.7	75.8	33.6	27.6	27.6	10.0	35.7	24.7	85.0	-13.7
L-52	R125/branched ester	33.6	52.2	14.4	29.8	6.7	16.0	27.3	11.0	22.5	28.5	10.0	24.2	13.2	50.7	-2.3
L-53	R143a/branched ester	13.8	16.7	20.6	19.7	13.0	8.3	8.5	8.0	9.0		9.0	13.1	5.0	23.1	3.1

Table L.3. Acid Anion Analysis

Desiccant: L - Silica Gel

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
L-New	None																				860		
	50 ppm Moisture																						
L-11	R11/mineral oil	0	102																	10	379		
L-12	R12/mineral oil	4																			936		
L-13	R22/mineral oil	7	423	5		10				13											225		
L-14	R123/mineral oil	2	5	6	11																	1	1
L-15	R134a/ mixed ester	164	265	23	42	25	25	31		17,548	12,304										72		
L-16	R134a/branched ester	601	766	44	70	74	39			9,266	12,158										179		1
L-17	R152a/alkylbenzene	110										438							9,174				
L-18	R32/mixed ester	68	87	44		41				18,927	16,001						9,464			6	170	1	
L-19	R32/branched ester	591	472							10,348	9,498			436	848						546	1	
L-20	R124/alkylbenzene	22	9	56	76																705		
L-21	R125/mixed ester	45	480	38	38					17,000	15,716										55		
L-22	R125/branched ester	633	470	13	70	35	49			11,869	10,903										61	1	1
L-23	R143a/branched ester	634	159	25				50		10,659	2,815									7	65	2	
	1000 ppm Moisture																						
L-41	R11/mineral oil	0	53																		520		
L-42	R12/mineral oil	153	22	14						29										6		1	
L-43	R22/mineral oil	181	372	22					353	62											562		
L-44	R123/mineral oil	1	10		15															8		1	2
L-45	R134a/ mixed ester	13	44	11	160		76			14,227	17,241										81		
L-46	R134a/branched ester	733	714	50	26			140		10,660	8,708				117						112		1
L-47	R152a/alkylbenzene	72										309									653	1	
L-48	R32/mixed ester	32	40							13,767	8,600										407		
L-49	R32/branched ester	690	667			27				13,980	14,183			450	459						64	2	
L-50	R124/alkylbenzene	24	8	24	74																740	2	
L-51	R125/mixed ester	37	48	56	127		102			20,841	16,499										35		
L-52	R125/branched ester	683	512	11		52				13,174	11,334										78		1
L-53	R143a/branched ester	736	352	302	53					14,231	8,174											1	2

Table L.4. Gas Chromatography Analysis

Desiccant: L - Silica Gel

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
L-11	R11/mineral oil	291,789										604	618						355
L-12	R12/mineral oil		305,879									434	120						
L-13	R22/mineral oil			284,682								630							
L-14	R123/mineral oil					245,003						276							
L-15	R134a/ mixed ester								252,056			240							
L-16	R134a/branched ester								142,711	125		231	66						
L-17	R152a/alkylbenzene										230,080	13,656							
L-18	R32/mixed ester				198,528							12,700	264		1,211				
L-19	R32/branched ester				153,162							798	169						
L-20	R124/alkylbenzene						231,339		667			245			326				
L-21	R125/mixed ester							269,180				431	82						
L-22	R125/branched ester							278,908				750	154						
L-23	R143a/branched ester									193,243		28,380							
	1000 ppm Moisture																		
L-41	R11/mineral oil	266,552										1,896	582						
L-42	R12/mineral oil		288,433									518							
L-43	R22/mineral oil			303,640								856							
L-44	R123/mineral oil					314,794						272							
L-45	R134a/ mixed ester								248,080			1,209							
L-46	R134a/branched ester								221,532			29,358	211						
L-47	R152a/alkylbenzene										218,307	26,348							
L-48	R32/mixed ester				388,526							1,233			974				
L-49	R32/branched ester				216,541							287	176		255				
L-50	R124/alkylbenzene						225,090		168			163							
L-51	R125/mixed ester							272,097				1,988							
L-52	R125/branched ester							224,709				2,627	182						
L-53	R143a/branched ester									264,763		606	185						

Appendix M

Desiccant M: 3Å Core with Carbon

Table M.1. Summary Test Results

Desiccant; M - 3Å Carbon Core

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
M-New	None	2.5	0	-	-	-	4.9	-	-	-	9	-	71	-	0
	50 ppm Moisture														
M-11	R11/mineral oil	3.0	1	0	0	0	5.3	0.00	0.5	6	37	140	3,310	0	150
M-12	R12/mineral oil	3.0	2	0	2	1	7.3	0.09	<0.1	5	66	33	3,300	3	940
M-13	R22/mineral oil	5.5	3	0	0	1	4.1	0.00	<0.1	21	4,730	340	15,700	240	2,170
M-14	R123/mineral oil	2.5	0	0	0	0	5.5	0.34	0.5	84	210	94	2,740	0	0
M-15	R134a/ mixed ester	2.5	0	0	0	1	6.1	0.05	3.4	0	0	20	9	6,210	14,000
M-16	R134a/branched ester	2.5	2	0	1	1	8.2	0.00	3.9	24	0	3	8	8,620	11,700
M-17	R152a/alkylbenzene	4.5	1	0	0	1	7.1	0.69	1.9	25	940	44	0	2,990	570
M-18	R32/mixed ester	7.0	2	0	0	1	5.8	1.47	>30	4,540	9,080	5	45	39,700	28,800
M-19	R32/branched ester	3.0	2	0	2	3	4.7	1.70	>30	2,140	6,750	38	30	11,500	14,200
M-20	R124/alkylbenzene	2.5	0	0	0	0	6.5	0.05	<0.1	8	240	19	1,470	10	2,880
M-21	R125/mixed ester	2.5	1	0	1	1	7.9	0.00	5.9	2	11	6	14	9,970	17,600
M-22	R125/branched ester	2.5	2	0	0	1	6.3	0.00	4.3	0	0	8	9	4,290	16,600
M-23	R143a/branched ester	2.5	0	0	0	1	6.1	0.21	4.5	0	0	7	10	4,260	11,500
	1000 ppm Moisture														
M-41	R11/mineral oil	3.0	1	0	0	0	5.7	0.00	0.2	3	40	130	3,980	0	95
M-42	R12/mineral oil	3.0	2	0	0	1	8.0	0.00	<0.1	8	75	64	3,460	230	1,060
M-43	R22/mineral oil	5.5	3	0	0	1	11.0	0.00	<0.1	49	5,160	600	17,900	60	1,340
M-44	R123/mineral oil	2.5	0	0	0	0	4.9	0.30	1.2	1	160	30	2,700	4	0
M-45	R134a/ mixed ester	2.5	0	0	0	1	7.4	0.13	3.1	0	1	33	9	5,020	15,900
M-46	R134a/branched ester	2.5	2	0	1	1	9.6	0.00	3.3	0	1	2	0	3,510	11,400
M-47	R152a/alkylbenzene	4.5	1	0	0	1	5.1	1.29	0.7	170	2,390	79	18	4,810	1,350
M-48	R32/mixed ester	7.0	2	0	0	1	6.4	0.24	>30	3,280	9,980	10	40	26,900	27,000
M-49	R32/branched ester	3.0	2	0	2	3	3.9	0.00	>30	1,890	9,640	0	38	19,000	18,200
M-50	R124/alkylbenzene	2.5	0	0	0	0	6.5	0.00	0.9	7	230	14	1,730	20	3,830
M-51	R125/mixed ester	2.5	2	0	0	1	6.0	0.00	10.3	0	0	0	0	6,660	13,000
M-52	R125/branched ester	2.5	2	0	1	1	7.5	0.00	9.9	0	0	5	20	3,830	11,900
M-53	R143a/branched ester	2.5	0	0	0	1	6.9	0.17	6.4	0	0	5	9	3,840	10,500

Table M.2. Crush Strength Test Results

Desiccant: M - 3Å Carbon Core

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
M-New	None	2.5	6.9	7.6	1.0	3.5	9.3	2.6	6.2	7.2	1.8	10.0	4.9	2.9	10.7	-0.9
						50 ppm Moisture										
M-11	R11/mineral oil	3.3	4.3	7.4	6.2							4.0	5.3	1.8	9.0	1.6
M-12	R12/mineral oil	6.2	8.9	7.8	9.5	4.2						5.0	7.3	2.1	11.6	3.0
M-13	R22/mineral oil	4.7	3.8	3.7								3.0	4.1	0.6	5.2	3.0
M-14	R123/mineral oil	3.7	7.5	5.3	8.2	4.2	4.0					6.0	5.5	1.9	9.3	1.6
M-15	R134a/ mixed ester	6.1	5.5	7.2	5.9	5.8						5.0	6.1	0.7	7.4	4.8
M-16	R134a/branched ester	5.8	6.3	15.1	5.4							4.0	8.2	4.6	17.4	-1.1
M-17	R152a/alkylbenzene	6.3	7.8									2.0	7.1			
M-18	R32/mixed ester	6.4	7.6	5.5	4	5.8	5.5					6.0	5.8	1.2	8.2	3.4
M-19	R32/branched ester	4.5	2.0	6.6	5.1	1.5	3.4	7.8	3.6	7.6	4.8	10.0	4.7	2.2	9.0	0.4
M-20	R124/alkylbenzene	9.1	7.7	3.7	5.6							4.0	6.5	2.4	11.3	1.8
M-21	R125/mixed ester	7.6	8.3	7.0	6.9	8.8	6.8	10.4	7.2			8.0	7.9	1.2	10.4	5.4
M-22	R125/branched ester	8.5	5.1	9.3	8.7	5.7	3.6	3.5				7.0	6.3	2.5	11.3	1.4
M-23	R143a/branched ester	9.4	6.9	5.5	3.7	8.6	3.2	3.7	7.4			8.0	6.1	2.4	10.8	1.3
						1000 ppm Moisture										
M-41	R11/mineral oil	4.3	4.4	6.4	6.2	4.7	8.2					6.0	5.7	1.5	8.8	2.6
M-42	R12/mineral oil	9.0	11.8	6.1	6.1	7.0						5.0	8.0	2.4	12.9	3.1
M-43	R22/mineral oil	13.9	6.7	14.9	8.4							4.0	11.0	4.0	19.0	2.9
M-44	R123/mineral oil	3.2	8.3	7.0	3.5	2.4	4.8					6.0	4.9	2.3	9.5	0.2
M-45	R134a/ mixed ester	7.0	5.5	13.1	5.1	6.4						5.0	7.4	3.3	13.9	0.9
M-46	R134a/branched ester	4.2	6.4	3.6	5.6	16.0	17.0	14.7				7.0	9.6	6.0	21.6	-2.3
M-47	R152a/alkylbenzene	4.8	7.4	4.8	4.7	3.6						5.0	5.1	1.4	7.9	2.3
M-48	R32/mixed ester	5.0	6.6	4.5	3.2	4.6	6.7	8.3	8.8	4.8	11.0	10.0	6.4	2.4	11.2	1.5
M-49	R32/branched ester	2.9	3.7	3.1	4.5	3.8	3.3	5.1	5.4	3.4		9.0	3.9	0.9	5.7	2.1
M-50	R124/alkylbenzene	7.3	9.1	5.5	6.4	11.6	7.5	4.5	2.9	4.1		9.0	6.5	2.7	11.9	1.2
M-51	R125/mixed ester	3.3	7.3	3.9	9.6	7.6	5.5	4.6				7.0	6.0	2.3	10.5	1.4
M-52	R125/branched ester	7.0	13.5	6.6	8.2	3.5	4.6	8.9				7.0	7.5	3.3	14.0	0.9
M-53	R143a/branched ester	7.7	7.3	5.6								3.0	6.9	1.1	9.1	4.6

Table M.3. Acid Anion Analysis

Desiccant: M - 3Å Carbon Core

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
M-New	None																				427		1
	50 ppm Moisture																						
M-11	R11/mineral oil	0	151																	0	113		
M-12	R12/mineral oil	3	939																			1	
M-13	R22/mineral oil	224	2,172	13																	303		
M-14	R123/mineral oil	0																		8	338		2
M-15	R134a/ mixed ester	168	294	27	69	14	38	5	31	5,993	13,530										22		
M-16	R134a/branched ester	457	467	87		74	46			8,004	11,174										10		
M-17	R152a/alkylbenzene	20		1,030								1,940	568								32		
M-18	R32/mixed ester	2,470	763							37,245	16,231		868		10,895					116	227	2	
M-19	R32/branched ester	1,487								9,620	11,566			358			2,609			40	277		1
M-20	R124/alkylbenzene	10	1,085		406														1,394		195		
M-21	R125/mixed ester	25	44	55	128	28	51			9,858	17,405										21		1
M-22	R125/branched ester	198	468		29					4,095	10,956						5,173				22		
M-23	R143a/branched ester	235	495	4	52					4,020	10,944										18		
	1000 ppm Moisture																						
M-41	R11/mineral oil	0	95																	6	183		
M-42	R12/mineral oil	121	1,063	7										103							54		
M-43	R22/mineral oil	13	1,340							49											264		
M-44	R123/mineral oil	0	0	4																	377	1	1
M-45	R134a/ mixed ester	135	316	12	61	12	31	25	28	4,833	15,514										28	1	
M-46	R134a/branched ester	146	521	11	23					3,357	10,815										14		
M-47	R152a/alkylbenzene	38	87	1,841								2,933	572						690				
M-48	R32/mixed ester	1,818	1,741							25,123	13,848		996		9,871		520			54	386	2	1
M-49	R32/branched ester	2,420	3,149	3,907						12,532	6,749		1,271		7,024	174				37	386	3	1
M-50	R124/alkylbenzene	9	1,180	11	766														1,881		161	2	
M-51	R125/mixed ester	7	260						656	6,657	12,066										9		
M-52	R125/branched ester	177	475							3,649	11,472										31		
M-53	R143a/branched ester	167	472		57					3,676	9,926										10		

Table M.4. Gas Chromatography Analysis

Desiccant: M - 3Å Carbon Core

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
M-11	R11/mineral oil	289,406										1,186	87						
M-12	R12/mineral oil		286,195	248								661	126						
M-13	R22/mineral oil			235,379								2,272	8,441						
M-14	R123/mineral oil					325,451							136		1,099				
M-15	R134a/ mixed ester								142,900	70		237	158						
M-16	R134a/branched ester								221,968			27,047	431						
M-17	R152a/alkylbenzene										224,518	620	741	1,556					
M-18	R32/mixed ester				277,623							8,672	2,780		3,897		196		
M-19	R32/branched ester				168,398							3,859	4,103		2,870				
M-20	R124/alkylbenzene						289,954		150			186	94						
M-21	R125/mixed ester							274,926				3,235	344						
M-22	R125/branched ester							269,772				241	291						
M-23	R143a/branched ester									266,780		593	321			572			
	1000 ppm Moisture																		
M-41	R11/mineral oil	264,613										28,678							
M-42	R12/mineral oil		311,573									468	191						
M-43	R22/mineral oil			255,130								4,846	21,357						
M-44	R123/mineral oil					337,262						135	98		996				
M-45	R134a/ mixed ester								144,360	190		310	108						
M-46	R134a/branched ester								226,671			38,645	473						
M-47	R152a/alkylbenzene										216,576	13,214	481	691			2,111		
M-48	R32/mixed ester				291,885							10,379	3,676		701				
M-49	R32/branched ester				157,527							4,567	4,687						
M-50	R124/alkylbenzene						264,466					204	380						
M-51	R125/mixed ester							270,376				892	370						
M-52	R125/branched ester							283,550				445	398						
M-53	R143a/branched ester									244,933		11,143	173	414					

Appendix N

Desiccant N: 3Å Core with Carbon

Table N.1. Summary Test Results

Desiccant: N - 3Å Carbon Core

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
N-New	None	2.5	0	-	-	-	4.9	-	-	-	8	-	110	-	0
	50 ppm Moisture														
N-11	R11/mineral oil	3.0	1	0	0	0	4.9	0.00	0.3	9	19	150	3,860	0	680
N-12	R12/mineral oil	3.0	2	0	2	1	6.1	0.00	<0.1	11	43	36	4,080	270	1,220
N-13	R22/mineral oil	5.0	2	0	0	1	3.7	0.00	0.7	32	5,610	750	14,800	150	1,360
N-14	R123/mineral oil	2.5	0	0	0	0	4.6	0.25	0.2	2	70	81	3,350	0	360
N-15	R134a/ mixed ester	2.5	0	0	0	2	3.8	0.00	4.2	0	0	7	14	6,790	20,200
N-16	R134a/branched ester	2.5	0	0	0	2	5.2	0.00	3.3	0	0	2	12	3,900	13,100
N-17	R152a/alkylbenzene	4.5	1	0	0	1	10.5	0.38	1.5	35	770	25	30	1,660	940
N-18	R32/mixed ester	6.0	2	0	0	1	4.2	0.20	>30	4050	8,350	0	36	30,200	21,600
N-19	R32/branched ester	2.5	1	0	0	3	3.9	0.23	>30	2270	5,620	0	0	10,800	7,900
N-20	R124/alkylbenzene	2.0	0	0	0	0	4.4	0.00	0.2	7	220	32	1,970	14	4,580
N-21	R125/mixed ester	2.5	1	0	0	2	5.0	0.00	8.1	1	69	4	0	6,920	20,800
N-22	R125/branched ester	2.5	2	0	1	1	4.7	0.00	7.9	0	0	5	18	3,630	16,100
N-23	R143a/branched ester	2.5	0	0	0	3	4.0	0.00	8.5	0	0	13	9	4,800	13,900
	1000 ppm Moisture														
N-41	R11/mineral oil	2.5	1	0	0	1	5.7	0.00	0.1	7	50	170	4,090	0	0
N-42	R12/mineral oil	3.0	2	0	2	1	6.8	0.00	<0.1	7	33	34	3,550	240	1,100
N-43	R22/mineral oil	5.0	2	0	0	1	6.3	0.00	0.1	45	6,090	1,450	14,800	5	1,420
N-44	R123/mineral oil	2.5	0	0	0	0	5.8	0.38	0.4	3	37	64	3,220	22	440
N-45	R134a/ mixed ester	2.5	0	0	0	2	4.8	0.00	4.4	0	0	6	49	8,880	21,700
N-46	R134a/branched ester	2.5	1	0	0	1	4.6	0.04	0.1	0	4	7	0	4,550	17,200
N-47	R152a/alkylbenzene	4.5	2	0	0	0	5.1	1.27	0.3	100	1,430	40	38	2,290	1,340
N-48	R32/mixed ester	6.0	2	0	0	1	7.5	0.43	>30	4040	9,700	14	43	40,600	23,500
N-49	R32/branched ester	2.5	1	0	0	3	5.5	0.08	>30	1960	9,830	0	21	30,900	15,300
N-50	R124/alkylbenzene	2.5	0	0	0	0	5.2	0.00	<0.1	2	340	7	2,100	74	4,220
N-51	R125/mixed ester	2.5	1	0	0	2	4.2	0.00	8.9	0	0	9	0	6,390	18,400
N-52	R125/branched ester	2.5	2	0	1	2	6.7	0.00	8.6	0	0	2	15	4,760	16,900
N-53	R143a/branched ester	3.0	2	0	0	2	5.3	0.00	6.9	0	1	6	16	4,100	11,800

Table N.2. Crush Strength Test Results

Desiccant: N - 3Å Carbon Core

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
N-New	None	5.5	5.8	2.2	2.2	7.8	5.2	4.3	1.9	5.5	8.6	10.0	4.9	2.3	9.5	0.3
						50 ppm Moisture										
N-11	R11/mineral oil	2.2	3.2	4.4	5.1	8.0	3.8	5.1	8.2	5.4	3.3	10.0	4.9	2.0	8.8	0.9
N-12	R12/mineral oil	3.5	7.7	4.8	8.2							4.0	6.1	2.3	10.6	1.5
N-13	R22/mineral oil	4.6	3.1	3.9	3.2							4.0	3.7	0.7	5.1	2.3
N-14	R123/mineral oil	4.5	2.8	5.2	4.3	6.7	4.1	3.3	5.4	4.7	4.5	10.0	4.6	1.1	6.7	2.4
N-15	R134a/ mixed ester	4.1	3.0	6.3	3.2	3.4	3.0					6.0	3.8	1.3	6.4	1.3
N-16	R134a/branched ester	5.7	5.2	6.0	3.2	5.2	4.9	5.6	5.6			8.0	5.2	0.9	6.9	3.4
N-17	R152a/alkylbenzene	11.1	13.1	8.9	8.9							4.0	10.5	2.0	14.5	6.5
N-18	R32/mixed ester	4.0	4.5	2.6	5.4	4.9	6.1	3.7	2.4	4.4		9.0	4.2	1.2	6.6	1.8
N-19	R32/branched ester	5.1	1.4	4.6	3.8	5.0	3.5					6.0	3.9	1.4	6.7	1.1
N-20	R124/alkylbenzene	4.8	4.4	4.1	4.4							4.0	4.4	0.3	5.0	3.9
N-21	R125/mixed ester	8.4	5.4	5.2	5.6	3.9	2.4	1.5	5.2	7.4		9.0	5.0	2.2	9.4	0.6
N-22	R125/branched ester	6.9	3.3	4.2	4.4							4.0	4.7	1.5	7.8	1.6
N-23	R143a/branched ester	3.6	3.7	4.3	2.4	1.0	6.4	5.8	4.3	4.3		9.0	4.0	1.6	7.2	0.7
						1000 ppm Moisture										
N-41	R11/mineral oil	4.3	4.4	6.4	6.2	4.7	8.2					6.0	5.7	1.5	8.8	2.6
N-42	R12/mineral oil	8.8	8.0	4.7	5.8							4.0	6.8	1.9	10.6	3.0
N-43	R22/mineral oil	5.3	7.5	6.5	4.7	4.5	6.9	8.6				7.0	6.3	1.5	9.3	3.2
N-44	R123/mineral oil	7.3	7.2	7.4	3.8	3.3						5.0	5.8	2.1	9.9	1.7
N-45	R134a/ mixed ester	5.2	4.9	4.4								3.0	4.8	0.4	5.6	4.0
N-46	R134a/branched ester	3.7	7.4	2.8								3.0	4.6	2.4	9.5	-0.2
N-47	R152a/alkylbenzene	6.9	5.7	4.4	3.5							4.0	5.1	1.5	8.1	2.1
N-48	R32/mixed ester	11.0	5.1	6.5								3.0	7.5	3.1	13.7	1.4
N-49	R32/branched ester	6.2	3.1	3.9	1.9	3.2	7.9	5.0	8.8	9.6		9.0	5.5	2.8	11.0	0.0
N-50	R124/alkylbenzene	4.3	2.9	2.6	12.4	5.0	4.1	5.3				7.0	5.2	3.3	11.9	-1.4
N-51	R125/mixed ester	5.6	7.0	4.7	3.8	3.6	2.3	2.1				7.0	4.2	1.8	7.7	0.6
N-52	R125/branched ester	12.6	5.3	5.1	3.8							4.0	6.7	4.0	14.7	-1.3
N-53	R143a/branched ester	6.2	4.6	2.6	6.8	6.2						5.0	5.3	1.7	8.7	1.9

Table N.3. Acid Anion Analysis

Desiccant: N - 3Å Carbon Core

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
N-New	None																				672		2
	50 ppm Moisture																						
N-11	R11/mineral oil	0	598		81															0	66		
N-12	R12/mineral oil	141	1,219	9										118									
N-13	R22/mineral oil	139	1,365	15																	185		
N-14	R123/mineral oil	0	115				246														56	1	
N-15	R134a/ mixed ester	156	298		112		53		35	6,636	19,727										35	1	
N-16	R134a/branched ester	334	886		40					3,530	12,140			40							47		1
N-17	R152a/alkylbenzene	9	7	1,012								639	196						740				
N-18	R32/mixed ester	1,959	1,365							28,055	14,169			177	6,075					84	173	1	1
N-19	R32/branched ester	1,780	88							8,816	5,669			199	2,147					60	168		1
N-20	R124/alkylbenzene	14	1,446		747														2,392		44	2	
N-21	R125/mixed ester	6	104	7	239		127			6,910	20,368												
N-22	R125/branched ester	204	841		23					3,430	15,198										23		
N-23	R143a/branched ester	278	610		64					4,520	13,203												
	1000 ppm Moisture																						
N-41	R11/mineral oil	0																		0	180		1
N-42	R12/mineral oil	130	1,099	5										103									
N-43	R22/mineral oil	5	1,424																		164		
N-44	R123/mineral oil	3	102				339			19											59		1
N-45	R134a/ mixed ester	13	101	7			234			8,856	21,372										42		
N-46	R134a/branched ester	261	757	9	81					4,284	16,316												
N-47	R152a/alkylbenzene	29	56	1,384								876	87						1,201				
N-48	R32/mixed ester	2,442	1,211							38,143	21,610		724							104	165	2	2
N-49	R32/branched ester	3,139	2,933	4,755						23,024	8,051		934		3,405						186	1	1
N-50	R124/alkylbenzene	4	1,396	7	492							63							2,330		97	2	
N-51	R125/mixed ester		20		20				60	6,390	18,258										34		
N-52	R125/branched ester	237	764		30					4,525	16,129										23		
N-53	R143a/branched ester	232	524	5	101					3,865	11,151									5	13		

Table N.4. Gas Chromatography Analysis

Desiccant: N - 3Å Carbon Core

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
N-11	R11/mineral oil	291,409										639							
N-12	R12/mineral oil		326,271									371	74						
N-13	R22/mineral oil			281,702								11,016	14,128						
N-14	R123/mineral oil					296,886						48,488			744				
N-15	R134a/ mixed ester								281,866			251	228						
N-16	R134a/branched ester								291,231			636	377						
N-17	R152a/alkylbenzene										249,765	974	732	951					
N-18	R32/mixed ester				314,310							10,685	4,057		614				
N-19	R32/branched ester				162,194							5,685	4,180		378				
N-20	R124/alkylbenzene						293,854					194	124						
N-21	R125/mixed ester							281,182				949	328						
N-22	R125/branched ester							275,748				5,004	429						
N-23	R143a/branched ester									273,159		959	246						
	1000 ppm Moisture																		
N-41	R11/mineral oil	274,603										562							
N-42	R12/mineral oil		326,085									565							
N-43	R22/mineral oil			266,061								5,292	19,770						
N-44	R123/mineral oil					315,643						176	143		1,213				
N-45	R134a/ mixed ester								284,277			287	343						
N-46	R134a/branched ester								270,217	104		135	43						
N-47	R152a/alkylbenzene										226,862	9,116	521	764			2,122		
N-48	R32/mixed ester				338,425							6,127	3,730		1,468				
N-49	R32/branched ester				181,378							1,319	5,241		144				
N-50	R124/alkylbenzene						269,561					152	360						
N-51	R125/mixed ester							261,221				669	377						
N-52	R125/branched ester							242,148				12,519	235						
N-53	R143a/branched ester									224,553		35,230	271						

Appendix T

Desiccant T: 4Å Core with Carbon

Table T.1. Summary Test Results

Desiccant: T - 4Å Carbon Core

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
T-New	None	2.5	0	-	-	-	7.3	-	-	-	22	-	98	-	0
	50 ppm Moisture														
T-11	R11/mineral oil	3.5	1	0	0	0	5.7	0.00	0.2	34	130	290	6,240	0	340
T-12	R12/mineral oil	3.0	0	0	0	0	7.9	0.00	<0.1	9	610	74	8,650	16	0
T-13	R22/mineral oil	2.5	0	0	0	1	5.0	0.00	<0.1	52	2,460	490	12,400	150	1,430
T-14	R123/mineral oil	3.5	0	0	0	0	7.8	0.26	1.4	3	82	38	3,560	24	830
T-15	R134a/ mixed ester	2.5	0	0	0	2	6.5	0.00	8.6	1	3	7	52	10,200	20,100
T-16	R134a/branched ester	2.5	0	0	0	2	2.9	0.00	13.5	29	1	12	16	8,170	11,600
T-17	R152a/alkylbenzene	4.0	2	0	0	0	6.7	0.32	0.4	150	2,610	35	190	1,720	35
T-18	R32/mixed ester	2.5	0	0	1	1	7.9	0.28	>30	2850	9,810	0	44	22,800	41,100
T-19	R32/branched ester	2.5	1	0	0	3	5.1	0.00	>30	650	8,540	0	55	30,300	12,700
T-20	R124/alkylbenzene	2.5	0	0	1	0	9.5	0.00	<0.1	8	720	20	1,770	68	570
T-21	R125/mixed ester	2.5	0	0	0	3	7.0	0.00	4.6	0	0	4	0	8,170	13,900
T-22	R125/branched ester	2.5	0	0	0	2	3.0	0.80	8.2	0	4	4	26	5,640	12,600
T-23	R143a/branched ester	2.5	0	0	0	2	7.3	0.00	10.5	1	33	6	170	7,050	20,500
	1000 ppm Moisture														
T-41	R11/mineral oil	3.5	1	0	0	0	5.5	0.00	0.2	7	220	160	6,680	0	340
T-42	R12/mineral oil	3.0	0	0	0	0	6.8	0.00	<0.1	8	360	80	8,350	59	540
T-43	R22/mineral oil	2.5	0	0	0	1	4.6	0.11	<0.1	120	2,260	890	14,500	160	1,880
T-44	R123/mineral oil	3.5	0	0	0	0	8.5	0.39	<0.1	3	84	120	3,120	28	850
T-45	R134a/ mixed ester	2.5	0	0	0	1	7.9	0.00	8.7	0	0	16	13	11,000	14,500
T-46	R134a/branched ester	3.0	0	0	0	2	8.6	0.00	10.7	13	1	0	44	9,660	17,700
T-47	R152a/alkylbenzene	4.0	2	0	0	0	7.2	0.59	0.5	91	2,280	22	44	830	1,140
T-48	R32/mixed ester	2.5	0	0	0	2	6.1	0.19	>30	2770	9,290	16	0	22,700	28,100
T-49	R32/branched ester	2.5	0	0	0	2	6.1	0.32	25.1	560	6,670	24	41	14,600	16,200
T-50	R124/alkylbenzene	2.5	0	0	1	0	10.4	0.00	<0.1	3	810	30	1,960	17	2,830
T-51	R125/mixed ester	3.0	0	0	0	2	9.0	0.00	1.7	2	11	5	121	5,900	27,400
T-52	R125/branched ester	2.5	0	0	0	2	5.4	0.00	9.7	0	2	4	27	4,970	12,800
T-53	R143a/branched ester	2.5	0	0	0	3	10.3	0.00	3.1	0	22	1	30	3,750	9,460

Table T.2. Crush Strength Test Results

Desiccant: T - 4Å Carbon Core

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
T-New	None	10.5	14.0	5.8	6.9	7.6	7.3	4.0	2.7	9.3	4.8	10.0	7.3	3.3	14.0	0.6
						50 ppm Moisture										
T-11	R11/mineral oil	6.7	9.5	4.5	5.6	2.1	8.3	3.3	6.4	7.7	3.2	10	5.7	2.4	10.6	0.9
T-12	R12/mineral oil	5.6	16	8.6	3.9	4.9	12	6.5	7.1	6.3		9	7.9	3.8	15.6	0.2
T-13	R22/mineral oil	6.5	5	5.9	5	2.7	6	4.5	4.7	4.8		9	5.0	1.1	7.2	2.8
T-14	R123/mineral oil	14.6	4.8	5.9	8.4	4.6	10	13.7	4.5	3.5		9	7.8	4.2	16.1	-0.5
T-15	R134a/ mixed ester	6	5.4	7.4	5.9	7.8	7.2	6.2	5.9	8.2	4.8	10	6.5	1.1	8.7	4.3
T-16	R134a/branched ester	1	3.8	3.9	3.3	2.3						5	2.9	1.2	5.3	0.4
T-17	R152a/alkylbenzene	3.1	5.5	8.3	8	8.8						5	6.7	2.4	11.5	1.9
T-18	R32/mixed ester	12.3	11.6	10.8	11.5	6.2	5.4	5.5	6.7	4.3	4.8	10	7.9	3.2	14.4	1.5
T-19	R32/branched ester	4.1	6.4	5.3	4.2	5.5	4.9	5.4				7	5.1	0.8	6.7	3.5
T-20	R124/alkylbenzene	11.8	10.8	7.3	9.5	8						5	9.5	1.9	13.2	5.7
T-21	R125/mixed ester	8.4	6.5	6.5	6.7	7						5	7.0	0.8	8.6	5.4
T-22	R125/branched ester	3.2	3.1	2.8								3	3.0	0.2	3.4	2.6
T-23	R143a/branched ester	9.6	9.3	8.3	6.3	5.6	3.7	7	4.5	10.7	8.4	10	7.3	2.3	12.0	2.7
						1000 ppm Moisture										
T-41	R11/mineral oil	1.9	1.7	8.5	5.8	9.8	5.4					6	5.5	3.3	12.1	-1.1
T-42	R12/mineral oil	10.3	7.1	4.4	8.2	12.5	3.5	6.5	4.6	4		9	6.8	3.1	13.0	0.6
T-43	R22/mineral oil	6.1	5.3	6	3.1	6.4	2.2	3.2				7	4.6	1.7	8.1	1.2
T-44	R123/mineral oil	12.2	8.7	6	10.4	8.5	10.8	8.8	2.8	9.7	7.4	10	8.5	2.7	13.9	3.2
T-45	R134a/ mixed ester	8.9	4.8	11.6	3.9	11.3	7.5	9.4	5.6	7.8		9	7.9	2.7	13.3	2.4
T-46	R134a/branched ester	10.6	6.3	11.8	5.7	11.6	5.8					6	8.6	3.0	14.6	2.6
T-47	R152a/alkylbenzene	4.6	3.9	6	8.2	9.6	8.5	9.4				7	7.2	2.3	11.8	2.5
T-48	R32/mixed ester	3.5	8.2	8.5	5.5	6.5	5.3	6	5.9	4.9	6.6	10	6.1	1.5	9.1	3.1
T-49	R32/branched ester	5.7	5.6	4.2	7.6	7.5						5	6.1	1.4	9.0	3.3
T-50	R124/alkylbenzene	6.5	8.7	13.1	11.8	10.5	7.2	10.6	17.5	7.3	10.6	10	10.4	3.3	17.0	3.8
T-51	R125/mixed ester	7.3	12.5	9.2	6.8							4	9.0	2.6	14.1	3.8
T-52	R125/branched ester	4.7	7.4	4.2	4.5	6.3						5	5.4	1.4	8.2	2.7
T-53	R143a/branched ester	9.1	16.2	9	12.5	14.9	8.4	8.7	8.4	9.1	7.1	10	10.3	3.1	16.5	4.2

Table T.3. Acid Anion Analysis

Desiccant: T - 4Å Carbon Core

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
T-New	None																				768		1
	50 ppm Moisture																						
T-11	R11/mineral oil		45		300															4	224	1	
T-12	R12/mineral oil	8		8																3	423	1	1
T-13	R22/mineral oil	151	1,426																	7	248	1	1
T-14	R123/mineral oil	2	248	22	587																255		1
T-15	R134a/ mixed ester	8	103	20	273					10,135	19,702										101		2
T-16	R134a/branched ester	493	539	30	236					7,651	10,862												
T-17	R152a/alkylbenzene	41	35	1,404						55		225								1	359	1	1
T-18	R32/mixed ester	1,357	3,168							21,435	23,976		604		13,371					28	590	1	1
T-19	R32/branched ester	1,668	1,974							26,606	10,686			2,043							563		2
T-20	R124/alkylbenzene	7		8												53	571			2	606		1
T-21	R125/mixed ester	13	50	26	165					8,136	13,671										23		
T-22	R125/branched ester	271	459		252					5,370	11,851										68		1
T-23	R143a/branched ester	400	656	22	1,041	17				6,613	18,804										315	2	2
	1000 ppm Moisture																						
T-41	R11/mineral oil	0	0		338						0										429		1
T-42	R12/mineral oil	12	344		193					3				44						6	113	1	1
T-43	R22/mineral oil	165	1,880																	6	160		
T-44	R123/mineral oil	2	237	26	611																154		2
T-45	R134a/ mixed ester	21	44	23	176	21				10,960	14,236									3	27		1
T-46	R134a/branched ester	542	675		555	60				8,672	15,519			390	913						129		1
T-47	R152a/alkylbenzene	12	21	648						37		129							1,124			1	2
T-48	R32/mixed ester	1,349	2,127							21,325	14,776				11,149					29	240	1	1
T-49	R32/branched ester	843								13,646	11,776			62	4,429					12	481	1	2
T-50	R124/alkylbenzene	6	1,012	11	1,212												606				630		1
T-51	R125/mixed ester	6	256		111		60			5,890	26,740						221				448	1	2
T-52	R125/branched ester	249	463		271					4,726	12,095										73		1
T-53	R143a/branched ester	228	365		294					3,520	8,777						27				50		1

Table T.4. Gas Chromatography Analysis

Desiccant: T - 4Å Carbon Core

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
T-11	R11/mineral oil	228,621										33,202							
T-12	R12/mineral oil		296,667									146	418						
T-13	R22/mineral oil			276,143								9,420	3,736						
T-14	R123/mineral oil					349,235						217	234		444				458
T-15	R134a/ mixed ester								272,170			287	412						
T-16	R134a/branched ester								281,413			324	268						
T-17	R152a/alkylbenzene										226,963	798	691	718					
T-18	R32/mixed ester				358,522							3,613	7,151		986				
T-19	R32/branched ester				183,984							1,197	5,354						
T-20	R124/alkylbenzene						151,481					246							
T-21	R125/mixed ester							262,788				159	389						
T-22	R125/branched ester							269,322				11,393	437	210					
T-23	R143a/branched ester									209,715		40,617	327						
	1000 ppm Moisture																		
T-41	R11/mineral oil	271,051										667	218						
T-42	R12/mineral oil		284,132									294	816						
T-43	R22/mineral oil			208,404								49,134	9,084	226					
T-44	R123/mineral oil					344,095						403	175		358				988
T-45	R134a/ mixed ester								259,142			1,229	395						
T-46	R134a/branched ester								240,796			3,227	880						
T-47	R152a/alkylbenzene										276,373	1,275	824				1,637		
T-48	R32/mixed ester				368,166							3,116	7,291		693				
T-49	R32/branched ester				341,568							6,173	5,444		1,085				
T-50	R124/alkylbenzene						154,758					294							
T-51	R125/mixed ester							336,213				752	491						
T-52	R125/branched ester									244,579		413	415						
T-53	R143a/branched ester									258,586		2,384	80						

Appendix V

Desiccant V: 4Å Core with Carbon

Table V.1. Summary Test Results

Desiccant: V - 4Å Carbon Core

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
V-New	None	2.5	0	-	-	-	6.3	-	-	-	4	-	110	-	0
	50 ppm Moisture														
V-11	R11/mineral oil	3.0	1	0	0	0	7.1	0.00	<0.1	7	130	160	5,750	0	240
V-12	R12/mineral oil	3.0	1	0	0	0	5.8	0.00	<0.1	11	200	76	7,080	0	0
V-13	R22/mineral oil	2.5	1	0	0	1	3.0	0.00	<0.1	19	2,380	1,250	10,900	26	730
V-14	R123/mineral oil	3.0	0	0	0	0	5.5	0.42	0.2	2	15	28	3,160	22	500
V-15	R134a/ mixed ester	2.5	0	0	0	2	5.3	0.63	12.8	0	4	3	22	15,400	19,200
V-16	R134a/branched ester	2.5	0	0	0	1	7.9	0.00	19.5	1	0	11	25	10,100	21,000
V-17	R152a/alkylbenzene	4.0	2	0	0	0	4.8	0.17	0.3	79	1,780	42	45	1,620	44
V-18	R32/mixed ester	2.5	0	0	0	2	4.2	0.31	>30	980	7,220	4	29	34,500	20,100
V-19	R32/branched ester	2.5	0	0	1	2	5.2	0.15	>30	1040	7,750	3	16	19,800	11,500
V-20	R124/alkylbenzene	2.5	0	0	0	0	11.6	0.00	<0.1	88	140	63	460	1,530	910
V-21	R125/mixed ester	2.5	0	0	0	2	8.5	0.19	7.9	0	0	4	15	9,580	22,500
V-22	R125/branched ester	2.5	0	0	0	2	7.4	0.33	5.3	0	1	9	11	6,760	13,600
V-23	R143a/branched ester	2.5	0	0	0	2	6.8	0.31	8.0	9	14	15	37	7,570	13,700
	1000 ppm Moisture														
V-41	R11/mineral oil	3.0	1	0	0	0	6.1	0.00	0.4	6	27	290	3,900	5	520
V-42	R12/mineral oil	2.5	0	0	0	0	9.7	0.00	<0.1	8	46	63	4,690	68	1,000
V-43	R22/mineral oil	3.5	0	0	0	1	6.2	0.00	<0.1	96	960	1,230	13,400	610	1,470
V-44	R123/mineral oil	3.0	0	0	0	0	10.1	0.33	0.1	3	89	125	4,100	12	670
V-45	R134a/ mixed ester	2.5	0	0	0	2	7.5	0.03	12.6	0	0	11	14	14,000	15,700
V-46	R134a/branched ester	2.5	0	0	0	1	9.6	0.00	19.9	0	1	31	110	12,400	23,600
V-47	R152a/alkylbenzene	4.0	2	0	0	0	6.6	0.13	0.3	87	1,530	39	46	1,730	32
V-48	R32/mixed ester	2.5	0	0	0	2	4.5	0.17	>30	1300	8,100	14	37	30,800	24,100
V-49	R32/branched ester	2.5	0	0	1	2	4.9	0.28	>30	380	6,460	8	23	15,200	9,770
V-50	R124/alkylbenzene	2.5	0	0	0	0	11.8	0.00	<0.1	3	190	24	1,830	7	1,660
V-51	R125/mixed ester	2.5	0	0	0	2	6.9	0.00	7.8	0	0	6	10	9,250	20,800
V-52	R125/branched ester	2.5	0	0	0	2	8.8	0.00	10.9	0	0	0	0	7,240	15,700
V-53	R143a/branched ester	3.0	0	0	0	2	6.4	0.29	5.0	26	23	9	39	5,940	14,500

Table V.2. Crush Strength Test Results

Desiccant: V - 4Å Carbon Core

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
V-New	None	5.3	7.1	5.2	7.5	9.5	5.0	6.3	6.0	6.9	4.2	10.0	6.3	1.5	9.4	3.2
						50 ppm Moisture										
V-11	R11/mineral oil	8.2	5.1	5.0	10.1	9.5	5.3	9.4	5.4	5.3	8.0	10	7.1	2.1	11.3	2.9
V-12	R12/mineral oil	8.4	7.3	3.6	3.7	5.9						5	5.8	2.1	10.1	1.5
V-13	R22/mineral oil	3.2	2.7	3.5	2.5							4	3.0	0.5	3.9	2.1
V-14	R123/mineral oil	7.8	5.7	4.2	6.4	5.2	6.4	5.2	3.4			8	5.5	1.4	8.3	2.8
V-15	R134a/ mixed ester	4.5	7.7	3.6								3	5.3	2.2	9.6	1.0
V-16	R134a/branched ester	6.2	9.3	7.9	8.2							4	7.9	1.3	10.5	5.3
V-17	R152a/alkylbenzene	5.6	6.0	4.2	4.8	4.6	4.4	5.8	3.1			8	4.8	1.0	6.7	2.9
V-18	R32/mixed ester	5.0	2.9	3.4	5.4							4	4.2	1.2	6.6	1.8
V-19	R32/branched ester	5.2	7.3	5.5	3.8	5.6	4.4	4.9				7	5.2	1.1	7.5	3.0
V-20	R124/alkylbenzene	10.2	14.4	13.9	7.3	12.1						5	11.6	2.9	17.4	5.8
V-21	R125/mixed ester	8.0	6.9	9.9	9.1	8.6						5	8.5	1.1	10.8	6.2
V-22	R125/branched ester	7.4	7.5	8.3	6.5							4	7.4	0.7	8.9	6.0
V-23	R143a/branched ester	10.3	7.8	5.3	6.4	4.4						5	6.8	2.3	11.5	2.2
						1000 ppm Moisture										
V-41	R11/mineral oil	5.0	8.6	4.7	6.6	5.4	4.6	5.4	8.3			8	6.1	1.6	9.3	2.9
V-42	R12/mineral oil	12.7	9.1	14.6	8.6	7.7	5.3					6	9.7	3.4	16.5	2.9
V-43	R22/mineral oil	6.6	10.8	5.5	2.8	3.5	7.5	10.3	2.5			8	6.2	3.2	12.6	-0.3
V-44	R123/mineral oil	10.9	9.6	13.0	12.4	9.7	12.6	7.6	6.5	8.6		9	10.1	2.3	14.7	5.5
V-45	R134a/ mixed ester	7.5	7.4	7.1	5.8	10.5	6.8	7.2				7	7.5	1.5	10.4	4.6
V-46	R134a/branched ester	7.0	13.8	11.1	4.1	11.8						5	9.6	3.9	17.4	1.7
V-47	R152a/alkylbenzene	5.2	6.0	9.5	6.0	6.5						5	6.6	1.7	10.0	3.3
V-48	R32/mixed ester	5.6	4.5	3.4								3	4.5	1.1	6.7	2.3
V-49	R32/branched ester	6.6	3.5	7.6	5.1	4.4	6.0	4.1	3.6	3.2		9	4.9	1.5	8.0	1.8
V-50	R124/alkylbenzene	9.9	14.5	13.7	9.5	11.2						5	11.8	2.2	16.2	7.3
V-51	R125/mixed ester	4.8	4.6	6.3	10.9	8.1	10.3	3.9	7.0	6.4	6.9	10	6.9	2.3	11.6	2.3
V-52	R125/branched ester	6.6	12.7	8.2	7.7							4	8.8	2.7	14.2	3.4
V-53	R143a/branched ester	10.0	6.6	6.9	5.9	7.5	6.0	4.0	3.9			8	6.4	2.0	10.3	2.4

Table V.3. Acid Anion Analysis

Desiccant: V - 4Å Carbon Core

		Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
Code	System Fluids	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
V-New	None																				1,388		1
	50 ppm Moisture																						
V-11	R11/mineral oil	0	179		63																548	1	1
V-12	R12/mineral oil	0																		12	886		
V-13	R22/mineral oil	5	730							21										4	921		1
V-14	R123/mineral oil	13	150	9	347															8	45		
V-15	R134a/ mixed ester	52	77	66	216	61				15,257	15,565		120		3,229					4	418		1
V-16	R134a/branched ester	638	706	58	402					9,357	19,864									4	242	1	1
V-17	R152a/alkylbenzene	39	44	1,332						28		223								2	692	1	1
V-18	R32/mixed ester	1,144	925			525				32,875	16,256		571		2,362						572		1
V-19	R32/branched ester	1,734	1,619	550						17,024	7,702		205	495	2,021					22	469	1	1
V-20	R124/alkylbenzene	5	301		605					66								1,461			590		3
V-21	R125/mixed ester	15	76	17	169					9,545	22,300										44		
V-22	R125/branched ester	358	547	26	129					6,380	12,943										121		1
V-23	R143a/branched ester	328	544		197					7,240	12,972						30			4	276		1
	1000 ppm Moisture																						
V-41	R11/mineral oil	5	297		157						66									6	222		
V-42	R12/mineral oil	12	501		497									56						2	728	1	
V-43	R22/mineral oil	608	1,467																	12	467		
V-44	R123/mineral oil	1	258	11	416																564		1
V-45	R134a/ mixed ester	42	48	50	148	48			17	13,885	15,428		111			24				2	128	1	2
V-46	R134a/branched ester	647	1,094	27	645	52				11,535	21,868	174									278	1	1
V-47	R152a/alkylbenzene	36	32	1,431						104		164								2	787	2	
V-48	R32/mixed ester	1,088	716			357				29,382	19,458		419		3,541						1,540		2
V-49	R32/branched ester	1,964				272				12,754	6,428		288	226	2,167		890			15	545		2
V-50	R124/alkylbenzene	2	750	5	910															6	892	2	1
V-51	R125/mixed ester	7	57		131					9,247	20,655										137		
V-52	R125/branched ester	386	604	21	118					6,837	15,017										425		
V-53	R143a/branched ester	344	626		339					5,593	13,514										112	1	1

Table V.4. Gas Chromatography Analysis

Desiccant: V - 4Å Carbon Core

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
V-11	R11/mineral oil	214,176										27,813	217						
V-12	R12/mineral oil		296,994									587	304						
V-13	R22/mineral oil			267,760								5,079	8,811						
V-14	R123/mineral oil					343,633						236	208		905				538
V-15	R134a/ mixed ester								261,151	1,650		10,920	599						
V-16	R134a/branched ester								267,908			314	715						
V-17	R152a/alkylbenzene										207,582	27,997	743	350					
V-18	R32/mixed ester				348,437							3,239	8,963		1,078				
V-19	R32/branched ester				180,632							1,724	5,709		276				
V-20	R124/alkylbenzene						145,122					172	146						
V-21	R125/mixed ester							244,798				735	361		461				
V-22	R125/branched ester							234,749	763			11,350	365						
V-23	R143a/branched ester									280,871		455	459			876			
	1000 ppm Moisture																		
V-41	R11/mineral oil	201,636										35,523	168						
V-42	R12/mineral oil		306,348									580	597						
V-43	R22/mineral oil			358,724								1,805	7,565						
V-44	R123/mineral oil					357,694						330	307		823				348
V-45	R134a/ mixed ester								265,507	90		321	663						
V-46	R134a/branched ester								278,237			338	590						
V-47	R152a/alkylbenzene										260,119	1,124	846	342					
V-48	R32/mixed ester				363,296							2,373	6,319		603				
V-49	R32/branched ester				330,814							3,554	8,734		932				
V-50	R124/alkylbenzene						148,840					152	178						
V-51	R125/mixed ester							248,052				301	390						
V-52	R125/branched ester							276,163				845	527						
V-53	R143a/branched ester									315,693		23,350	669			905			

Appendix W

Desiccant W: 3Å Core (No Carbon)

Table W1. Summary Test Results

Desiccant: W - 3Å Core (No Carbon)

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
W-New	None	2.5	0	-	-	-	4.0	-	-	-	13	-	85	-	0
	50 ppm Moisture														
W-11	R11/mineral oil	2.5	1	0	0	0	5.3	0.00	0.1	9	0	110	3,340	23	1,190
W-12	R12/mineral oil	3.0	0	0	0	0	5.4	0.00	<0.1	8	280	73	3,430	1	0
W-13	R22/mineral oil	3.5	0	0	0	1	3.7	0.00	<0.1	19	4,250	480	10,500	4	3,280
W-14	R123/mineral oil	2.5	0	0	0	1	4.5	0.36	<0.1	3	7	75	3,840	3	300
W-15	R134a/ mixed ester	2.5	0	0	0	2	7.8	0.00	7.9	0	0	3	52	9,490	21,700
W-16	R134a/branched ester	2.5	0	0	1	1	5.4	0.00	8.0	0	0	4	42	6,770	23,100
W-17	R152a/alkylbenzene	4.5	1	0	0	1	5.6	0.35	3.3	24	1,090	140	97	2,230	2,720
W-18	R32/mixed ester	7.0	2	0	0	2	5.0	0.22	>30	4,070	4,990	5	17	40,900	16,700
W-19	R32/branched ester	4.5	2	0	0	2	4.5	0.13	>30	3,090	6,330	13	32	34,400	16,200
W-20	R124/alkylbenzene	2.5	0	0	1	0	9.4	0.00	<0.1	3	8	14	2,470	4	1,400
W-21	R125/mixed ester	3.0	0	0	0	2	7.1	0.00	5.1	0	0	6	9	9,160	19,800
W-22	R125/branched ester	2.5	0	0	0	2	5.5	0.00	10.5	0	0	4	5	5,660	15,100
W-23	R143a/branched ester	2.5	0	0	0	1	7.9	0.26	6.3	1	1	9	210	6,100	26,400
	1000 ppm Moisture														
W-41	R11/mineral oil	2.5	1	0	0	0	4.3	0.00	1.7	7	6	70	4,140	27	710
W-42	R12/mineral oil	3.0	0	0	0	0	5.2	0.00	0.1	7	7	62	3,060	12	890
W-43	R22/mineral oil	3.5	0	0	0	1	7.2	0.00	<0.1	64	4,080	750	10,300	16	3,780
W-44	R123/mineral oil	2.5	0	0	0	0	4.9	0.26	0.9	2	82	33	3,850	1	1,120
W-45	R134a/ mixed ester	2.5	0	0	0	2	6.7	0.67	7.6	0	0	8	9	13,200	18,400
W-46	R134a/branched ester	2.5	0	0	0	2	5.8	0.00	9.1	0	0	0	14	11,600	17,100
W-47	R152a/alkylbenzene	4.5	1	0	0	1	7.2	0.42	2.8	67	1,320	200	32	5,410	2,400
W-48	R32/mixed ester	6.5	1	0	0	2	5.2	0.21	>30	3,720	8,880	0	0	43,600	38,900
W-49	R32/branched ester	3.5	1	0	0	1	5.0	0.26	>30	140	9,250	0	23	1,330	12,100
W-50	R124/alkylbenzene	2.5	0	0	0	0	8.9	0.00	<0.1	5	28	38	2,350	1	1,320
W-51	R125/mixed ester	2.5	0	0	0	2	6.4	0.00	8.1	1	0	9	17	11,000	19,000
W-52	R125/branched ester	2.5	0	0	0	2	8.3	1.27	5.7	0	0	0	10	6,540	16,900
W-53	R143a/branched ester	2.5	0	0	0	2	5.5	0.00	10.0	0	108	4	22	4,770	12,100

Table W.2. Crush Strength Test Results

Desiccant: W - 3Å Core (No Carbon)

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
W-New	None	7.3	4.5	4.1	3.7	2.0	2.9	3.2	3.0	4.1	5.2	10.0	4.0	1.5	6.9	1.1
						50 ppm Moisture										
W-11	R11/mineral oil	6.7	3.9	5.8	8.3	6.7	5.6	4.3	2.6	4.1		9	5.3	1.8	8.9	1.8
W-12	R12/mineral oil	6.2	5.8	5.9	7.3	2.8	5.3	4.2				7	5.4	1.5	8.3	2.4
W-13	R22/mineral oil	5.2	3.3	4.6	3.3	4.8	3.1	3.2	3.3	2.7		9	3.7	0.9	5.5	1.9
W-14	R123/mineral oil	8.5	5.2	4.7	2.3	4.8	3.1	5.9	3.8	4.8	2.2	10	4.5	1.9	8.3	0.8
W-15	R134a/ mixed ester	10.9	7.2	8.6	4.3							4	7.8	2.8	13.3	2.2
W-16	R134a/branched ester	7.6	6.9	5.2	4.6	2.9						5	5.4	1.9	9.2	1.7
W-17	R152a/alkylbenzene	5.8	6.8	5.6	6.8	4.4	2.5	7.5				7	5.6	1.7	9.1	2.2
W-18	R32/mixed ester	3.2	5.6	3.2	4.3	4	5.1	8.2	4.7	8.1	3.2	10	5.0	1.9	8.7	1.2
W-19	R32/branched ester	3.5	4.3	5.5	5.3	6.2	5.1	3.7	3	4		9	4.5	1.1	6.6	2.4
W-20	R124/alkylbenzene	9.9	12.3	5	6.1	18.2	5.1					6	9.4	5.2	19.8	-1.0
W-21	R125/mixed ester	8.1	7.3	7.5	5.8	6.8						5	7.1	0.9	8.8	5.4
W-22	R125/branched ester	6	3.1	6.9	3.9	2.3	5.4	6.5	6.6	8.9		9	5.5	2.1	9.7	1.4
W-23	R143a/branched ester	5.7	8.5	4.7	9.5	5.3	4.7	13.5	7.6	11.8		9	7.9	3.2	14.3	1.5
						1000 ppm Moisture										
W-41	R11/mineral oil	6.8	3.5	3.1	3.9							4	4.3	1.7	7.7	1.0
W-42	R12/mineral oil	5.7	5.8	4.9	4.4							4	5.2	0.7	6.5	3.9
W-43	R22/mineral oil	4.4	7	5.1	7.5	13.5	5.6					6	7.2	3.3	13.8	0.6
W-44	R123/mineral oil	3.2	5	2.3	4.1	5.1	4.3	2.8	6.2	6.7	9.5	10	4.9	2.1	9.2	0.6
W-45	R134a/ mixed ester	8.5	6.2	5	6.6	7.1						5	6.7	1.3	9.2	4.1
W-46	R134a/branched ester	6.2	8.3	4.3	6.9	3.5						5	5.8	1.9	9.7	1.9
W-47	R152a/alkylbenzene	13.1	8.2	6.2	2.7	5.8						5	7.2	3.8	14.9	-0.5
W-48	R32/mixed ester	6.5	5.7	3.5	5.8	6.1	5	4	9	3.4	2.7	10	5.2	1.9	8.9	1.4
W-49	R32/branched ester	3.8	4.6	3.6	4.8	4.6	4.4	9.6	3.4	6.3	4.9	10	5.0	1.8	8.6	1.4
W-50	R124/alkylbenzene	9.5	7.5	10.7	9.5	7.2						5	8.9	1.5	11.8	5.9
W-51	R125/mixed ester	10.8	5.6	4.9	4.3							4	6.4	3.0	12.4	0.4
W-52	R125/branched ester	8.8	9.3	8.1	6.9							4	8.3	1.0	10.4	6.2
W-53	R143a/branched ester	10.5	6.1	4.1	6.5	7.1	5.7	2.8	4	4.9	3.7	10	5.5	2.2	10.0	1.1

Table W.3. Acid Anion Analysis

Desiccant: W - 3Å Core (No Carbon)

Code	System Fluids	Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
		Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
W-New	None																				92		2
	50 ppm Moisture																						
W-11	R11/mineral oil	3	397		794					20												1	
W-12	R12/mineral oil	1																				1	
W-13	R22/mineral oil	4	3,277																				
W-14	R123/mineral oil	0	90	3	207																		2
W-15	R134a/ mixed ester	5	56	3	105	5	82		52	9,455	21,449					18					9		
W-16	R134a/branched ester	357	832	8	290					6,385	21,965					24							
W-17	R152a/alkylbenzene	259	172	1,970	1,347								1,204								150	1	
W-18	R32/mixed ester	1,365	439							39,537	9,990				6,295					74	72	4	
W-19	R32/branched ester	3,391	1,890							24,965	10,114	966		5,040	4,183					66	120	2	1
W-20	R124/alkylbenzene	4	1,227		177																	1	2
W-21	R125/mixed ester	10	32		58					9,150	19,753												
W-22	R125/branched ester	306	628	5	71	7				5,346	14,421										20		
W-23	R143a/branched ester	300	967	3	392					5,796	25,031										45	1	1
	1000 ppm Moisture																						
W-41	R11/mineral oil		539		174					27										2			
W-42	R12/mineral oil	3	812		80					9												1	
W-43	R22/mineral oil	16	3,782																	1			
W-44	R123/mineral oil	1	135		988																79		2
W-45	R134a/ mixed ester	37	34	33	25	39	24		28	13,078	18,272												
W-46	R134a/branched ester	565	761	6		23	79			11,027	16,211										9		
W-47	R152a/alkylbenzene	29	161	1,610	1,425					87			814	3,686						2	103	1	1
W-48	R32/mixed ester	2,211	2,218							41,421	26,890				9,805					69	304	2	
W-49	R32/branched ester	129	2,576	84						1,118	6,518		522		2,446					32	339	1	1
W-50	R124/alkylbenzene	1	1,108		216																27		1
W-51	R125/mixed ester	10	33	20	161					10,959	18,769									5			
W-52	R125/branched ester	347	749	10	80					6,186	16,058									10	14	1	1
W-53	R143a/branched ester	256	498							4,512	11,615										3		

Table W.4. Gas Chromatography Analysis

Desiccant: W - 3Å Core (No Carbon)

Code	Peak ID >> / Reten. Time >>	GC Peak Areas																	
		R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
		7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
W-11	R11/mineral oil	230,089										34,506							
W-12	R12/mineral oil		310,416									136	204						
W-13	R22/mineral oil			263,749								4,753	11,091						
W-14	R123/mineral oil					350,497						154	182		1,277				
W-15	R134a/ mixed ester								277,787			762	464						
W-16	R134a/branched ester								279,002			208	438						
W-17	R152a/alkylbenzene										244,948	992	609	850					
W-18	R32/mixed ester				327,711							8,774	4,589		723				
W-19	R32/branched ester				140,825							7,441	4,180		185				
W-20	R124/alkylbenzene						149,022					224	174						
W-21	R125/mixed ester							240,927				719	348						
W-22	R125/branched ester							245,454				2,367	516						
W-23	R143a/branched ester									273,544		1,698	408			701			
	1000 ppm Moisture																		
W-41	R11/mineral oil	266,787										721							
W-42	R12/mineral oil		317,314									620							
W-43	R22/mineral oil			295,553								3,315	5,867						
W-44	R123/mineral oil					365,256						2,127			934				
W-45	R134a/ mixed ester								249,279	1,680		12,153	342						
W-46	R134a/branched ester								270,306			237	320						
W-47	R152a/alkylbenzene										224,765	823	764	959					
W-48	R32/mixed ester				334,185							6,836	3,983		715				
W-49	R32/branched ester				294,976							9,056	5,568		775				
W-50	R124/alkylbenzene						150,378					196	164						
W-51	R125/mixed ester							244,407				12,565	417						
W-52	R125/branched ester							234,645	2,971			11,790	433						
W-53	R143a/branched ester									214,637		38,027	344						

Appendix X

Desiccant X: 3Å Core (No Carbon)

Table X.1. Summary Test Results

Desiccant: X - 3Å Core (No Carbon)

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
X-New	None	2.5	0	-	-	-	6.8	-	-	-	1	-	48	-	0
	50 ppm Moisture														
X-11	R11/mineral oil	3.5	0	0	0	0	5.0	0.00	<0.1	1	270	290	5,690	2	49
X-12	R12/mineral oil	2.5	0	0	0	0	7.7	0.08	0.4	4	36	65	2,480	0	130
X-13	R22/mineral oil	3.5	0	1	0	1	6.7	0.00	<0.1	9	2,960	340	4,970	1	1,450
X-14	R123/mineral oil	2.5	0	0	0	0	4.7	0.12	<0.1	1	2	45	1,300	0	140
X-15	R134a/ mixed ester	2.5	0	0	0	2	8.1	0.00	6.2	0	0	11	22	11,900	16,600
X-16	R134a/branched ester	2.5	0	0	0	1	7.2	0.00	9.4	22	0	7	15	6,400	12,300
X-17	R152a/alkylbenzene	5.0	2	0	0	0	6.6	1.83	2.4	80	780	110	33	1,430	12
X-18	R32/mixed ester	7.0	1	0	0	1	4.9	0.22	>30	4780	7,090	28	37	48,100	22,800
X-19	R32/branched ester	5.5	1	0	0	1	7.3	0.23	>30	3930	4,320	0	26	19,400	30,300
X-20	R124/alkylbenzene	2.5	0	0	1	0	9.2	0.00	<0.1	29	120	160	900	130	1,870
X-21	R125/mixed ester	3.0	0	0	0	1	5.3	0.00	4.4	0	0	10	19	7,330	16,700
X-22	R125/branched ester	2.5	0	0	0	1	4.0	0.00	9.7	3	0	6	19	4,810	11,000
X-23	R143a/branched ester	2.5	0	0	0	1	4.0	0.00	1.2	22	3	18	37	5,290	13,400
	1000 ppm Moisture														
X-41	R11/mineral oil	3.5	0	0	0	0	5.1	0.00	0.5	4	190	300	5,370	0	0
X-42	R12/mineral oil	2.5	0	0	0	0	9.0	0.00	<0.1	7	72	78	2,360	2	590
X-43	R22/mineral oil	3.5	0	0	0	1	8.4	0.00	0.2	120	2,830	860	3,720	65	2,480
X-44	R123/mineral oil	2.5	0	0	0	0	5.7	0.15	2.7	1	10	47	1,340	60	150
X-45	R134a/ mixed ester	2.5	0	0	0	2	7.0	0.00	8.7	0	0	10	20	9,840	30,700
X-46	R134a/branched ester	2.5	0	0	0	1	4.0	0.13	11.2	0	48	2	44	7,200	16,000
X-47	R152a/alkylbenzene	5.0	2	0	0	0	6.8	0.33	3.1	53	1,050	40	18	3,410	810
X-48	R32/mixed ester	7.5	1	0	0	1	7.5	0.25	>30	4110	6,150	23	39	26,100	23,900
X-49	R32/branched ester	5.5	1	0	0	1	11.0	0.27	>30	4050	9,170	0	11	15,300	23,800
X-50	R124/alkylbenzene	2.5	0	0	1	0	6.0	0.00	<0.1	7	36	15	1,060	6	1,580
X-51	R125/mixed ester	2.5	0	0	0	1	4.4	0.00	9	0	0	5	12	6,420	16,500
X-52	R125/branched ester	2.5	0	0	0	2	4.0	0.00	8.8	0	0	6	0	4,810	11,700
X-53	R143a/branched ester	2.5	0	0	0	1	4.2	0.00	4.8	0	0	18	62	4,260	8,450

Table X.2. Crush Strength Test Results

Desiccant: X - 3Å Core (No Carbon)

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
X-New	None	9.9	8.3	4.3	6.0	6.5	8.4	8.1	3.8	6.8	6.1	10.0	6.8	1.9	10.6	3.0
						50 ppm Moisture										
X-11	R11/mineral oil	4.8	6.3	9.5	3.6	4.9	2.7	6.2	6.5	3.2	2.3	10	5.0	2.2	9.4	0.6
X-12	R12/mineral oil	6.1	10.6	7.1	6.9	8						5	7.7	1.7	11.2	4.3
X-13	R22/mineral oil	11.7	7.3	3.5	4.5	9.2	4					6	6.7	3.3	13.3	0.1
X-14	R123/mineral oil	4.5	3.7	2.4	6.4	2.8	3.5	6.4	7.3	4.3	5.7	10	4.7	1.7	8.0	1.4
X-15	R134a/ mixed ester	8.3	8.9	8.6	4.4	8.6	5	13.1	6.1	5.6	12.6	10	8.1	3.0	14.1	2.2
X-16	R134a/branched ester	7.2	8.2	10.5	7.4	7.6	6.2	3.3				7	7.2	2.2	11.5	2.9
X-17	R152a/alkylbenzene	8.9	8	3.9	5.5							4	6.6	2.3	11.2	2.0
X-18	R32/mixed ester	7.9	4.9	2.9	8.7	3.2	5.4	4	3.7	3.9	4.1	10	4.9	2.0	8.8	1.0
X-19	R32/branched ester	7.7	5.4	8.3	5.1	8	9.3					6	7.3	1.7	10.7	3.9
X-20	R124/alkylbenzene	19	6.9	4.9	6.1							4	9.2	6.6	22.4	-3.9
X-21	R125/mixed ester	6	6	3.5	5.3	5.7						5	5.3	1.0	7.4	3.2
X-22	R125/branched ester	5.4	3.4	4.2	3.5	4.2	3.3					6	4.0	0.8	5.6	2.4
X-23	R143a/branched ester	3.2	4.3	5.3	4	3.1						5	4.0	0.9	5.8	2.2
						1000 ppm Moisture										
X-41	R11/mineral oil	3.9	4.3	6.6	5.2	4.4	4	3.9	3.7	9.8		9	5.1	2.0	9.1	1.1
X-42	R12/mineral oil	13.1	13.6	11.2	4.4	7.5	11.4	5.5	5.4			8	9.0	3.7	16.5	1.6
X-43	R22/mineral oil	7.2	11.9	7.3	7.3							4	8.4	2.3	13.1	3.8
X-44	R123/mineral oil	8.6	5.9	4.4	3	9.1	4.9	4.1	5.3	5.7		9	5.7	2.0	9.7	1.6
X-45	R134a/ mixed ester	8.5	8.4	6.1	5.1							4	7.0	1.7	10.4	3.6
X-46	R134a/branched ester	4.5	4.5	3.5	3.4							4	4.0	0.6	5.2	2.8
X-47	R152a/alkylbenzene	8.2	6.5	6	7.6	5.6	8.5	6.9	5.2	7.6	5.8	10	6.8	1.1	9.1	4.5
X-48	R32/mixed ester	6.7	9.9	8.6	4.7							4	7.5	2.3	12.0	2.9
X-49	R32/branched ester	19.8	7.3	15.7	4.6	7.7						5	11.0	6.4	23.9	-1.8
X-50	R124/alkylbenzene	5.4	6.3	3.6	8.5							4	6.0	2.0	10.0	1.9
X-51	R125/mixed ester	4	3.3	2	6.4	2.2	5.2	3.7	6.6	4.5	6.1	10	4.4	1.7	7.7	1.1
X-52	R125/branched ester	5.4	3.6	3								3	4.0	1.2	6.5	1.5
X-53	R143a/branched ester	4.7	4.4	2.2	3.6	6.2	3.8	4.2				7	4.2	1.2	6.6	1.7

Table X.3. Acid Anion Analysis

Desiccant: X - 3Å Core (No Carbon)

		Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
Code	System Fluids	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
X-New	None																				168		1
	50 ppm Moisture																						
X-11	R11/mineral oil	2	49																		0		
X-12	R12/mineral oil												130									1	1
X-13	R22/mineral oil	1	1,446																		160		
X-14	R123/mineral oil	0	42		102															0			1
X-15	R134a/ mixed ester	32	39	39	96	36	83		45	11,841	16,293									2	42		1
X-16	R134a/branched ester	352	549							6,046	11,673						68			4	41		1
X-17	R152a/alkylbenzene	12	12	1,394						22											23	1	2
X-18	R32/mixed ester	2,097	909							45,967	15,299				6,592					42		1	
X-19	R32/branched ester	2,013	1,007		13,197					15,680	8,196	1,041		695	7,910					66	132		1
X-20	R124/alkylbenzene	81	945	45	923																83		
X-21	R125/mixed ester		35		65					7,330	16,631												
X-22	R125/branched ester	274	527		44					4,538	10,449										29		
X-23	R143a/branched ester	309	579	20	404					4,957	12,136				311					166	51		1
	1000 ppm Moisture																						
X-41	R11/mineral oil	0	0																	0	0		
X-42	R12/mineral oil	2	489		99															2		1	
X-43	R22/mineral oil	62	1,942							3	534									4	19		
X-44	R123/mineral oil	3	39	57	116																73		1
X-45	R134a/ mixed ester	14	30	10	76	9	57	7	32	9,797	14,946				15,553						41		
X-46	R134a/branched ester	371	664	19	331		167			6,809	14,836									5	79		1
X-47	R152a/alkylbenzene	110	16	1,440								1,857	667				128				34		2
X-48	R32/mixed ester	1,424	969							24,652	15,431		952		6,590					56	175	3	
X-49	R32/branched ester	1,686	290							12,671	14,601	955			8,921					65			
X-50	R124/alkylbenzene	6	614		141								39				782				33	1	2
X-51	R125/mixed ester	4	27	16	39					6,399	16,396												
X-52	R125/branched ester	271	530	3	60					4,542	11,068												
X-53	R143a/branched ester	249	443	8	258					4,001	7,510				238						44		

Table X.4. Gas Chromatography Analysis

Desiccant: X - 3Å Core (No Carbon)

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
X-11	R11/mineral oil	218,159										34,842	130						
X-12	R12/mineral oil		255,431	193								246	138						
X-13	R22/mineral oil			320,118								1,822	2,798						
X-14	R123/mineral oil					349,793						174	102		411				
X-15	R134a/ mixed ester								281,879			196	159						
X-16	R134a/branched ester								271,439			519	334						
X-17	R152a/alkylbenzene										214,532	348	417	653			3,271		
X-18	R32/mixed ester				308,405							13,842	3,837		693				
X-19	R32/branched ester				142,986							3,328	3,139		325				
X-20	R124/alkylbenzene						143,584					184							
X-21	R125/mixed ester							276,777				192	98						
X-22	R125/branched ester							256,497				573	160						
X-23	R143a/branched ester									238,533		388	105						
	1000 ppm Moisture																		
X-41	R11/mineral oil	202,685										28,848	225						
X-42	R12/mineral oil		290,630									221	97						
X-43	R22/mineral oil			256,019								1,866	3,213						
X-44	R123/mineral oil					334,061						132			493				
X-45	R134a/ mixed ester								281,235			263	158						
X-46	R134a/branched ester								260,458	346		182	200						
X-47	R152a/alkylbenzene										243,525	629	550	803					
X-48	R32/mixed ester				313,197							10,396	3,585		770				
X-49	R32/branched ester				305,647							11,566	3,154		836				
X-50	R124/alkylbenzene						151,492					212							
X-51	R125/mixed ester							73,918				265							
X-52	R125/branched ester							244,122				13,758	189						
X-53	R143a/branched ester									238,318		28,198	143						

Appendix Y

Desiccant Y: 4Å Core (No Carbon)

Table Y.1. Summary Test Results

Desiccant: Y - 4Å Core (No Carbon)

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
Y-New	None	2.5	0	-	-	-	6.1	-	-	-	14	-	71	-	0
	50 ppm Moisture														
Y-11	R11/mineral oil	3.0	1	0	0	0	7.1	0.00	<0.1	4	22	79	4,530	13	1,150
Y-12	R12/mineral oil	3.0	2	0	0	0	4.9	0.00	<0.1	8	72	88	5,940	3	1,010
Y-13	R22/mineral oil	4.0	2	0	0	1	7.2	0.00	0.2	51	6,250	810	18,800	7	4,730
Y-14	R123/mineral oil	3.0	0	0	0	0	5.7	0.67	<0.1	3	13	120	4,230	16	250
Y-15	R134a/ mixed ester	2.5	0	0	0	2	6.0	0.00	5.9	0	1	5	20	7,230	18,200
Y-16	R134a/branched ester	2.5	0	0	0	1	7.4	0.00	5.7	0	2	5	17	5,130	13,400
Y-17	R152a/alkylbenzene	5.0	2	0	0	1	4.2	0.54	3.0	31	430	180	51	1,670	310
Y-18	R32/mixed ester	4.0	1	0	0	2	4.7	1.16	>30	1790	11,700	9	24	29,400	83,300
Y-19	R32/branched ester	3.0	3	0	0	1	5.8	0.10	>30	990	7,650	17	29	16,600	7,190
Y-20	R124/alkylbenzene	2.5	1	0	0	0	4.3	0.06	<0.1	5	1,110	15	4,320	25	0
Y-21	R125/mixed ester	3.0	0	0	0	2	8.8	0.46	7.8	0	1	6	17	9,300	25,800
Y-22	R125/branched ester	2.5	1	0	0	2	8.0	0.00	6.3	0	0	6	41	5,620	19,400
Y-23	R143a/branched ester	2.5	0	0	0	1	5.1	0.00	9.1	12	93	6	100	6,890	17,000
	1000 ppm Moisture														
Y-41	R11/mineral oil	3.0	1	0	0	0	6.0	0.00	<0.1	14	74	240	7,990	32	290
Y-42	R12/mineral oil	3.0	0	0	0	0	7.6	0.00	<0.1	7	220	68	8,260	4	2,240
Y-43	R22/mineral oil	4.0	0	1	0	1	5.7	0.00	<0.1	63	5,660	870	16,700	77	4,430
Y-44	R123/mineral oil	3.0	0	0	0	0	5.7	0.60	0.4	2	18	54	4,840	6	290
Y-45	R134a/ mixed ester	2.5	0	0	0	2	6.5	0.00	10.9	0	2	4	28	7,000	18,200
Y-46	R134a/branched ester	2.5	0	0	0	1	6.4	0.00	13.0	0	0	8	71	4,640	19,800
Y-47	R152a/alkylbenzene	4.5	1	0	0	1	7.3	0.28	2.2	10	430	110	41	1,180	450
Y-48	R32/mixed ester	4.0	1	0	0	2	6.1	0.24	>30	3340	8,810	0	19	40,000	20,900
Y-49	R32/branched ester	5.5	2	0	0	1	3.9	0.32	>30	1350	10,100	4	36	16,800	11,800
Y-50	R124/alkylbenzene	2.5	0	0	1	0	7.2	0.00	<0.1	4	250	59	2,710	9	1,910
Y-51	R125/mixed ester	3.0	0	0	0	2	5.3	0.39	6.6	0	52	5	45	8,800	28,300
Y-52	R125/branched ester	2.5	1	0	0	2	4.9	0.00	13.7	0	0	8	27	8,100	19,000
Y-53	R143a/branched ester	2.5	0	0	0	2	3.1	0.00	9.9	6	1	4	210	4,960	28,100

Table Y.2. Crush Strength Test Results

Desiccant: Y - 4Å Core (No Carbon)

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
Y-New	None	2.7	5.2	3.3	4.3	6.6	4.2	7.0	6.0	12.5	9.3	10.0	6.1	3.0	12.0	0.2
						50 ppm Moisture										
Y-11	R11/mineral oil	8.5	9.2	8.6	4.3	10.3	6.3	5.7	4.1	5.9	7.8	10	7.1	2.1	11.3	2.8
Y-12	R12/mineral oil	3.1	8.4	3.3								3	4.9	3.0	10.9	-1.1
Y-13	R22/mineral oil	8.5	10.5	5.7	5.3	6.1						5	7.2	2.2	11.7	2.8
Y-14	R123/mineral oil	3.7	5.1	5.9	4.3	6.8	9.4	6.7	3.7			8	5.7	1.9	9.6	1.8
Y-15	R134a/ mixed ester	6.4	5.9	4.7	6.8							4	6.0	0.9	7.8	4.1
Y-16	R134a/branched ester	8.4	8.5	7.6	5.2							4	7.4	1.5	10.5	4.4
Y-17	R152a/alkylbenzene	3.4	7.8	2.2	4.1	3.5						5	4.2	2.1	8.5	-0.1
Y-18	R32/mixed ester	5.8	3.2	3.9	5.7							4	4.7	1.3	7.3	2.0
Y-19	R32/branched ester	9.3	4.8	5.4	5.1	4.5						5	5.8	2.0	9.8	1.9
Y-20	R124/alkylbenzene	4.7	3.6	5.9	2.8							4	4.3	1.3	6.9	1.6
Y-21	R125/mixed ester	7.8	8.8	8.9	9.3	7.6	6.1	10.1	11.6			8	8.8	1.7	12.1	5.4
Y-22	R125/branched ester	5.0	9.4	10.5	10.4	7.6	5.2					6	8.0	2.5	13.0	3.0
Y-23	R143a/branched ester	6.8	6.7	3.9	5.5	4.2	3.7					6	5.1	1.4	7.9	2.3
						1000 ppm Moisture										
Y-41	R11/mineral oil	2.5	4.7	5.4	5.5	7.6	7.8	12.1	4.9	3.8	5.3	10	6.0	2.7	11.3	0.6
Y-42	R12/mineral oil	10.8	8.0	7.9	2.5	8.7						5	7.6	3.1	13.7	1.4
Y-43	R22/mineral oil	5.3	5.9	5.6	7.6	7.5	4.2	4.0	5.2			8	5.7	1.3	8.3	3.0
Y-44	R123/mineral oil	8.6	5.9	4.4	3.0	9.1	4.9	4.1	5.3	5.7		9	5.7	2.0	9.7	1.6
Y-45	R134a/ mixed ester	6.4	5.5	8.8	5.1							4	6.5	1.7	9.8	3.1
Y-46	R134a/branched ester	6.4	5.1	4.4	6.1	10.1						5	6.4	2.2	10.8	2.0
Y-47	R152a/alkylbenzene	8.2	6.5	6.0	7.6	5.6	7.8	9.3	6.3	8.8		9	7.3	1.3	10.0	4.7
Y-48	R32/mixed ester	11.4	7.3	4.6	3.4	2.4	5.7	9.8	4.4			8	6.1	3.2	12.4	-0.2
Y-49	R32/branched ester	1.6	2.6	2.1	1.5	7.9	9.3	4.7	1.8			8	3.9	3.1	10.1	-2.2
Y-50	R124/alkylbenzene	12.5	4.7	5.0	5.6	11.0	4.4					6	7.2	3.6	14.4	0.0
Y-51	R125/mixed ester	4.2	4.3	6.3	6.4	8.7	4.7	3.9	3.5			8	5.3	1.8	8.8	1.7
Y-52	R125/branched ester	5.6	5.3	4.1	5.7	5.0	2.8	5.8				7	4.9	1.1	7.1	2.7
Y-53	R143a/branched ester	3.7	2.0	4.8	2.0							4	3.1	1.4	5.9	0.4

Table Y.3. Acid Anion Analysis

Desiccant: Y - 4Å Core (No Carbon)

		Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
Code	System Fluids	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
Y-New	None																				126		1
	50 ppm Moisture																						
Y-11	R11/mineral oil				71			13	1,077														
Y-12	R12/mineral oil	3	1,002		4																	1	
Y-13	R22/mineral oil	7	3,998								731									3	8		
Y-14	R123/mineral oil	2	79	14	176																3		2
Y-15	R134a/ mixed ester	4	35	2	22	7				7,222	18,132									2	18		1
Y-16	R134a/branched ester	252	543		21	5				4,871	12,845									4	22		1
Y-17	R152a/alkylbenzene	24	20	1,042	292					45		558									7	1	2
Y-18	R32/mixed ester	2,134		6,349						18,383	17,587		557	2,510	65,133					24			
Y-19	R32/branched ester	3,012				2,327				10,543	6,037			424	1,151	308				17	113		3
Y-20	R124/alkylbenzene	5								20											125		
Y-21	R125/mixed ester	14	26	13	37	12				9,262	25,720											1	
Y-22	R125/branched ester	296	694	4	51					5,324	18,665										14	1	2
Y-23	R143a/branched ester	317	601							6,577	16,144				303					4	20		
	1000 ppm Moisture																						
Y-41	R11/mineral oil		294			32																1	1
Y-42	R12/mineral oil	4	2,033		203																18	1	
Y-43	R22/mineral oil	12	3,882							65	544									7	4		
Y-44	R123/mineral oil	2	88	4	203																0	1	1
Y-45	R134a/ mixed ester	5	37	3	24				17	6,993	18,160									2	8	1	1
Y-46	R134a/branched ester	272	854	7	332					4,363	18,598									6	29		1
Y-47	R152a/alkylbenzene	9	21	1,038	433					130											12	1	1
Y-48	R32/mixed ester	3,985	2,239							36,053	11,399		1,014		6,201					32	161	1	
Y-49	R32/branched ester	4,039	3,680	1,756						10,881	6,784		263		1,066	94				13	121	2	2
Y-50	R124/alkylbenzene	9	1,426		432												51					2	2
Y-51	R125/mixed ester	4	73	13	348					8,779	27,833										27		
Y-52	R125/branched ester	403	766	4	73	9				7,684	18,206												
Y-53	R143a/branched ester	278	1,000		458	3				4,674	26,686										49		2

Table Y.4. Gas Chromatography Analysis

Desiccant: Y - 4Å Core (No Carbon)

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
Y-11	R11/mineral oil	198,410										28,094	220						
Y-12	R12/mineral oil		285,938									324	306						
Y-13	R22/mineral oil			290,097								5,969	13,354						
Y-14	R123/mineral oil					319,895						240	128		1,311				836
Y-15	R134a/ mixed ester								268,982			236	418						
Y-16	R134a/branched ester								265,564			201	402						
Y-17	R152a/alkylbenzene										263,098	1,281	792	378			1,040		
Y-18	R32/mixed ester				130,101							18,155	3,481	1,085	429				
Y-19	R32/branched ester				144,779							6,727	5,799		145				
Y-20	R124/alkylbenzene						277,571		178			300	199						
Y-21	R125/mixed ester							278,608				226	438			1,278			
Y-22	R125/branched ester							210,828				170	276						
Y-23	R143a/branched ester									204,797		37,173	397						
	1000 ppm Moisture																		
Y-41	R11/mineral oil	214,735										36,592							
Y-42	R12/mineral oil		281,288									172	270						
Y-43	R22/mineral oil			266,735								7,016	9,275						
Y-44	R123/mineral oil					350,612						158	86		1,091				1,016
Y-45	R134a/ mixed ester								272,585			309	731						
Y-46	R134a/branched ester								221,843			27,559	486						
Y-47	R152a/alkylbenzene										239,204	14,515	853	672					
Y-48	R32/mixed ester				298,484							122,215	7,683		725				
Y-49	R32/branched ester				275,634							12,293	6,801		878				
Y-50	R124/alkylbenzene						131,602					182							
Y-51	R125/mixed ester							263,152				678	378		1,039				
Y-52	R125/branched ester							241,290				396	414						
Y-53	R143a/branched ester									221,324		38,719	266						

Appendix Z

Desiccant Z: 4Å Core (No Carbon)

Table Z.1. Summary Test Results

Desiccant: Z - 4Å Core (No Carbon)

Code	System Fluids	Liquid Color (2-8)	Desic Color (0-3)	Copper Plating (0-5)	Solids Formation (0-3)	Steel Corrosion (0-3)	Crush Strength (lbs)	GC % Ref Reacted (wt %)	Total Acid Number (mg KOH)	F ion in Liquid (ppm)	F ion on Desiccant (ppm)	Cl ion in Liquid (ppm)	Cl ion on Desiccant (ppm)	Org Acid in Liquid (ppm)	Org Acid on Desic (ppm)
Z-New	None	2.5	0	-	-	-	3.8	-	-	-	45	-	54	-	0
	50 ppm Moisture														
Z-11	R11/mineral oil	3.0	2	0	0	0	2.3	0.15	<0.1	6	3	200	6,010	1	280
Z-12	R12/mineral oil	3.0	2	0	0	0	2.8	0.00	<0.1	4	280	34	3,190	0	1,120
Z-13	R22/mineral oil	2.5	1	0	0	1	2.1	0.11	<0.1	53	3,680	620	16,900	9	3,620
Z-14	R123/mineral oil	3.0	1	0	0	0	3.4	0.25	0.3	3	280	64	3,050	15	360
Z-15	R134a/ mixed ester	2.5	0	0	0	2	3.5	0.00	7.1	0	1	4	18	8,060	18,400
Z-16	R134a/branched ester	2.5	0	0	0	1	3.3	0.00	6.1	0	0	3	93	5,810	24,500
Z-17	R152a/alkylbenzene	5.0	2	0	0	1	1.9	0.43	2.6	62	490	220	65	2,490	45
Z-18	R32/mixed ester	6.0	2	0	0	3	1.7	0.00	>30	4,330	15,500	16	18	32,200	30,400
Z-19	R32/branched ester	4.0	0	0	0	2	5.4	1.17	>30	1,690	16,400	6	44	23,900	10,600
Z-20	R124/alkylbenzene	2.5	0	0	0	0	4.2	0.49	<0.1	14	1,290	29	3,290	11	410
Z-21	R125/mixed ester	2.5	0	0	0	3	4.5	0.00	17.7	0	3	2	17	9,840	21,000
Z-22	R125/branched ester	2.5	0	0	0	3	4.8	0.00	13.9	0	0	2	13	8,870	16,300
Z-23	R143a/branched ester	2.5	0	0	0	2	3.4	0.00	7.4	3	300	5	40	5,080	15,100
	1000 ppm Moisture														
Z-41	R11/mineral oil	3.0	1	0	0	0	4.4	0.00	<0.1	10	200	140	5,900	9	370
Z-42	R12/mineral oil	3.0	1	0	0	0	3.9	0.00	<0.1	6	130	63	3,850	5	1,360
Z-43	R22/mineral oil	2.5	0	0	0	1	3.9	0.00	<0.1	23	3,080	743	14,700	5	4,050
Z-44	R123/mineral oil	3.0	1	0	0	0	2.8	0.28	<0.1	5	420	53	3,250	4	800
Z-45	R134a/ mixed ester	2.5	0	0	0	2	3.8	0.00	5.9	0	1	10	52	8,850	26,600
Z-46	R134a/branched ester	2.5	0	0	0	1	8.3	0.00	11.6	0	0	0	83	5,460	25,100
Z-47	R152a/alkylbenzene	5.0	1	0	0	0	4.0	0.43	3.2	600	830	70	36	770	250
Z-48	R32/mixed ester	7.5	2	0	0	2	4.0	0.22	>30	5,130	9,700	45	27	45,400	34,900
Z-49	R32/branched ester	3.5	1	0	0	2	3.0	0.17	>30	1,060	1,610	4	31	15,800	19,300
Z-50	R124/alkylbenzene	2.5	0	0	0	0	9.8	0.00	<0.1	3	75	24	220	1,370	33,200
Z-51	R125/mixed ester	3.0	0	0	0	1	4.7	0.00	19.2	0	0	10	28	8,330	26,300
Z-52	R125/branched ester	2.5	0	0	0	2	3.7	0.00	9.8	0	0	6	8	4,440	14,900
Z-53	R143a/branched ester	2.5	0	0	0	2	3.1	0.00	10.7	0	4	2	140	4,980	23,200

Table Z.2. Crush Strength Test Results

Desiccant: Z - 4Å Core (Carbon)

Code	System Fluids	Test # 1	2	3	4	5	6	7	8	9	10	Total # of Tests	Crush Strength (lbs) Avg	Std Dev	Upper 95%	Lower 95%
Z-New	None	2.7	2.4	4.0	1.9	5.8	2.5	4.2	3.2	6.4	5.2	10.0	3.8	1.6	6.9	0.7
						50 ppm Moisture										
Z-11	R11/mineral oil	2.4	1.0	5.6	1.6	1.2	2.1	1.3	1.8	4.2	1.9	10	2.3	1.5	5.2	-0.6
Z-12	R12/mineral oil	3.3	1.6	1.9	4.3							4	2.8	1.3	5.3	0.3
Z-13	R22/mineral oil	2.2	1.4	1.8	1.9	2.5	2.7					6	2.1	0.5	3.0	1.1
Z-14	R123/mineral oil	3.5	3.6	2.6	4.4	2.7	3.2	4.0	2.7	4.3		9	3.4	0.7	4.8	2.1
Z-15	R134a/ mixed ester	2.7	3.4	3.9	3.8							4	3.5	0.5	4.5	2.4
Z-16	R134a/branched ester	4.5	2.1	2.7	3.8							4	3.3	1.1	5.4	1.1
Z-17	R152a/alkylbenzene	1.5	2.9	2.7	1.6	0.9						5	1.9	0.8	3.6	0.2
Z-18	R32/mixed ester	3.5	2.0	0.8	1.3	1.1	1.6					6	1.7	1.0	3.6	-0.2
Z-19	R32/branched ester	7.3	5.0	3.7	9.3	4.1	3.2					6	5.4	2.4	10.2	0.7
Z-20	R124/alkylbenzene	3.0	4.6	5.6	3.6	5.1	3.2					6	4.2	1.1	6.3	2.0
Z-21	R125/mixed ester	3.8	6.9	4.8	3.3	4.5	3.4					6	4.5	1.3	7.1	1.8
Z-22	R125/branched ester	6.6	5.3	4.9	3.2	4.2						5	4.8	1.3	7.4	2.3
Z-23	R143a/branched ester	3.6	3.5	4.5	2.0	5.5	4.6	2.2	3.3	1.4		9	3.4	1.3	6.1	0.7
						1000 ppm Moisture										
Z-41	R11/mineral oil	3.1	3.4	7.5	3.7	3.1	3.5	9.8	2.9	3.7	3.2	10	4.4	2.3	9.0	-0.3
Z-42	R12/mineral oil	3.5	4.6	4.8	2.6							4	3.9	1.0	5.9	1.8
Z-43	R22/mineral oil	2.2	3.0	1.8	6.1	8.3	2.0					6	3.9	2.7	9.3	-1.5
Z-44	R123/mineral oil	3.8	2.0	1.8	2.0	3.8	2.6	3.7				7	2.8	0.9	4.7	1.0
Z-45	R134a/ mixed ester	4.0	2.9	4.7	4.4	2.9						5	3.8	0.8	5.5	2.1
Z-46	R134a/branched ester	10.6	7.5	4.5	7.5	7.5	9.9	9.3	6.8	8.3	10.8	10	8.3	1.9	12.1	4.4
Z-47	R152a/alkylbenzene	4.3	2.9	3.1	1.7	3.3	3.5	5.0	7.8	4.4		9	4.0	1.7	7.4	0.6
Z-48	R32/mixed ester	3.8	7.2	2.3	3.0	3.1	2.9	7.6	2.3	4.7	3.4	10	4.0	1.9	7.9	0.2
Z-49	R32/branched ester	3.1	2.4	2.0	2.1	2.4	5.3	4.9	2.4	2.7	2.5	10	3.0	1.2	5.3	0.7
Z-50	R124/alkylbenzene	16.1	11.8	5.1	6.2							4	9.8	5.1	20.0	-0.4
Z-51	R125/mixed ester	5.2	4.8	4.1	3.8	4.7	5.7	4.9				7	4.7	0.6	6.0	3.5
Z-52	R125/branched ester	1.7	4.2	5.0	3.7							4	3.7	1.4	6.5	0.8
Z-53	R143a/branched ester	3.7	2.0	4.8	2.0							4	3.1	1.4	5.9	0.4

Table Z.3. Acid Anion Analysis

Desiccant: Z - 4Å Core (No Carbon)

		Anion Concentration (PPM)																				Number Of Unknowns	
		Formate		Acetate		Propanoate		Butyrate		Pentanoate		Hexanoate		Heptanoate		2Ethylhexanoate		Benzoate		Sulfate			
Code	System Fluids	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic	Liq	Desic
Z-New	None																				223		1
	50 ppm Moisture																						
Z-11	R11/mineral oil	1	276																	3			
Z-12	R12/mineral oil	0	1,117																	0	78		
Z-13	R22/mineral oil	9	3,616																		30	1	2
Z-14	R123/mineral oil	9	73	6	289															7	178		2
Z-15	R134a/ mixed ester	20	31	55	38		20		24	7,983	18,267										23		
Z-16	R134a/branched ester	282	721	4	85					5,507	21,733				1,956	18					17		1
Z-17	R152a/alkylbenzene	87	45	1,746								656									35	1	2
Z-18	R32/mixed ester	2,716								29,480	13,062		1,499		15,791					67	207		
Z-19	R32/branched ester	2,688				577				20,365	6,770	311	601		3,213						181	1	
Z-20	R124/alkylbenzene	11	413																		102	1	
Z-21	R125/mixed ester	18	49	19	145	15	94		66	9,786	20,594						71				14		1
Z-22	R125/branched ester	429	678	3	41					8,434	14,883						670				18		2
Z-23	R143a/branched ester	253	731							4,824	14,065				276					5	32		
	1000 ppm Moisture																						
Z-41	R11/mineral oil	2	326	7	47																144		
Z-42	R12/mineral oil	3	1,361							2											16	1	
Z-43	R22/mineral oil	5	4,053																		9		
Z-44	R123/mineral oil	2	181	2			622													9	248		2
Z-45	R134a/ mixed ester	9	91	4	71		43		34	8,835	26,346									7	51		1
Z-46	R134a/branched ester	338	948		178					5,121	23,070				937						45		
Z-47	R152a/alkylbenzene	5	15			770											231				29	1	3
Z-48	R32/mixed ester	3,579	2,261							41,865	17,937		1,629		13,074					91	93	2	
Z-49	R32/branched ester	1,164	1,869							14,622	16,339				1,055						37	1	
Z-50	R124/alkylbenzene	6	86	12	64				194	1,350	18,401				14,428						195		1
Z-51	R125/mixed ester		79	7				57		8,269	26,188												
Z-52	R125/branched ester	227	584	9	34	9				4,194	14,233										25		1
Z-53	R143a/branched ester	252	744	15	68		51			4,712	20,620						1,755				62		4

Table Z.4. Gas Chromatography Analysis

Desiccant: Z - 4Å Core (No Carbon)

		GC Peak Areas																	
	Peak ID >>	R-11	R-12	R-22	R-32	R-123	R-124	R-125	R-134a	R-143a	R-152a	NCG	CO2	Unkn 1	Unkn 2	Unkn 3	Unkn 4	Unkn 5	Unkn 6
Code	Reten. Time >>	7.00	2.00	1.40	0.70	12.50	3.00	0.90	1.18	1.00	1.38	0.35	0.55	0.90	1.30	2.90	4.20	4.60	5.20
	50 ppm Moisture																		
Z-11	R11/mineral oil	325,960										187	236	477					
Z-12	R12/mineral oil		250,980									107,489							
Z-13	R22/mineral oil			299,154								1,439	473	328					
Z-14	R123/mineral oil					278,551							118		687				
Z-15	R134a/ mixed ester								252,974			4,436							
Z-16	R134a/branched ester								261,618			400	270						
Z-17	R152a/alkylbenzene										200,645	286	802	867					
Z-18	R32/mixed ester				95,669							33,692	4,168						
Z-19	R32/branched ester				196,468							7,270	1,916		2,300				
Z-20	R124/alkylbenzene						265,075					137	266		1,291				
Z-21	R125/mixed ester							258,429				1,687							
Z-22	R125/branched ester							241,439				729	148						
Z-23	R143a/branched ester									221,356		37,186	228						
	1000 ppm Moisture																		
Z-41	R11/mineral oil	195,770										35,931	257						
Z-42	R12/mineral oil		276,866									700	216						
Z-43	R22/mineral oil			285,694								2,636	4,985						
Z-44	R123/mineral oil					289,832						314	210		819				
Z-45	R134a/ mixed ester								243,566			357	176						
Z-46	R134a/branched ester								278,850			215	272						
Z-47	R152a/alkylbenzene										129,112	25,504	366	549					
Z-48	R32/mixed ester				277,976							16,461	5,358		616				
Z-49	R32/branched ester				127,415							9,610	5,332		218				
Z-50	R124/alkylbenzene						155,559					392							
Z-51	R125/mixed ester							274,844				178	278						
Z-52	R125/branched ester							233,375				13,003	228						
Z-53	R143a/branched ester									211,940		35,813							