



REPORT
INTERTEK ETL SEMKO Division
1717 Arlingate Lane COLUMBUS, OHIO 43228

ORDER NO.3088851

Page 1 of 4

DATE: January 6, 2006

TEST REPORT NO.: 3088851

RENDERED TO:

MJ Research and Development
5607 Candlewood
Houston, TX 77056

AUTHORIZATION: The test was authorized by Fred Massey; Purchase Order No. SIGNED QUOTE.

SPECIMEN DESCRIPTION: The tests were performed on specimens identified by the client as Sample ICE 32.

INTRODUCTION: This report describes the results of the Etna Products sample in accordance with ASHRAE 99, for Process Fluids with Potentially Low System Concentration. The test evaluations were conducted at Intertek Testing Services located in Columbus, OH between 12/21/05 and 1/4/06.

MATERIALS AND METHODS:

ASHRAE 99, Sealed Glass Tube Method to Test the Chemical Stability of Material for use within Refrigeration Systems, Procedure for Process Fluids with Potentially Low System Concentration

Common Materials

Degreased, cut copper, aluminum, and steel coupons.

R-152a

Glass tubes, sealed on one end

Procedure for Preparing Glass Tubes and Injecting Lubricants and Refrigerants

Procedures for sealed tube tests for chemical compatibility were supplied by Trane according to the following guidelines:

1. Three small glass tubes were prepared for each process chemical/refrigerant combination.
2. And additional sets of three tubes were prepared with no process chemical control samples.
3. In each tube, 1 gram of lubricant was injected using a calibrated syringe.
-for R-152a samples, CPI Engineering Solest 68POE oil was used.
4. In each tube 0.75 gram of new refrigerant was added according to ASHRAE 97 procedures.
5. One coupon of copper, one coupon of aluminum, and one coupon of steel were placed in each tube.
6. Each tube was sealed to exclude any air and moisture.
7. Tubes containing R-152a were placed in a calibrated 175 C oven for 14 days.

Subject: An independent organization testing for safety, performance, and certification.

This report is for the exclusive use of INTERTEK's Client and is provided pursuant to the agreement between INTERTEK and its Client. INTERTEK's responsibility and liability are limited to the terms and conditions of the agreement. INTERTEK assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the INTERTEK name or one of its marks for sale or advertisement of the tested material, product or service must first be approved in writing by INTERTEK. The observations and test results in this report by itself does not imply that the material, product or service is or has ever been under an INTERTEK certification program.

Procedure for Analyzing Sealed Tubes

Visual Analyses

1. After the tubes were in the oven for 14 days at 175 C, they were removed and allowed to cool to room temperature.
2. Each group of tubes (3) was arranged according to the product and any broken tubes were noted.
3. Each tube was examined for clarity of lubricant solution, particulates, and haze. Copper plating, dulling, darkening, pitting, film formation and any surface changes were noted for each metal in the tube.
4. Using one tube, the physical compatibility (miscibility) was determined using the following procedure:
 - The tube was first observed at room temperature for any solids or immiscible liquids.
 - The tube was then cooled to -40 C and any change from the control samples (solid precipitate, floc formation, haze, or immiscibility) was noted.
 - Any visual observations were recorded as the tube cooled.

Chemical Analyses

1. After all chemical observations were conducted, each tube was placed in a liquid nitrogen bath for approximately 5 minutes, or until the contents of the tube were frozen.
2. For each product, 2 small glass vials were labeled according to the product and weighed to the nearest 0.01g.
 - One tube was labeled for TAN
 - One tube was labeled for ICP
3. Once the tubes were frozen they were removed from the nitrogen and scored on the upper portion of the tube and broken.
4. Immediately after the tube was broken, it was placed, broken side down, in the appropriate glass vial. And the contents were allowed to warm back to room temperature, thus draining into the vial.
5. This was repeated for each tube and after all the liquid was in the glass vial, the broken tube was removed (with the metals remaining in the tube) and the vial was weighed to the nearest 0.01.
6. The amount of lubricant was determined by subtracting the weight of the empty vial from the weight of the vial with the lubricant.

Total Acid Number (TAN)

1. An solution (49.5% toluene, 49.5% isopropyl alcohol, and 1% water), and 6 drops of color indicator (bromothymol blue) was prepared and then titrated using a 0.01M solution of KOH, until the solution turned a slightly dark green color.
2. A small amount of this solution was added to the vial labeled "TAN".
3. Using a calibrated 0.25ml syringe, KOH was slowly added to the solution and mixed until a slightly dark green color was achieved.
4. The amount of KOH used was noted and the acid number was determined using the following formula:
$$\text{Wt. KOH} \times \text{Molarity of KOH} \times 56.1 / \text{wt. of lubricant} = \text{mgKOH/g of sample}$$
$$56.1 = \text{molecular weight of KOH}$$
5. This was performed on 1 tube from each product/refrigerant combination and on 1 tube from each control sample.

Dissolved Metals

1. The lubricant sample was diluted to 10% in kerosene.
2. The vial contents were mixed well and all ICP samples were run on the "Normallube" program on the ICP. The ICP is calibrated using a 50ppm standard for 21 different elements with a detection level of 0.01ppm.
3. Values for aluminum, chromium, copper, iron, lead, tin, and zinc were noted. Any value under 1ppm was noted as <1 ppm.

Subject: An independent organization testing for safety, performance, and certification.

This report is for the exclusive use of INTERTEK's Client and is provided pursuant to the agreement between INTERTEK and its Client. INTERTEK's responsibility and liability are limited to the terms and conditions of the agreement. INTERTEK assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the INTERTEK name or one of its marks for sale or advertisement of the tested material, product or service must first be approved in writing by INTERTEK. The observations and test results in this report by itself does not imply that the material, product or service is or has ever been under an INTERTEK certification program.

4. This was performed on 1 tube from each product/refrigerant combination and on 1 tube from each control sample.

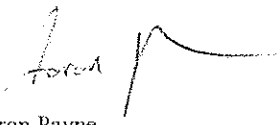
Refrigerant Decomposition

1. The contents of the third tube were analyzed for refrigerant decomposition.
2. After attaching the tube to an apparatus containing a small cylinder, it was attached to a vacuum pump
3. After a sufficient vacuum was achieved, the tube was placed in liquid nitrogen to freeze the contents of the tube, and then the sample cylinder was frozen.
4. The tube was then broken and allowed to warm. This facilitated the transfer of refrigerant from the tube to the sample cylinder.
5. The cylinder was allowed to warm to room temperature and then analyzed by gas chromatography.

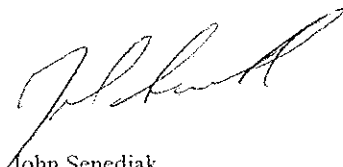
Treatment for Process Chemicals with Low System Concentration

1. Prior to testing the process chemical, it is determined what metal coupon is to be exposed to the fluid, the application strength, the temperature, the amount of drying time, and the drying temperature.
2. The metal coupon is then placed in a vial containing the fluid.
3. After approximately 5 minutes, the metal coupons are carefully removed with clean pliers.
4. The coupons are then allowed to air dry, overnight.
5. The condition and appearance of the coupon is recorded, as a baseline description, in order to assess any changes that may occur after aging.
6. The metals are then introduced into the glass tubes, and the above process is completed.

Test Performed by:


Aaron Payne
Chemist
Analytical Laboratory

Report Approved by:


John Sencdiak
Lab Manager
Analytical Laboratory

Subject: An independent organization testing for safety, performance, and certification.

This report is for the exclusive use of INTERTEK's Client and is provided pursuant to the agreement between INTERTEK and its Client. INTERTEK's responsibility and liability are limited to the terms and conditions of the agreement. INTERTEK assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the INTERTEK name or one of its marks for sale or advertisement of the tested material, product or service must first be approved in writing by INTERTEK. The observations and test results in this report by itself does not imply that the material, product or service is or has ever been under an INTERTEK certification program.

Appendix A

Results, Physical Properties

Tube ID	Refrigerant	Product	Lubricant	Total Acid Number (mgKOH/g)	Refrigerant Decomposition (% by weight)	Dissolved Al (ppm)	Dissolved Cu (ppm)	Dissolved Fe (ppm)
MJ	R-152a	ICE 32	PAG	.04	<.05	<1	2	3

Results, Visual Inspections

Tube ID	Refrigerant	Lubricant	Additive	Visual Inspection, liquid phase	Visual Inspection, Copper	Visual Inspection, Aluminum	Visual Inspection, Steel
MJ	R-152	PAG	ICE 32	1a	1	0	1

Liquid Phase Visual Inspection Legend

*0 = No change *1a = Slight darkening *1b = Cloudy *2a = Moderate darkening *2b = Cloudy
 *3a = Extreme darkening *3b = Cloudy *4a = Opaque

Steel Coupon Visual Inspection Legend

*0 = No change *1 = Slight darkening *2 = Slight discoloration *3 = Moderate copper plating *4 = Heavy copper plating

Copper and Aluminum Visual Inspection Legend

*0 = No change *1 = Slight tarnish *2 = Slight corrosion *3 = Moderate corrosion *4 = Heavy corrosion

Subject: An independent organization testing for safety, performance, and certification.

This report is for the exclusive use of INTERTEK's Client and is provided pursuant to the agreement between INTERTEK and its Client. INTERTEK's responsibility and liability are limited to the terms and conditions of the agreement. INTERTEK assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the INTERTEK name or one of its marks for sale or advertisement of the tested material, product or service must first be approved in writing by INTERTEK. The observations and test results in this report by itself does not imply that the material, product or service is or has ever been under an INTERTEK certification program.