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Effect of Selected Contaminants in Air Conditioning and Refrigeration Equipment

Final Report

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EXECUTIVE SUMMARY

The intent of this study was to investigate the effects of air, water, organic acid, and refrigerant contaminants on compressor wear, durability, and longevity. A statistical analysis determined that meaningful results would be produced by running 128 compressors charged with one of four chosen refrigerants at high and low temperatures contaminated in various combinations with 200 ppm water, 0.1 total acid number (TAN), 4% (v/v) air, and 4% (w/w) refrigerant. The refrigerants studied were R-507A, R-407C, R-22, and R-134a. R-507A compressors were contaminated with R-502, R-407C units with R-22, and R-134a machines with R-12. The R-22 compressors did not include a refrigerant contaminant. Sixteen compressors were added as controls, bringing the total number studied to 144.

A glass sealed tube stability study was performed at the same time using the same refrigerants, lubricants, and contaminants as the compressors at 135°C (275°F) and 165°C (329°F). The glass sealed tube stability study provided a visual example of the occurrences inside the running compressors.

Conclusions Drawn from Sealed Tube Visual Observations

System Refrigerant	System Temperature	
	135°C (275°F)	**165°C (329°F)**
R-507A (Appendix I)	• ***Acid*** corrodes copper in gas phase. • ***Air*** generates precipitate.	• ***Acid*** corrodes copper in gas phase and corrodes valve steel. • ***Air*** generates precipitate.
R-407C (Appendix J)	• ***Air*** corrodes valve steel and generates precipitate. • ***Water***, ***acid***, and ***R-22*** corrode copper.	• ***Air*** generates precipitate. • ***Water***, ***acid***, and ***R-22*** corrode valve steel.
R-22* (Appendix K)	• ***Air*** corrodes all metals and generates precipitate.	• ***Air*** corrodes all metals and generates precipitate.
R-134a (Appendix L)	• ***Water*** and ***acid*** corrode copper. • ***Acid*** and ***air*** generate precipitate.	• ***Air*** generates precipitate.

* The R-22 system generated significantly more corrosion than others did.

A final statistical analysis was performed based on a database compiled from visual observations and chemical analysis of the compressors torn down after 12,000 hours running

time. A complete photographic history was also compiled for each compressor's main components. (See Appendix A)

Based on the statistical analysis, R-507A and R-22 were associated with a higher percentage of abnormal machines than R-407C and R-134a. Suniso 3GS was associated with a substantially higher number of abnormal machines than RL32S. Machines that had contaminant acid, air, and water added were declared abnormal far more than control machines. Performance of machines that had refrigerant added as a contaminant was mixed; some machines were worse than controls, others were better. Discharge pressure tended to be lower for outcome variables that were declared normal. Suction pressure tended to be higher for outcome variables that were declared normal. Discharge, return gas, and sump temperatures tended to be lower for outcome variables that were declared normal.

In conclusion, this comprehensive study indeed proves that low levels of water, organic acid, and especially air contribute to the degradation of compressor performance and compressor life. The sealed tube tests at two different temperatures and duration also clearly identified the corrosive effects of water and organic acid, but most importantly showed that the presence of air accelerates refrigerant and lubricant decomposition. Clearly, the lubricant type plays an extraordinary role in tolerance to contaminant levels. Polyolesters are significantly more susceptible to water and the presence of air. This is clearly shown by both the compressor and sealed tube studies.

All of the R-22 compressor test units survived the duration of the study and contained contaminants identical to the other HFC machines. The primary difference was that the R-22 units were a chlorinated refrigerant lubricated with a mineral oil, whereas the HFC machines were lubricated with a polyolester.

Bear in mind that all of the test stands were operated without any kind of contaminant control such as a filter drier or some component in the liquid line prior to the expansion valve. The results reported for compressor can bottom residue, trash in the in-line screen, and residue in the expansion valve could possibly have been eliminated with a filter drier.

The type and construction of the filter drier is an important concept to keep in mind, but more importantly is the contaminant needing to be trapped by the drier. Solid debris, water, acids, and varnish causing issues can be effectively controlled. Therefore, reactive components and solid debris can be retained. What cannot be retained in a filter drier is circulating air

contamination. As evidenced in the sealed tube testing, air is consumed, producing carbon monoxide and carbon dioxide, as well as increasing organic acid content. Naturally, a filter drier equipped to handle quantities of organic acid would be superior. In mineral oil and R-22 systems, air has less of a negative effect and the traditional use of drying-only filter driers may be ideal. In fact, R-22 test stands also show the tolerance of contaminants with chlorinated mineral oil systems.

Finally, organic acid contaminants can be formed *in situ* with the presence of water. The presence of water is shown to be a negative factor in lubrication as well. Friction and wear are attributed to increased acid content in some machines. The inclusion of air in HFC and polyolester systems should be considered the most serious of contaminants. Circulating levels of air in new systems should be kept at lower levels than recommended in current industry guidelines.

INTRODUCTION

Historically, the Air Conditioning and Refrigeration (AC&R) industry has produced a highly reliable product. This success story is attributable to effective common sense and the realization that a quality product requires the use of reliable components and quality manufacturing practices to minimize ambient contaminants.

AC&R systems must be free of contaminants. Contaminants can be solids, liquids, or gasses. Concentrations can range from mere traces of reactive process fluids to process fluids that cause a reaction with lubricants and refrigerants resulting in chemical reactions that produce harmful materials. Traditionally, the refrigerants used were chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs) and included major use refrigerants such as R-12 and R-22 and some blends of these materials. Harmful contaminant materials can range from very dilute amounts of gaseous hydrochloric (HCl) or hydrofluoric (HF) acids obtained from refrigerant decomposition or other refrigerant decomposition intermediates.

AC&R systems also need to be dry. The use of CFCs and HCFCs traditionally require the moisture limits to be less than 50-60 ppm since the presence of moisture will hydrolyze these refrigerants. In wet systems, the formation of HCl can have negative results from iron corrosion caused by trace amounts of ferric chloride and cuprous chloride. Solution of copper salts in mineral oils with CFCs and HCFCs help promote copper plating in addition to other mechanisms.

Nearly a decade ago, The Montreal Protocol established the elimination of CFC and HCFC refrigerants and ushered in hydrofluorocarbons (HFCs) in an attempt to minimize the destruction of the ozone layer. Still using traditional strategies, the AC&R industry moved to maintain the same physical properties of compressor and system lubrication by selecting miscible lubricants with these refrigerants. The use of HFCs with mineral oils is an immiscible combination, but is not necessarily incompatible with the hermetic systems.

The miscible lubricant class chosen for use with HFCs is polyolesters of the pentaerythritol variety and is available in all the required viscosity and miscibility ranges for compressor lubrication. Like the chlorinated refrigerants, polyolester lubricants can be partially hydrolyzed by water forming various levels of carboxylic acids. Unlike HCl or HF, carboxylic acids are considered weak acids under all conditions. However, when a hermetic system is dry, below 50 ppm moisture, HCl, HF, and carboxylic acids are essentially unionized and can be

unreactive toward metal surfaces. However, one of the unique features of a carboxylic acid is its ability to form soluble metal carboxylates that can circulate in a hermetic system. Circulating metal carboxylates can clog capillary tubes, hence very dry systems are required.

Therefore, whether the AC&R industry produces hermetic systems with CFC, HCFC, or HFC refrigerants, with mineral or polyolester lubrication, the elimination of water as a contaminant is essential. Doing so minimizes metal corrosion, the circulation of refrigerant-insoluble metal salts, metals erosion, and plugged expansion devices, such as capillary tubes and refrigerant metering valves.

Refrigerant producers were quick to realize that CFCs and HCFCs produced and packaged with levels of non-condensable gasses (NCGs) above 1.5% of the vapor volume can cause false high pressures and hydrocarbon oxidation, as well as other disruptive products.

For refrigerant manufacturers, the ARI 700 refrigerant specification was established as a means of monitoring the quality of a refrigerant. Typically, refrigerant is produced at lower levels of NCGs. With the advent of alternatives and replacements, refrigerant chemical companies want to produce the best available product in order to maintain a positive reputation in the AC&R industry.

Air, the other ambient contaminant, is frequently overlooked as a reactive component. Air is taught to be a non-condensable gas and its entrapment in the condenser causes a reduction in the efficiency of the refrigeration system. However, air contains oxygen and trapped oxygen will provide a mechanism for an oxidation reaction with lubricants, metals, and refrigerant decomposition products. Typically, however, the industry is taught to believe air causes higher discharge pressures and temperatures and hence reduced performance.

The known and readily available manufacturing procedure for removing NCGs and water from refrigerant hermetic systems is simply to apply a residual system vacuum of at least 100 millitorr. Manufacturing AC&R equipment at these vacuum levels ensures a free product free from any contaminant-induced failure.

There are two kinds of NCGs with which to be concerned: 1) Those that are pure unreactive nitrogen and 2) those that are principally air. Oxygen in air is a well known corrodant and in the presence of moisture can produce disastrous effects. Nitrogen, although inert, should not be present due to excessively high pressures within the system.

Existing CFC refrigeration systems use mineral oils and the internals of these old machines contain trace amounts of metallic chlorides and the chlorinated refrigerant. Generally, R-12 systems are retrofitted with R-134a and R-502 systems are retrofitted with either R-404A or R-507A. Theoretically, the remaining chlorinated refrigerant can be considered a contaminant and could interfere with long-term performance. Long-term controlled tests are needed to evaluate this potential failure mode.

The AC&R industry has been very successful in producing a highly reliable product because of modern technology. It is dangerous to deviate from what is known to be right. We know that having a dry system (10 to 15 ppm moisture) and introducing clean refrigerant from a liquid supply tank with less than 1.5 % of NCGs in the vapor phase of that tank provides for a reliable system. To rephrase, the ARI 700 refrigerant specification maintains that refrigerant is supplied with less than 1.5% v/v of air in the vapor space above the liquid refrigerant in the supply tank and that *not* all of the refrigerant has a minimum of 1.5% v/v air. This means that charging liquid refrigerant into a new system is essentially air free. Using refrigerants with higher levels of contaminants than specified in ARI Standard 700 is very risky. The risk comes from the fact that not all of the CFC, HCFC, or HFC refrigerants have the same air solubility characteristics and simply accepting the ARI-700 specification as a maximum of 1.5% v/v may not be good enough for HFC refrigerants.

BACKGROUND

Compressors selected for AC&R systems are qualified by the manufacturer for long term reliability, capacity, and electrical efficiency. Compressor information is traditionally supplied by the compressor manufacturer that tests their products for reliability at accelerated application conditions. These tests generally last 4000 hours and do not evaluate the effects of contaminants of water, NCGs, acid production, or refrigerant decomposition.

Materials selected for system and compressor construction and lubrication are traditionally tested by using the glass sealed tube test method. This method is a static comparative analytical approach and does not capture the effects of the long-term dynamic relationship found in compressors. Sealed tubes use material coupons that are immersed in compressor lubricant and refrigerant and are constructed scrupulously dry and without any non-condensable gasses or acids present.

This research work was designed to include a sealed tube comparative corrosion study using selected levels of contaminants at the same concentrations that were introduced into the compressors and the AC&R hot gas bypass test systems. Thomas (1993) described the impact of carboxylic acids, moisture, and air as the NCG. The refrigerants used by Thomas included HFC-32, HFC-125, and HFC-143a and most of the commonly used metals in AC&R systems. An earlier paper by DuPont (1992) also confirmed the adverse effects of added moisture and air to a sealed tube system using PAGs and HFC-134a.

To evaluate the temperature, pressure, and refrigerant effects, test stands were operated at two different discharge temperatures. The run time for the AC&R test stands was slated for 12,000 hours, representing at least five years of continuous service. Similarly, sealed tubes were also evaluated at two different temperatures for two different times to simulate the same amount of compressor life.

The concentration levels of contaminants introduced to the compressors were typical of a manufacturing error and at levels very close to recovered refrigerant. The organic acid level was 0.100 TAN, representing a typical off-spec lubricant. All of the test systems were first desiccated with molecular sieve desiccant to known water levels, the desiccants were removed, and water was added at a level typical of a poor evacuation or of system parts that were potentially damp due to atmospheric moisture. Air was added at 4% of the void volume of the test system. That is also a level typical of poor evacuation or a suction leak at charging fittings

with charging refrigerant specified at 1.5% v/v. Small amounts (4% w/w) of R-12, R-22, or R-502 was added to R-134a, R-407C, or R-507A respectively. That level is typical of a retrofit application using those refrigerants.

TEST STANDS

Hot Gas Bypass Test Stand Description

A statistical analysis was carried out in order to design an experiment that would produce statistically meaningful results. This analysis showed that meaningful results could be achieved using 128 compressors running with four different refrigerants and two levels each of four reactive contaminants at high and low temperatures ($4 \times 2^5 = 128$). Sixteen compressors would be added as pure controls, bringing the total number of compressors to 144. This number ensured that the investigation would have at least 32 observations per main effect and have a reasonable power to detect statistical significance if the main effect of the contaminant or refrigerant on outcome was of moderate size. In the test matrix on the following page, please note that R-22 had 12 controls since there was no contaminant gas, thereby providing additional baseline statistical significance.

In order to accommodate this large number of compressor tests, a test stand was devised that minimized physical space requirements while providing ease of control of the test stand conditions. The test stand for each compressor was built as a hot-gas bypass stand to allow for simple, effective control of a continuously running system (see Schematic). The entire stand has a footprint area of 2.5 square feet with a depth of 2.5 feet and a width of 1 foot. The maximum height of each stand is 16". The test stands were distributed on wooden benches built specifically for this purpose. These benches carried condenser water supply piping and all necessary electrical and signal wiring. Wika glycerin-filled analog pressure gauges were installed to measure discharge and suction pressures in psig. An elapsed time indicator was wired into each stand in such a manner that it could only run when the compressor was running so that an accurate total run-time could be established for each unit.

All compressors were manufactured by Copeland Corporation in Sydney, Ohio, and all compressors share a common date of manufacture. The compressors using R-22, R-507A, and R-407C were all model RS43C1E-CAV-250 with start and run capacitors having a nominal 0.54 Hp motor. The R-134a stands used model RS40C1E-IAV-250 compressors that were supplied with a start capacitor only and the same motor power. Each compressor was modified by the manufacturer to contain a threaded port in the side of the bottom shell. This modification was for installing an oil-sampling valve on each unit so that periodic sampling and analysis of the lubricant could be performed.

Test Matrix

Test number	R-507A, R-407C, and R-134a (36 units per refrigerant = 108 units)				Temp	R-22 (36 units)		
	4% other refrigerant (w/w)	Organic acid TAN (0.10 mg KOH/ g sample)	4% air by volume	moisture level (ppm)		Organic acid TAN (0.10 mg KOH/ g sample)	4% air by volume	moisture level (ppm)
1	control			10	high	control		10
2	control			10		control		10
3	control			10		control		10
4	yes	—	—	10		control		200
5	—	yes	—	10		control		200
6	—	—	yes	10		control		200
7	yes	yes	—	10		yes	—	10
8	yes	yes	yes	10		yes	—	10
9	yes	—	yes	10		—	yes	10
10	—	yes	yes	10		—	yes	10
11	yes	—	—	200		yes	yes	10
12	—	yes	—	200		yes	yes	10
13	—	—	yes	200		yes	—	200
14	—	—	—	200		yes	—	200
15	yes	yes	—	200		—	yes	200
16	yes	yes	yes	200		—	yes	200
17	yes	—	yes	200		yes	yes	200
18	—	yes	yes	200		yes	yes	200
19	control			10	low	control		10
20	control			10		control		10
21	control			10		control		10
22	yes	—	—	10		control		200
23	—	yes	—	10		control		200
24	—	—	yes	10		control		200
25	yes	yes	—	10		yes	—	10
26	yes	yes	yes	10		yes	—	10
27	yes	—	yes	10		—	yes	10
28	—	yes	yes	10		—	yes	10
29	yes	—	—	200		yes	yes	10
30	—	yes	—	200		yes	yes	10
31	—	—	yes	200		yes	—	200
32	—	—	—	200		yes	—	200
33	yes	yes	—	200		—	yes	200
34	yes	yes	yes	200		—	yes	200
35	yes	—	yes	200		yes	yes	200
36	—	yes	yes	200		yes	yes	200

Each test stand was supplied with a water-cooled 1/3 ton counter-flow heat exchanger manufactured by Doucette Industries, Inc. (model #CX-H-033). Refrigerant flow is directed through the inner tube of the condenser and exits into a one pound liquid receiver manufactured by Refrigeration Research. Filter driers were not used. Coolant flow through the condenser is controlled by a water-regulating valve manufactured by Metrex Valve Co. This valve (model #840P-37-SE) uses an adjustable compression spring in opposition to a diaphragm that is exposed to compressor discharge pressure. The purpose of this valve is to regulate the condensing pressure by varying the flow of 13°C (55°F) inlet coolant to the condenser. Many of these valves had to be modified by installing springs of different spring constant in order to accommodate the discharge pressure in a particular system.

Liquid refrigerant leaving the receiver passes through a vertically mounted Sporlan SA-12 See-All sight glass with moisture indicator on its way to the mixing chamber. Before entering the mixing chamber, the liquid refrigerant is throttled by a constant pressure expansion valve manufactured by Parker Hannifin Corporation. This valve, a model A4, has a range of 5" Hg vacuum to 90 psig, and contains a 200 mesh inlet filter screen. The mixing chamber for each stand was bent in-house out of ½" OD copper tubing, with approximately ten bends total. The mixing chamber is approximately eight feet in length and the outlet to the return line is approximately three inches lower than the inlet and approximately seven inches above the lowest section of the mixing chamber. In addition to the water regulating valve and the expansion valve, a ¼" Parker right angle needle valve (part #2F-V2AN-B) was installed in the compressor discharge line, a few inches from the discharge port. This valve was used to meter hot gas from the discharge port to the inlet of the mixing chamber, downstream of the constant pressure expansion valve to provide hot-gas bypass control and return gas temperature. A valve was added to the process port of the compressor for adding contaminants and/or removing gas samples. This valve is referred to as the injection/sampling valve.

For compressor protection, all units were wired through Ranco pressure cutout switches (model #012-4834-000) that allowed for the setting of both high and low pressure trip points. The standard thermal cutout device was also installed on each compressor as shipped from the manufacturer. One 30A rated circuit breaker was assigned for every five compressors, and manual resets of five units at a time were required if 208VAC power was interrupted at any time (except for computer initiated shut-downs). The condenser coolant is an approximately 70%

water and 30% ethylene glycol mixture, by volume. This coolant was maintained at approximately 55°F by the main coolant chilling system in the test laboratory, which has more than sufficient capacity for 144 test stands. Numerous protection devices are installed to protect the test stands from loss or reduction of condenser coolant flow due to leaks, pump failure, electrical phase loss, or chilling system failure, all of which would result in the immediate shut-down of the test stands under computer control.

Data Acquisition and Control

A PC-based measurement and data collection system was devised to provide the monitoring and logging functions needed to maintain the test stands within operational limits while still remaining within budget constraints. The large number of test stands (up to 160) coupled with the constraints on compressor operating conditions and measured parameters indicated a definite need for some level of automation. The time required for a technician(s) to measure, record, and make adjustments to each test stand was not practical, and the cost of hiring a full time staff of technicians dedicated only to those tasks was prohibitive. At the same time, the cost to provide full measurement, logging, and control of each stand is also excessive when the cost of transducers, motorized valves, and associated electronics and programming is factored in. Instead, a compromise was achieved that fit within budget constraints while still providing critical data and reducing manpower requirements and technician workload.

Data Acquisition Requirements

A requirement for each test stand was that it run within a tight range of temperatures and pressures for the test life cycle and that each stand have sufficient controls to effect changes needed to maintain those conditions. Specifically, discharge, return gas, and sump temperatures needed to be measured, along with discharge and suction pressures. In addition, if any stand exceeded 121°C (250°F), it was to be shut off. Since relationships can be established between temperatures and pressures, a decision was made to automate the temperature measurements only. This allowed for the use of relatively inexpensive thermocouples while avoiding the high cost of pressure transducers and related hardware. Additionally, many data acquisition equipment vendors sell off-the-shelf equipment for thermocouple measurements that provide automatic calibration, signal conditioning, isolation, and cold junction compensation. Rather than automating the test stand controls, which would be extremely costly, the computer can alert

the technician as to which test stands require action based on system temperatures. Semiautomatic controls such as mechanical water regulating valves and constant pressure expansion valves could then be adjusted by the technician, who is aided by the presence of analog pressure gauges for discharge and return gas installed on each test stand. Also, the computer can log the data from each stand, average it on a daily basis, and present it to the technician, thus allowing trends to be observed. Lastly, limits can be set so that the computer may shut down a compressor that has exceeded those limits.

System Description

The system was based on a 386DX PC running DOS. The keyboard and monitor were placed on a mobile cart, and a keyboard/monitor extender was installed. This allowed the keyboard and monitor to be wheeled out to any test stand so that the technician could immediately observe temperature data as he makes adjustments to the stand. A 16 channel, 15 bit-resolution thermocouple and voltage input board from Keithley-Metrabyte was used for reading thermocouples and alarm signals. This board, the DAS-TC, provides on-board automatic and continuous calibration, signal conditioning and cold junction compensation so that thermocouples may be read directly via an external screw terminal board with an on-board CJC sensor. Since there was a need to measure three type 'T' thermocouples for each of up to 160 test stands, channel multiplexing (MUX) was required. Multiplexing reduced both the number of analog input cards needed and the amount of wiring complexity associated with direct interfacing of sensor signals. However, the number of multiplexers required was still cost prohibitive. Therefore, the required multiplexers were designed and constructed in-house at much reduced cost. These consisted of 6-pole relays with low resistance, bifurcated gold-flashed crossbar contacts mounted on printed circuit boards with screw terminals for bus wire and signal wire connections. One multiplexer board was used for each test stand, and each board was then attached to a common set of thermocouple buses made of extension grade type "T" thermocouple bus wire. Copper and constantan terminal connectors were used wherever thermocouple connections were made. The multiplexers were controlled by the PC program via a Keithley 48 channel digital output board. The program activated four multiplexers per channel so that 12 channels of thermocouple data from four test stands could be read at one time. The A/D conversions are initiated after waiting for the settling and debounce time of the multiplexers and

analog signals. Ten conversions on each channel are made and then averaged to give a temperature reading on each channel, including cold junction compensation.

The software was developed in QuickBASIC 4.5 running in a DOS environment. The software program allowed for fully automated monitoring, logging, and averaging of all temperature data with optional printing of the data on a daily or per-scan basis. It also provides for continuous monitoring of an individual test stand, the ability to turn on or off all or individual test stands, and full color-coded display of all relevant test stand data on-screen including temperatures, set-points, compressor serial number, refrigerant, lubricant, condenser cooling water inlet and outlet temperatures, and on/off status. Color coding and text messages provide status information on the relevance of the actual discharge, return gas, and sump temperatures with respect to the set-point (or ideal) temperatures for each stand, thus providing the technicians with a rapid and complete picture of the compressor operating conditions. Additionally, the program provides the capability to assign set-point temperatures for discharge, return gas, and sump either globally or on an individual basis at any time, and to set the number of acceptable excursions from set-points that may occur before the compressor is automatically shut down. This allows flexibility in the handling of each compressor as each one may behave differently in terms of operating conditions, wear rates, etc. due to the various contaminants present in the systems.

In automatic mode, the computer makes a decision based on the actual temperatures and set-point conditions to warn the technician and flag the compressor, leave it alone, or shut it down. Once the compressor is shut down, it must be restarted by a technician who can view the reason(s) for the shut down and make appropriate adjustments to the stand. The capability of turning compressors on or off from the computer keyboard was provided using a Keithley Metrabyte digital I/O board with 192 output channels. This board controlled four racks of electromechanical relay boards, which were in turn wired to a single bi-stable relay at each test stand. This relay controls power to the compressor and a Hobbs elapsed time meter, which logs compressor run-time in hours and tenths of an hour.

A final provision of the computer program was the ability to continuously monitor the status of three emergency shutdown switches and a low-pressure cutout switch on the cooling water inlet distribution manifold. These four switches are regularly polled in software, which will immediately shut down all test stands and the coolant circulation pumps if a dry contact

closure were detected. Upon shutdown, an automatic telephone dialer system is initiated by the software. This system places telephone calls to three separate laboratory personnel and plays a pre-recorded message warning that a shutdown has occurred. A provision was made to allow for testing of the cutout switches and the response system without causing an actual shutdown to occur.

Compressor Test Conditions

As previously discussed, the test stands were assembled on four benches; one bench for each primary refrigerant used in the study. These four refrigerants were R-507A, R-407C, R-22, and R-134a. The R-22 test stands all used mineral oil (Suniso 3GS) as the lubricant, and the remaining test stands used the polyolester Emkarate RL32S. The statistical analysis conducted previous to starting the experiment indicated that 128 contaminated test stands plus 16 controls would provide statistically relevant data while keeping the size and cost of the experiment within a reasonable budget. For each bench, there were also two sets of conditions to be run; half of the stands on each bench would run at a high discharge temperature condition and the other half would run at a low discharge temperature condition. The high and low discharge temperatures were selected to be 10°C (50°F) apart. The selected contaminants were air, water, organic acid, and chlorine-containing refrigerant (either R-12, R-502, or R-22). The operating conditions are summarized in the table below. Water was added to the appropriate stand to bring the amount of water in the lubricant to be 200ppm; in addition, 50mg were to be added for the compressor winding insulation content. The amount of air to be added to the appropriate stands was determined to be 4% of the void volume of the compressor, and the amount of chlorine-containing refrigerant to be added was also determined to be 4% by weight of the primary refrigerant in the stand.

Refrigerant	Return gas temp (°F)	Dicharge pressure (psig)	Discharge temp (°F)	Suction pressure (psig)	Sump temp (°F)
R-22	65	175	212	32	179
	60	280	143	78	98
R-134a	63	160	224	10	212
	57-64	145	187	20	174
R-407C	58-65	325	141-153	70-75	81-96
	61-62	200	180-193	35-40	147-162
R-507A	54	185	180	30	140
	62	355	235	14	242

The compressor test conditions are within the published operating envelopes for pressure and temperature. The two motor types used in this work were identical except for the start winding.

Introduction of Contaminants

The process of introducing contaminants was carried out in several stages. The compressors were brazed into the test stands, leak checked, filled with lubricant, and evacuated to a deep vacuum (50 micron) with a 050 size molecular sieve desiccant filter drier present. It should be noted that the compressors were shipped from the manufacturer with a dry nitrogen charge and no lubricant. After charging the compressors with the appropriate type and volume of dry lubricant and refrigerant, the units were then run for a 72 hour break-in period with the appropriate filter driers installed to dry the systems. The R-407C systems used XH-11 molecular sieve filters and the rest of the stands used 4AXH-6 molecular sieve filters. Upon completion of the 72 hour break-in, lubricant samples were taken from each of the 144 compressors via the oil-sampling port previously described (see Appendix B). An anhydrous vessel under partial vacuum equipped with a 4" by 1/8" stainless steel needle was used for sampling 15 ml of the lubricant into sample bottles sealed by septum and aluminum compression rings. These sample bottles were heated at 105°C (221°) for 30 minutes prior to use to assure dryness before sealing. The sealed samples were then analyzed for moisture content by KF coulometric titration.

Upon validation of dry compressors, each test stand was run at the specified operating conditions for another 24 hours while temperature data was taken to make sure that each stand would meet proper conditions. Then, with the compressor still running, each stand was valved so that liquid refrigerant flow was blocked from the filter drier, bringing down the pressure to vacuum levels in the drier so that as much refrigerant as possible could be removed from it. The filter driers were then removed and replaced by sight glasses from Sporlan, which were dried for 30 minutes at 105°C (221°F). The estimated refrigerant loss from each stand was 1 ounce. The compressors were then re-started, brought to the previous conditions, and monitored for any significant changes from the previous state for a period of 24 hours. After this second 24 hour run, and while still hot, 6 ounces of lubricant were removed to serve as a reference standard and also to allow room in the compressor for the addition of acidic lubricant, if required. The addition of carboxylic acid-dosed acidic lubricant was the method of introduction of the acid contaminant to the appropriate systems. Initially, water contaminant was also to be added in this fashion, so that either a wet lubricant or a wet acidic lubricant would be added to those stands

needing water and/or acid. Instead, water was added to the system via a cylinder and piston arrangement because this allowed for precise amounts of liquid water to be injected into a test stand. A cylinder of known diameter was fitted with a piston and appropriate seals, and a single port with a minimum volume was added, along with a toggle valve of known internal volume and a vacuum purge valve and vacuum pressure gauge. The cylinder was then filled with liquid water, and a zero headspace volume was adjusted with the piston position using nitrogen gas on the opposite face of the piston. A direct connection was then made between the test stand sampling/injection port and the valve connection on the cylinder. Since the sampling/injection port on the test stand is on the suction side of the compressor, the pressure could be adjusted to either above or below atmospheric to assist in the removal or injection of material to or from the compressor, which made sampling easier. The volume between the toggle valve and the compressor sampling/injection port was then brought down to vacuum through the vacuum purge valve, which is connected to an external vacuum pump. Once the pressure gauge shows a good vacuum, the vacuum purge valve was shut, and the sample/injection port valve on the test stand was opened, which filled the vacuumed volume with refrigerant at suction pressure. The suction pressure was previously adjusted to a value lower than the pressure achievable at the piston with the nitrogen gas. The nitrogen gas valve is then opened, forcing the piston down and the water into the test stand. When the piston reaches the bottom of the cylinder (zero cylinder volume), the toggle valve is closed and the test stand suction pressure is brought down to a vacuum condition to remove as much water/refrigerant in the small remaining volume between the cylinder and the test stand port as possible. The sample/injection port valve on the test stand was then closed and the suction pressure returned to normal operating conditions. It should be noted that this procedure required that the Ranco pressure cutout switches be adjusted so that the low-pressure cutout would not trip when the suction pressure was brought down into vacuum conditions. The adjustment had to be made after returning to normal suction pressures so that low-pressure cutout protection was again available.

Along with the water addition, the organic acid was added to select compressors as a mixture in RL32S for the R-507A, R-407C, and R-134a machines, or in 3GS for the R-22 machines. The organic acid cocktail was composed of three straight chain fatty acids mixed into the lubricant to generate a total acid number (TAN) of 0.1. These acids are pentanoic, hexanoic, and heptanoic acids, which are 5, 6, and 7 carbon chains, respectively, and are the most

commonly found acids formed in esters. This lubricant cocktail was added to the test stand in a manner similar to that used for removing lubricant with the exception that the test stand suction pressure was reduced below ambient pressure so that the lubricant could be sucked into the port. The same type of stainless steel needle and valve arrangement that was discussed above was used to draw the acidic lubricant cocktail from the sealed sample bottles into the test stand.

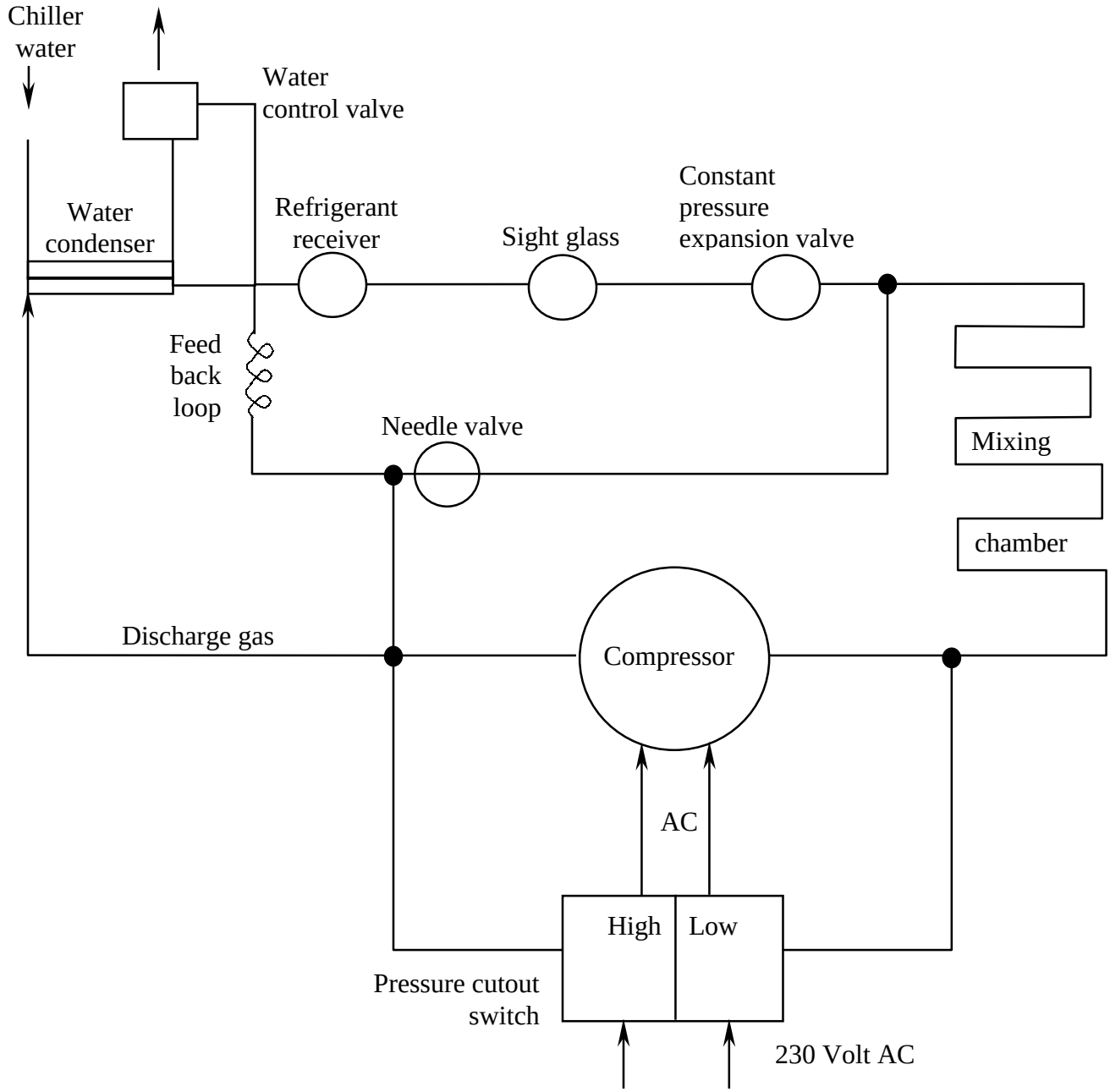
After the addition of water and organic acid to the selected compressors, the stands were run for 24 more hours and a 10ml lubricant sample was taken. This sample was used for moisture and TAN measurements. After 48 hours, specified stands were contaminated with the chlorinated refrigerant contaminant.

The requirement for a chlorinated refrigerant contaminant was met by using R-22 in the R-407C machines, R-12 in the R-134a machines and R-502 in the R-507A machines. A contaminant refrigerant was not used in the compressors that were running R-22 as there primary refrigerant. As previously stated, a mass of contaminant refrigerant equivalent to 4% of the mass of the primary refrigerant in a given compressor was added through the sample/injection port of the test stand. This procedure was simpler than that for adding water because the contaminant refrigerant could be added directly from a tank mounted on a refrigerant charging scale. The procedure required that the refrigerant hose connecting the tank to the sample/injection port be purged prior to opening the valve on the port. Also, the suction pressure of the running compressor was reduced to a level somewhat below that of the saturation pressure of the contaminant refrigerant in the tank so that flow could only proceed into the test stand to avoid contamination of the tank and loss of primary charge in the test stand. After purging the hose, the charging scale is zeroed and the valve on the sample/injection port is cracked open. Flow rate of contaminant refrigerant into the test stand could be controlled by adjusting the opening of the valve and by regulating the suction pressure of the running compressor. The suction pressure adjustments required actions similar to those discussed in the description of the water and air injection method. Once the contaminant refrigerant was added, the stands ran for 48 hours while pressures and temperatures were closely monitored for any significant differences.

Finally, the test stands selected to have air contamination were inoculated. The injection of an amount of zero air equal to 4% of the void volume of the compressor was performed in a manner identical to that for water, using the same apparatus. Again, the pressures and temperatures were closely monitored for a few days to observe any dramatic change in post

contamination operating conditions. Approximately five days after the contamination process was completed, samples were acquired from those test stands that had air and/or refrigerant contaminants introduced. These samples were again taken from the sample/injection port on the test stands into a sampling device made specifically for removing the samples and injecting them into a gas chromatography column. The sampling device had a vacuum port and vacuum pressure gauge and was brought down to vacuum for at least 15 minutes prior to receiving a sample from a compressor test stand. The gas chromatography results along with the TAN and moisture values taken from the lubricant samples provided a complete picture of the true contamination level of each compressor. This data indicated whether a particular stand required more or less of a certain contaminant. The results of the moisture and TAN analysis of the lubricant removed from the running system (see Appendix C) yielded lower levels of water than anticipated. Therefore, the stands were allowed to remain in a static condition for 20 days to allow water to equilibrate within the compressor sump (see Appendix D). The entire procedure described above was repeated somewhat several times before satisfactory levels of contamination were reached, as was described in several progress reports prepared during the course of this project (see Appendices E and F).

Schematic of Hot Gas Bypass Test Stand



CHEMICAL METHODS

Compressor Sampling

Oil

Each compressor was modified by the manufacturer to contain a threaded port in the side of the bottom shell. This modification was for installing an oil-sampling valve on each unit to enable periodic sampling and analysis of the lubricant. An anhydrous vessel under partial vacuum equipped with a 4" by 1/8" stainless steel needle was used for sampling 15ml of the lubricant into sample bottles sealed by septum and aluminum compression rings. These sample bottles were heated at 105°C (221°F) for 30 minutes prior to use to assure dryness. The sealed samples were then analyzed for moisture content, TAN, and fluoride/chloride ion content.

Refrigerant

Gas samples were collected from operating compressors for the GC analysis of all refrigerants and gaseous contaminants formed during operation. Proper use of the sampling device (Figure 3) enabled individual samples to be collected from an operating compressor and carried to the laboratory for immediate GC analysis.

To collect a sample, the refrigerant sampling device was connected with a 6" charging hose to the injection/sampling valve, which was braised onto the process port on the suction side of each compressor. The charging hose and sampling device were evacuated and the compressor valve was slowly opened to fill the sampling device. The valves on the sampling device were then opened and it was slowly vented for approximately ten seconds. The pressurized gases were trapped in the sampling device by closing all valves. The sampling device was then connected to the sample inlet of the 6-port GC valve (Figure 1). One valve on the sampling device was opened to allow the trapped gases to flush and fill the sample loop slowly. The sample loop was allowed to reach atmospheric pressure and the gases were injected onto the GC column (Figure 2).

Coulometric Moisture Analysis

The moisture content of the compressor and sealed tube lubricant was determined by coulometric Karl Fischer (KF) titration. This instrument electronically titrates as little as 10µg of

water with internally generated iodine. The accuracy of the coulometer was periodically checked using KF water standard.

To analyze oil samples for moisture content, about 1ml of oil was injected into the coulometer and titrated. The sample weight (g) (weight of full syringe minus weight of empty syringe) and the titrated water (µg) displayed on the coulometer was recorded and used to calculate parts per million water.

Equation 1
Water (ppm) Calculation

$$\frac{\text{titrated water}(\mu g)}{\text{sample weight}(g)} \times \frac{1g}{10^6 \mu g} \times \frac{10^6}{1} = \text{ppm water}$$

Total Acid Number (TAN) of Lubricants

The total acid number (TAN) of lubricants was determined by titration of the lubricant acids with KOH using a color indicator as an end-point (ASTM D664).

The solvent blank was analyzed as follows: (1) 50ml of titration solution, 5-10 drops of p-naphtholbenzein indicator, and a magnetic stir bar were placed in a 100ml beaker; (2) the beaker was covered with a wooden lid and the burette tip was inserted through a hole in the lid (the cover was used to prevent evaporation during the slow titration); and (3) the solvent blank was titrated drop-wise with the standardized KOH solution until the light green endpoint lasted at least 30 seconds.

The oil samples were analyzed by weighing 5-10 grams of lubricant into a 100ml beaker and proceeding as outlined in the preceding paragraph beginning with Step 1. Dark lubricants discolored the solution, causing the end-point to be varying shades of brown. Sometimes as little as one gram of a very dark lubricant had to be used so that the endpoint color change could be detected.

Equation 2
Total Acid Number (TAN)

$$\text{TAN} = \frac{(S - B)N \times 56.1}{W} = \frac{\text{mg KOH}}{\text{gram of sample}}$$

S = ml KOH needed to titrate sample
B = ml KOH needed to titrate solvent blank
N = standardized normality of KOH
W = weight of sample (grams)

Fluoride and Chloride Analysis of Lubricants

Fluoride and chloride ions were extracted from oils into water using a high water:oil ratio. The oil was filtered from the water and the halogens were quantitated using ion selective electrodes.

To prepare the fluoride and chloride standard curves, either 50ml of 10^{-6}M F or 10^{-5}M Cl standard and either 2ml of fluoride TISAB solution or chloride ISA solution were placed in a 100ml beaker. This solution was stirred and the stable millivolt (mV) reading was taken using the fluoride (or chloride) and reference electrodes. This procedure was then repeated to determine the mV readings of the 10^{-5}, 10^{-4}, 10^{-3}, and 10^{-2}M F standards (or the 10^{-4}, 10^{-3}, and 10^{-2}M Cl standards). A fluoride (or chloride) semi-log plot of standard concentration (y) versus mV reading (x) was created.

The samples were prepared by first weighing 1-1.5g of oil into a screw-top tube and then adding approximately 25ml of distilled water. The weight was recorded, the plastic cap was rinsed with distilled water; the tube was capped and then shaken vigorously for 15-30 seconds before being placed on a tube rotator for 1 hour. A GF/A filter paper was rinsed with 100 ml distilled water and the water was discarded. The oil/water mixture from the tube was filtered through the pre-rinsed filter paper into a pre-rinsed 100ml volumetric flask. The test tube, filter, and funnel were rinsed with more distilled water to bring the volume to exactly 100ml.

The samples were analyzed for fluoride or chloride concentration by the following procedure. 50ml of the sample prepared as directed above were placed in a 100ml beaker with either 2ml of fluoride TISAB solution or chloride ISA solution. This solution was stirred and the stable mV reading of the solution using the either fluoride (or chloride) and reference electrodes was determined. The following equations were used to determine the fluoride or chloride concentration of the sample.

Equation 3
Fluoride and Chloride Sample Molarity

$$y = ab^x$$

y = sample molarity
x = mV reading for sample
a = constant found from F or Cl standard curve
b = constant found from F or Cl standard curve

Equation 4
Fluoride Concentration of Sample

$$\frac{y \times 19 \times 0.1 \times 10^6}{W} = \text{ppm F}$$

y = sample molarity from Equation 3
W = sample weight (g)

Equation 5
Chloride Concentration of Sample

$$\frac{y \times 35.5 \times 0.1 \times 10^6}{W} = \text{ppm Cl}$$

y = sample molarity from Equation 3
W = sample weight (g)

Gas Chromatographic Analysis of Refrigerants and Contaminants

Refrigerants from working compressors and refrigerants from aged thermal stability glass sealed tubes were analyzed by gas chromatography (GC). The refrigerants were captured in evacuated sealed systems and loop-injected onto a GC column for detection with a thermal conductivity detector.

GC analysis was done on two sets of samples: (1) refrigerant gases and contaminants intentionally added to working compressors and (2) refrigerant gases and contaminants aged in sealed tubes. The same gaseous contaminants were added to both the compressors and the sealed tubes. These contaminants were 4% (v/v) air, 4% (w/w) R-12 in R-134a, 4% (w/w) R-502 in R-507A, and 4% (w/w) R-22 in R-407C. The GC system quantitated all added contaminants as well as unknown gases formed during compressor operation and sealed tube aging.

Two Scotty gas standards composed of 5% and 1% nitrogen, oxygen, carbon monoxide, carbon dioxide, and methane were purchased as one set of standards. Four other sets of standards were prepared: (1) 4% (v/v) air in R-22; (2) 4% (v/v) air + 4% (w/w) R-12 in R-134a; (3) 4% (v/v) air + 4% (w/w) R-502 in R-507A; and (4) 4% (v/v) air + 4% (w/w) R-22 in R-407C. These four standards were prepared in four 4.5 liter cylinders. The cylinders were first thoroughly evacuated and weighed. Then, 4.0 grams of air or contaminant refrigerant was allowed to enter the tank. After all connecting hoses were completely evacuated, 96.0 grams of

the main refrigerant component in the mixture were added to the cylinder. If both air and a refrigerant contaminant were added to a cylinder, then the weight ratio became 4:4:92 w/w/w.

Both the in-house prepared refrigerant standards and the Scotty gas standards were analyzed by connecting the tanks to the GC 6-port valve sample inlet (Figure 1) and slowly opening the tank valve to flush and fill the sample loop. The sample loop was allowed to reach atmospheric pressure and the gases were injected onto the GC column (Figure 2).

Gas samples were collected from operating compressors for the GC analysis of all refrigerants and gaseous contaminants formed during operation. Proper use of the sampling device (Figure 3) enabled individual samples to be collected from an operating compressor and carried to the laboratory for immediate GC analysis.

To collect a sample, the refrigerant sampling device was connected with a 6" charging hose to the injection/sampling valve, which was braised onto the process port on the suction side of each compressor. The charging hose and sampling device were evacuated and the compressor valve was slowly opened to fill the sampling device. The valves on the sampling device were then opened and it was slowly vented for approximately ten seconds. The pressurized gases were trapped in the sampling device by closing all valves. The sampling device was then connected to the sample inlet of the 6-port GC valve (Figure 1). One valve on the sampling device was opened to allow the trapped gases to flush and fill the sample loop slowly. The sample loop was allowed to reach atmospheric pressure and the gases were injected onto the GC column (Figure 2).

The refrigerant gases in the aged sealed tubes were analyzed by GC for refrigerants and other gaseous contaminants formed during the 28 days of aging at 165°C (329°F) or the 224 days at 135°C (275°F). A specially designed glass sealed tube breaking device (Figure 4) allowed gases captured from the broken sealed tube to be directly delivered to the GC sampling port.

The device consisted of a 5/8" stainless steel rod with a handle for turning and a hole into which a sealed tube could be inserted through the 11 mm Ace Thred. Both the rod and sealed tube were sealed into the device with buna-N O-rings. A ¼" charging hose was attached to the 2mm stopcock and a vacuum pump. A 1/16" ss tube connected the adapter to the sample inlet of the 6-port valve.

To break a sealed tube and collect a GC sample, the sealed tube was first put into a thermos of liquid nitrogen. The surface of the sealed tube was scratched where it was to be

broken. The sealed tube was then inserted into the breaking device (Figure 4) through the 11 mm Ace Thred opening and into the hole in the stainless rod, with the other end of the sealed tube remaining immersed in liquid nitrogen. The refrigerant sampling device was attached to the vent line of the 6-port valve both to monitor the system vacuum/pressure and to use it as a shut-off valve for evacuating the system. The entire system, including the sample loop in the sample filling position, was evacuated through the 2mm stopcock for at least five minutes. The 2mm stopcock was then closed and the liquid nitrogen removed. Rotating the handle of the breaking device broke the tube. The tube was warmed quickly using water or a torch. With the internal system pressure being monitored, the exit valve was opened to allow excess gas to escape and the sample loop gases to reach atmospheric pressure. The sample loop gases were then immediately injected onto the GC column.

The GC parameters were as follows:

- Instrument – Varian 3700 GC
- Column – 20' x 1/8" ss packed with 100/120 Haysep D
- Carrier gas – Helium at 18 ml/min
- Thermal conductivity detector
  - Range – 0.5 MV
  - Filament temperature – 200°C (392°F)
  - Current – 190 amps
- Temperatures
  - TCD – 160°C (320°F)
  - Column – 30°C (86°F) (5 minutes)→20°C/min (68°F/min)→150°C (302°F) (14 minutes)

Standard curves for each refrigerant, refrigerant contaminant, and non-condensable gas found in the samples were prepared by graphing GC peak area versus percent composition. The sample loop must be at atmospheric pressure before GC injection of all standards and samples take place. The percent composition of samples was determined directly from the standard curves once individual GC peak areas were determined.

Figure 1
6-Port Valve, Sample Filling

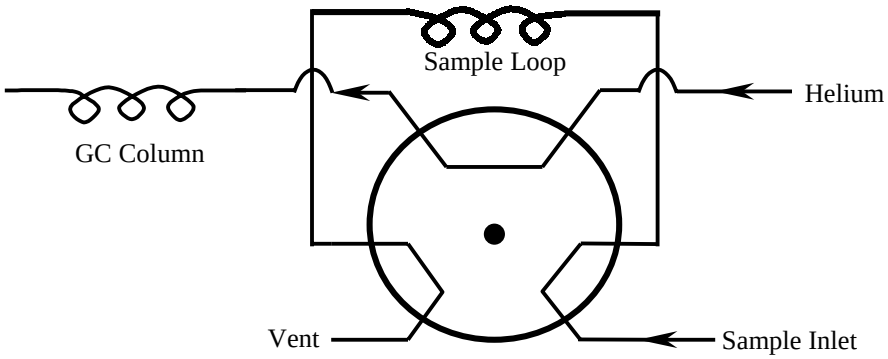


Figure 2
6-Port Valve, Sample Analysis

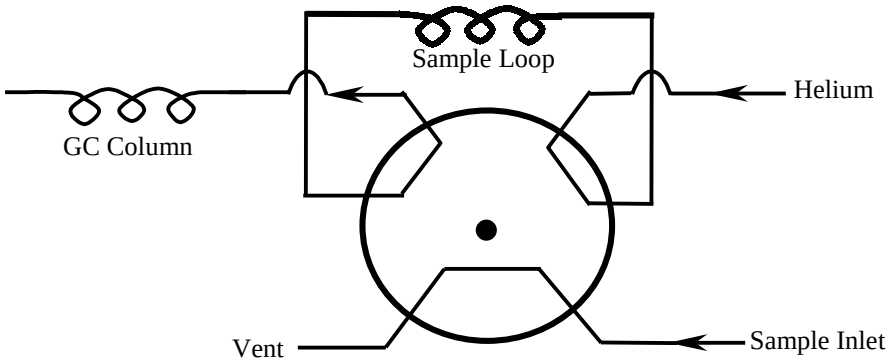


Figure 3
Freon Sampling Device

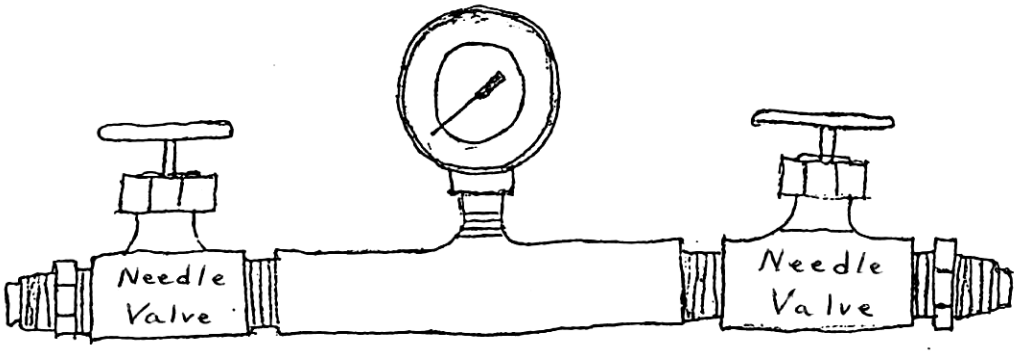
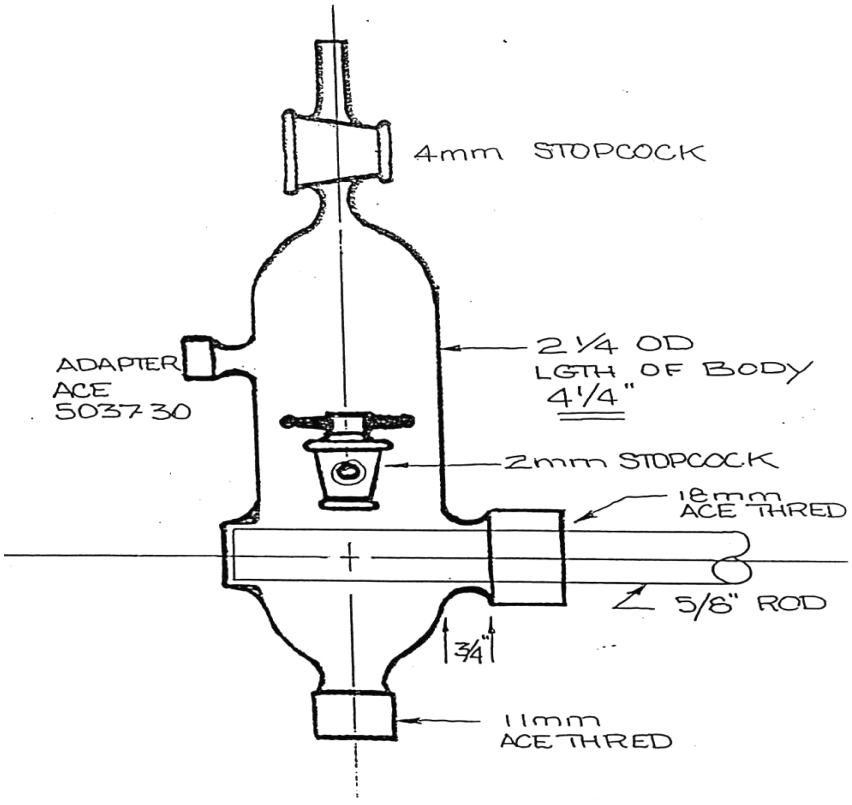


Figure 4
Sealed Tube Breaking Device



Thermal Stability Sealed Tube Analysis Method

This project specified that contaminant water, acid, air, and refrigerants R-12 in R-134a, R-22 in R-407C, or R-502 in R-507A be added to compressors to determine longevity and identify mechanical problems caused by specific contaminants. To get an "inside look" at the compressors under worst case conditions, a glass sealed tube stability study was also performed at two temperatures using the same lubricants, refrigerants, and contaminants as were used in the actual compressors. Glass sealed tubes are a static test whereas the compressor testing was dynamic. Normally, sealed tubes are produced to be pristine in format, excluding all NCGs, all acids, and all water. ASHRAE methods specify the tubes be made in this fashion because there was little interest in elucidating the effects of moisture, air, and system acids. If any of the system contaminants are present with R-12 and R-22, it was well known to produce a negative sealed tube response.

The stability tubes were observed for metallic corrosion and precipitate formation; observations that are important since the tubes mimic what happen inside the compressors. Similar to the empirical part of the study, the tubes were reacted at 135ºC (275°) and 165°C (329°F). The tubes aged at 165ºC (329°F) were observed after 3, 7, 14, and 28 days and those at 135°C (275°) were observed after 3, 7, 14, 28, 56, 112, and 224 days of aging. The contaminant levels were 200 ppm water, 0.1 TAN, 4% (v/v) air, and 4% (w/w) refrigerant. Appendix I, Appendix J, Appendix K, and Appendix L contain all sealed tube visual observations, chemical analysis results, and photographic history. An extra set of R-507A and R-134a sealed tubes were prepared with extra contaminant acid (0.4 TAN); visual observations only of these tubes are also included in Appendix I and Appendix L. The tubes with extra acid were prepared to illustrate the effects of excess acid in the presence of water and NCG content. Samples were analyzed in triplicate.

Glass Tube Preparation

Glass tubes were identified by burning ceramic marking ink into the glass on both ends using a propane torch. A cooler flame was used to smooth out the sharp stress lines in the glass around the burned area.

Metal Preparation

Copper, aluminum, and carbon steel were cleaned of oxide corrosion using carborundum paper and then cut to 3" in length. The steel and aluminum were approximately 0.2" wide. The metal coupons were wiped clean of dust, rinsed once with methanol, rinsed twice with ethyl acetate, air dried in a hood and placed in the tubes with the aluminum between the copper and steel.

Preparation of Lubricant with Water as a Contaminant

Unless water was an intended contaminant, the lubricant used contained <20ppm water. Mineral oils are hydrophobic and usually contained <20ppm water, but ester oils normally had to be dried. A Karl Fischer water analysis on about 1g of oil dictated the next step. If the oil tested >20 ppm water, it was dehydrated by putting it in a side arm flask with a magnetic bar and evacuated by stirring and applying gentle heat until a coulometric test of the oil showed <20ppm water content. Once dehydrated, the flask was sealed or the oil was poured into a pre-dried bottle, capped, and stored in a desiccator. If water was intended as a contaminant, then water was added to equal 200 ppm. Since ester oils are hydrophilic, water could be adsorbed simply by stirring the oil in an open beaker. With mineral oils, water was added to an oil using a syringe or Eppendorf pipette after calculating the amount to be added using the following formula:

Equation 6
Amount of Contaminant Water to Add to Mineral Oil

$$\frac{W(x-y)}{100} = \mu l\ H_2O$$

W = weight of the oil (g)
x = ppm concentration of water desired
y = ppm concentration of water present in oil

Lubricant Addition to Tubes

Each sealed tube test specified the ratio of lubricant:refrigerant. The total weight of lubricant and refrigerant was about 2g. Care was taken not to get oil on the region of the glass tube to be constricted. Weighing was on a 4-place electronic balance, with the weights recorded before and after oil addition.

Preparation of Refrigerant with Contaminants

Refrigerant, air, and acid were contaminants added to the sealed tubes. These contaminants were added by premixing air and/or the contaminant refrigerant in a small tank containing the main refrigerant gas. The small tank was thoroughly evacuated and weighed. 4.0 grams of air or contaminant refrigerant was allowed to enter the tank. After completely evacuating all connecting hoses, 96.0 g of the main refrigerant component in the mixture was added to the small tank. If both air and a refrigerant contaminant were added to the small tank, then the weight ratio became 4:4:92.

Charging Glass Tubes with Refrigerant Gas

A certain weight of refrigerant (see Equation 8) from the small prepared tanks must be added to each constricted glass tube. The weight of added refrigerant is indirectly controlled by the manometer attached to the gas manifold. The refrigerant inside the manifold has an initial pressure measured by the manometer mercury (Hg) level. As refrigerant is condensed inside the glass tube, the internal manifold pressure drops, as indicated by the fallen Hg level. The difference in Hg levels can be related to the weight of condensed refrigerant. Since the specific gravity of all refrigerants is different, a refrigerant constant, which relates Hg pressure drop to refrigerant gas weight, must be determined before sample tubes are charged with refrigerant (see Equation 7, Equation 8, and Equation 9).

Determination of Refrigerant Constant

Five empty glass tubes were prepared, their weights accurately recorded, and they were constricted. Each tube was then attached to the manifold and varying amounts of pure refrigerant from 150-300 mm Hg were precisely added. The tubes were sealed and allowed to warm to room temperature. The matched tops and bottoms of each tube were reweighed. The constant was calculated for each of the five samples by the formula below to obtain an average.

Equation 7
Refrigerant Constant

$$C = \frac{b - a}{H} = \text{grams/mm Hg}$$

C = refrigerant constant
a = initial weight of the tube (g)
b = final weight of refrigerant + tube (g)
H = mm of Hg pressure difference in manifold

Addition of Refrigerant to Sample Tubes

Each sealed tube test specified the ratio of lubricant:refrigerant. Once the lubricant was accurately weighed into the tube, the weight of refrigerant to be added was calculated by the following formula:

Equation 8
Weight of Refrigerant to be Added

$$R = \frac{L(1-P)}{P}$$

R = refrigerant weight (g)
L = lubricant weight (g)
P = percent lubricant [expressed as a decimal (i.e. 40% = .40)]

The mm of Hg manometer pressure drop needed to deliver a certain weight of refrigerant can be calculated from the above equation and the refrigerant constant.

Equation 9
Manometer Pressure Drop

$$M = \frac{R}{C}$$

M = mm Hg manometer pressure
R = refrigerant weight (g)
C = refrigerant constant (g/mm Hg)

Manifold Manipulations

A constricted tube containing the lubricant and coupons was attached to the gas manifold and evacuated. The tube was gently heated with the propane torch and vibrated to expel any dissolved gases from the oil and assist in dehydration. The sample was evacuated to <40mTorr and the valve to the sample was closed. The refrigerant gas was attached to the manifold with a charging hose and the hose was evacuated. The manifold was purged three times by adding refrigerant and evacuating it. The third evacuation was <60mTorr. Refrigerant was added to the manifold so that internal pressure was 800-900 mm Hg. The tube was submerged in liquid nitrogen in a thermos dewar. The tube valve to the manifold was opened slowly to allow the refrigerant gas to condense as it contacted the cold tube. The amount of added refrigerant was controlled by observing the manometer Hg fall. After the proper amount of refrigerant was

added, the dewar was filled with liquid nitrogen and the manifold evacuated to <40 mTorr. The tube valve was opened to eliminate non-condensable gases (such as air) from the tube and evacuated to <40 mTorr.

There are exceptions to the above directions. If the sample had a fixed amount of water in the oil >20ppm, then it was frozen in liquid nitrogen prior to the initial evacuation on the manifold. If the sample was intended to contain a certain amount of non-condensable gases, then the final evacuation prior to sealing the tube did not occur.

Sealing the Tube

After refrigerant from the small prepared tanks was added to the tube, the tube was sealed. The oxygen and MAPP gases were adjusted to give a 3-4" flame. With the tube still evacuated and in liquid nitrogen, the constriction was warmed uniformly until drawn inward by the vacuum. The fused portion was heated strongly while the tube was lowered to produce a molten thread, which was cut with the flame. The tube was annealed while in liquid nitrogen using a cooler carbon-rich flame. The annealing process deposited carbon on the glass, which was wiped off later. The tube was then removed from the liquid nitrogen.

Thermal Aging

Prior to aging, the two parts of the tube were matched and reweighed to determine the actual weight of refrigerant added to calculate the actual weight ratio of lubricant:refrigerant in the sealed tube. The tubes were placed into protective metal sleeves, the sleeves were then capped and put it into an oven at either 135°C (275°F) or 165ºC (329ºF). When it was time for a visual inspection, the oven was turned off and the tubes were allowed to cool prior to removal from the metal sleeve.

Visual Inspection of Tubes

The tubes were inspected at the aforementioned intervals for metal and liquid discoloration and any signs of precipitate formations. As the coupons heat-aged in the presence of lubricants, refrigerants, and contaminants, they were observed to corrode. The corrosion is manifested by color changes in the metals, which indicate the degree of reactivity. Each metal goes through a series of color changes as it corrodes (Table 1). For example, a copper coupon

changes to orange, dark orange, pink, and eventually black as it reacts with contaminants over time.

The qualification of metal coupon colors is subjective; since subtle shades of color are difficult to express, sometimes two colors were used to accurately describe the degree of coupon corrosion. The colors noted for each set of contaminants is an "average" of three sealed tubes and shows how the corrosion becomes more pronounced over time.

The metal coupons were long enough to extend above the liquid in the sealed tubes. The portion of the coupon above the liquid was exposed only to gas and often corroded at a different rate than the portion submerged in the lubricant and dissolved refrigerant. In the tables contained in Appendix I, Appendix J, Appendix K, and Appendix L, this differentiation is characterized by a forward slash. For example, "tan/orange" means that the three copper coupons for a particular reaction were tan-colored above the liquid level and orange below the liquid level. Sometimes coupons turned colors unexpected in the progression of reactivity. This was generally caused by a precipitate coating on the metal and was seen, for example, in some of the 3GS:R-22 tubes where the aluminum was coated with a pink precipitate.

Another indicator of reactivity in sealed tubes is the liquid color. Lubricant and refrigerant is colorless (clear) when no reaction has occurred. The tables in Appendix I, Appendix J, Appendix K, and Appendix L, show liquid color progressing from light yellow to brown, as the contaminants became more reactive with the metals. Some of this color may manifest itself in the form of a haze or precipitate. The color of the precipitate may be an indicator of its origins; for example, an orange precipitate comes from copper.

Formation of precipitates is the most serious problem in lubricant/refrigerant systems. In sealed tubes, precipitates appear as a haze in the liquid, a gummy coating on the metal and inside tube walls, and crystalline or flocculent solids that settle on the tube bottom. The quantity of precipitate in the tubes as noted in the tables in Appendix I, Appendix J, Appendix K, and Appendix L, is an approximation. For example, a table entry of "(3)" in the liquid column represents an amount of precipitate that easily covers the bottom of the tube and may be as great in volume as a pencil eraser.

Table 1
Stability Tube Metal Coupon Reactivity Rating Guide

Aluminum	Copper	Valve Steel
Least Reactive	**Least Reactive**	**Least Reactive**
NR Dull Gray Dark Gray Black	NR Orange Dark Orange Pink Yellow Light Tan Tan Brown Dark Brown Black	NR Blue-Green Gray Dark Gray Blue Purple Maroon Light Tan Tan Brown Dark Brown Black
Most Reactive	**Most Reactive**	**Most Reactive**
NR indicates no reaction or visible color change.		

Extended Sealed Tube Analysis

After the thermal aging period, the refrigerant and lubricant in the sealed tube was analyzed to detect chemical changes that occurred. (See Table 4, Table 5, Table 6, Table 7, Table 8, Table 9, Table 10, Table 11, and Table12.)

Gas Chromatography

Changes in refrigerant composition were detected by gas chromatography. The sealed tube was broken (Figure 4), the gas was captured in a sample loop (Figure 1), and the gas was injected (Figure 2) for compound separation on a 20' x 1/8" ss column packed with 100/120 mesh Haysep D.

TAN Analysis

The lubricant was also analyzed for total acid number by titration with KOH using a color indicator.

Photography

Color photographs of each set of tubes can be found in Appendix I, Appendix J, Appendix K, and Appendix L.

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TEST STAND WATER INJECTION TEST

Purpose

The purpose of this side project for the ARTI selected Contaminants Program was to determine if an enclosed 3 liter pressurized metal cylinder equipped with a movable vented piston could reproducibly dispense water and lubricant into a compressor. Ten samples of 140 µl (0.14 g) of water were added to 6 oz (180 g) of oil. The oil was then tested for water content by routine Karl Fischer coulometry (see Table 2).

Procedure

The enclosed metal cylinder was equipped with shutoff valves at the top and bottom of the cylinder housing. The piston could be moved upward (to be filled with oil) with vacuum pump suction and lowered (to dispense the oil) with air pressure. An L-tube was attached to the bottom shut-off valve (pointing upward) so that water could be added as oil left the cylinder. The cylinder would dispense 6 oz of oil when the piston rod moved downward 7/8".

Twelve 250 ml Erlenmeyer flasks were dried at 110°C (230°F) and stoppered. The lubricant used in this experiment was 10% IPA in RL32S. The purpose of the IPA was to solubilize the water after sample collection. The cylinder was loaded with this lubricant solution using suction. Using a 250 µl syringe, 140 µl water was added to the L-tube. The piston was forced downward 7/8" flushing the water from the L-tube and dispensing 6 oz of oil into a 250 ml Erlenmeyer flask through an identical valve mounted on test compressors. The sample was mixed until all water was in solution and then tested for water content by Karl Fischer. Ten samples were collected in this fashion along with two blanks containing no added water.

Calculations

Sample #3 was omitted due to water in suspension.

Blank average = 62 ppm

Average of 9 samples = 831 ppm

Standard Deviation of 9 samples = 26.2

Calculation of Added Water

140 µl water added = 0.14 g

180 g oil

$$\frac{0.14\text{g}}{180\text{g}} \times 10^6 = 777\,\text{ppm}\,H_2O$$

777 ppm + 62 ppm blank = 839 ppm target value.

Table 2
Results of Water Injection Test

Sample	Water (ppm)
1*	56
2	843
4	840
5	871
6	819
7	779
8	844
9	853
10	802
11	831
12	67

*Blank sample (no water added)

COMPLETION OF COMPRESSOR TESTING

The dynamic test was complete when all of the compressors had acquired 12,000 hours of run time. The final lubricant sample (6 ounces) was taken from the compressor while it was running. All of the refrigerant charge was pushed into the condenser and receiver assembly. The discharge line was then pinched and sealed by brazing, thereby saving the entire refrigerant charge for further analysis.

Finally, the compressor was evacuated and back-filled with dry nitrogen. All of the compressors were taken to Copeland to be cut open using their in-house can cutting milling machine. The compressors were then taken back to our laboratory with the top shell still in tact where they were purged with dry nitrogen gas to inhibit any air corrosion and rusting.

FAILED COMPRESSORS

Of the 144 compressors tested, only seven machines are recorded as failures. A unit was considered a failure when it was unable to maintain pressure and temperature set points. These machines are summarized in the following table.

Table 3
Summary of Failed Compressors

Unit	Refrigerant	Contaminants	Hours	Failure
Unit 55	R-407C	acid, water, and R-22	2,674	suction reed and backer broken
Unit 149	R-134a	water and R-12	2,859	seized crank due to copper plating
Unit 35	R-507A	air and water	3,555	broken suction reed
Unit 69	R-407C	water and R-22	5,333	suction reed and backer broken
Unit 9	R-507A	acid	5,369	seizure due to bronze plating
Unit 71	R-407C	acid and water	7,319	broken suction reed and backer
Unit 5	R-507A	control	10,525	motor grounded

Units 55, 35, and 69 all experienced cracking of the suction reed after a minimal number of hours. Broken suction backers and suction reeds were unusual, but found only after several thousand hours of running under normal conditions. Therefore, contaminants were not considered to be the primary cause of failure.

The early failure of Unit 149 was quite unusual because there was no indication that a copper plating-caused failure of the crank was about to occur. All of the mechanical parts were in excellent condition. The failure of unit 149 was definitely caused by the contaminants water and R-12. Smaller bearing tolerances may also have contributed to the failure.

Unit 9 was also running normal with no unusual history, but seized due to bronze plating of the bearing surfaces caused by the organic acid contaminant. Table H.1 shows a very high acid level, increased water formation, and a large amount of trash in the bottom of the can. All of the R-507A control and contaminated machines developed black sight glasses after 3,500-3,600 hours with no untoward performance responses. Except unit 5, a contaminant-free compressor that failed because of a grounded motor winding and had excessive acid and severe bronze bottom bearing wear. The inside of this compressor was jet black, had trace copper plating from the suction port, and a copper plating effect on the motor stator, along with rotor rub. The internals were badly worn due to a lower and upper crankshaft bearing failure and the excessive acid came from the rotor rub.

Unit 71 experienced mechanical fatigue of the reed and backer. However, the short amount of run time suggests that the reed may have been chemically stressed due to the amount of free HF circulating in the system.

The compressors used in this study were rated for R-22, R-134a, R-407C, and R-404A service. Naturally, with low temperature refrigerants such as R-507A and R-404A, the compression ratio increases and the lubricant performance is potentially decreased. There is no experimental evidence that suggests equivalent compression ratios with R-407C or R-22 would have yielded the same general bearing fatigue as did R-507A in a few of the machines. (see Statistical Analysis)

DISASSEMBLY OF COMPRESSORS

Individual compressors were opened and examined in a logical order. A query sheet with the outlined tear down order was used to record detailed observations on each compressor. The data from the query sheets was used to compile a database, which was then evaluated using a SASS statistical routine (see STATISTICAL ANALYSIS). Therefore, each compressor has a two page "report" containing the observations recorded on the query sheets, including the visual observations of the disassembled expansion valve, as well as the results of the final lubricant analysis, including the metal analysis determined by ICP spectroscopy (see APPENDIX A).

VISUAL OBSERVATIONS

In a study of this magnitude, a photographic record of the mechanicals removed from the compressors was essential to provide a comprehensive documentation of the effects of the contaminants. All of the macro and microphotographs were taken with a high-resolution digital camera equipped with a plano Nikon lens.

The mechanicals normally reviewed by compressor engineers as indicators of compressor function and wear are the crankshaft, piston connecting rods, valve seats, valve reeds, and their surfaces and trepan areas. The term "trepanning" signifies the indentation and wear caused by the valve reed action on the reed surface. The appearance of metal removal on the surface of the valve seat was significant with the various refrigerants and contaminants.

Crank Journal Responses to Contaminants

A good low wear example of the crank journal in the loaded position can be seen in the R-22 controls: unit 85 (CJ85), unit 86 (CJ86), and unit 87 (CJ87). These crank journals are considered clean with normal copper plating. A crank journal without copper plating is seen in the R-134a controls: unit 121 (CJ121), unit 122 (CJ122), and unit 123 (CJ123).

Crank journals that are scored with polish are found in the R-407C acid and air contaminant machines: unit 47 (CJ47), unit 48 (CJ48), and unit 49 (CJ49). Crank journals that are clean with polish and a medium level of wear are an R-407C with R-22 contaminant compressor (unit 62) (CJ62) and an R-507A acid contaminant compressor (unit 27) (CJ27).

An example of a crank journal showing corrosion, copper plating, and scoring with polish is a full contaminant R-407C machine (unit 73 CJ73). Crank journal with scoring, copper plating, no polish, and slight wear are found in two high temperature R-507A units: unit 13 (CJ13) with contaminant air and R-502 and unit 17 (CJ17) with contaminant air and water.

Connecting Rod Responses to Contaminants

The wear found on the connecting rod has two unique indications. The large end is easily affected by debris and corrosive system conditions; this is seen in the unloaded section of the circle. In the loaded section of the circle, scoring and heavy contact is indicative of lubrication film loss and general surface deterioration, presumably caused by contaminants.

An example of a clean and polished connecting rod (large end) is seen on the low temperature R-134a controls: unit 121 (CR121) and unit 122 (CR122). Because chlorine is present, the same surface response is seen with copper plating in R-22 controls: unit 85 (CR85) and unit 86 (CR86).

With contaminant water and R-22 introduced into a high temperature R-407C test stand, unit 51 (CR51) demonstrates slight wear and scoring on the large end of the connecting rod. The same response is seen in a high temperature R-507A compressor with contaminant air and R-502 (unit 13) (CR13). The next most severe observation is medium wear with scoring; this is produced by a high temperature R-507A machine contaminated with acid, air, and water (unit 22) (CR22). Since R-22 is a gas easily hydrolyzed by water, the surface condition of the large end of the connecting rod is worsened by the presence of air and organic acid, unit 119 (CR119) and unit 120 (CR120) demonstrate polish wear, but with scoring and corrosion.

The small end of the connecting rod is exposed to more severe loads than any other mechanical part in the compressor. Lubrication loss is definitely indicated here, but if there is a corrosive hermetic atmosphere, insult to the loaded surface will result. The small end of the connecting rod on control stands with R-507A (unit 6 CR6 and unit 23 CR23), R-407C (unit 42 CR42 and unit 59 CR59), R-22 (unit 85 CR85 and unit 103 CR103), and R-134a (unit 121 CR121 and unit 139 CR139) shows only polish and no wear. However, when the contaminant water is introduced into an R-22 compressor, the small end of the connecting rod demonstrates a polish corrosion response (unit 89 CR89). Slight wear with corrosion is seen with an R-134a unit contaminated with air and water (unit 133) (CR133). When contaminated with acid and water, the R-134a compressor shows medium wear and corrosion (unit 124) (CR124).

The presence of contaminant R-12, acid, air, and water with an R-134a unit elicits the worst response of medium wear, corrosion, and copper plating (unit 154) (CR154). The presence of air and water with a high temperature R-22 unit evokes polish and slight wear (unit 118) (CR118), but also copper plating, which is expected in this system. The copper plating failure mode is caused by the presence of air and water.

Valve Plate Responses to Contaminants

Valve plate observations are quite complex. The effects of temperature and the formation of varnish deposits are of utmost importance. The suction reed runs slightly cooler than the discharge reed and thermal effects are less. The indentation of the valve seat on the reed is referred to as trepanning in this report. As the differential pressure increases, so does the trepanning effect. Very slight trepanning is seen with an R-22 control compressor (unit 85) (VP85) and slight trepanning is seen in a high temperature R-22 machine (unit 104) (VP104). The amount of varnish ring just inside the valve seat zone increases with temperature and contaminant levels. With acid or water present, the varnish ring ranges from very slight to slight, seen with both low and high temperature R-134a compressors (unit 126 VP126 and unit 142 VP142). When R-12 is added as a contaminant, the suction reed of an R-134a machine shows copper plating (unit 142) (VP142). The effects of air and R-502 in a high temperature R-507A unit are seen in the worst case response of copper plating and corrosion along with medium trepanning and a heavy varnish ring (unit 13) (VP13).

The discharge reed is exposed to the highest temperatures within the machine. As the machine runs, over time hermetic acids can erode the reed surface, cause varnish accumulation, and eventually lead to leakage because the valve seat is eroded or worn. The control machines were R-22 and mineral oil and the contaminated machines contained the same levels of air, organic acid, and water contaminants as all of the other machines. The high temperature control compressors with R-22 (unit 103) (VP103) and R-407C (unit 59) (VP59) had the best visual responses: no corrosion, very slight trepanning, and no varnish ring. The next magnitude of varnish ring, very slight, is seen in unit 67 (VP67), a high temperature R-407C compressor that had contaminant air and R-22 present. The appearance of carbon, corrosion, bluing, a medium trepan, and a heavy varnish ring is displayed by unit 12 (VP12), a high temperature R-507A unit contaminated with acid, air, and R-502.

The condition of the valve seat is also essential to understanding the effects of system contaminants. The best understanding comes from the photomicrographs of the various valve seats. Although the suction seats are exposed to relatively low-pressure gas velocities and possibly lower temperatures than the discharge seat, they are not immune to erosion by contaminants. An example of a good suction seat is in unit 23 (VP23), a low temperature R-507A control machine. Contaminant air, acid, and R-22 in a low temperature R-407C

compressor (unit 48) (VP48) cause metal erosion of the seat to occur. Adding to the complexity of this analysis is the wear decomposition phenomena of unit 5 (VP5), an R-507A control machine showing a tremendous amount of metal erosion on both the suction seat and the reed. The discharge reeds do not always respond in the same fashion as the suction reeds. The discharge valve seat of unit 5 (VP5) shows only minor erosion and the discharge reed shows slight to medium trepanning.

Cylinder Bore Responses to Contaminants

Upon disassembly of the compressor and examination of the cylinder bore, various levels of varnishing were noted. This varnish ring may be formed by trace residue from manufacturing or during running.

Examples of no wear and no varnish ring are seen in the controls for R-22 (unit 85) (CB85) and R-134a (unit 123) (CB123). Cylinder bores with no wear but a very slight varnish ring are found in water and acid contaminated compressors with R-22 (unit 98) (CB98) and R-507A (unit 34) (CB34). A cylinder bore with low wear and a slight varnish ring came from unit 52 (CB52), a low temperature R-407C compressor with contaminant acid and water, and unit 99 (CB99), a low temperature R-22 compressor with contaminant air and water. A cylinder bore with low wear but with a medium varnish ring is seen in unit 62 (CB62), an R-22 contaminated low temperature R-407C unit. A cylinder bore with low wear but with a heavy varnish ring is found in unit 66 (CB66), also a low temperature R-407C unit, this one with contaminant air, acid, and R-22. Scoring of the wall of the cylinder bore along with copper plating and a slight varnish ring is seen in unit 117 (CB117), an air and water contaminated high temperature R-22 compressor. Corrosion in the cylinder bore along with medium varnish is displayed in unit 56 (CB56) and unit 74 (CB74), both low temperature R-407C compressors with acid, air, water, and R-22 contaminants, and in unit 144 (CB144), a high temperature R-134a unit with contaminant air.

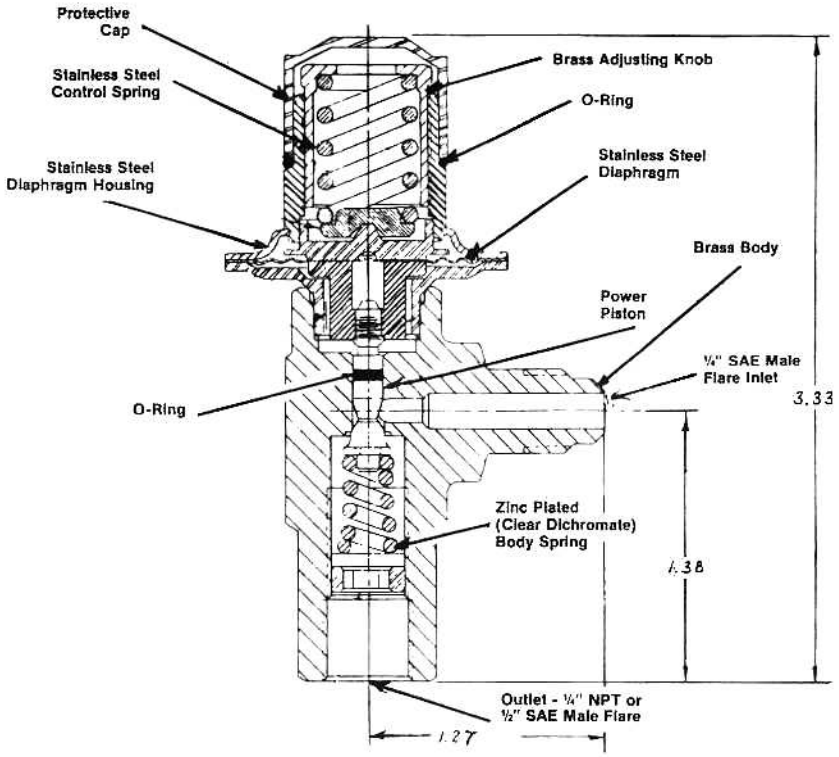
Expansion Valve Responses to Contaminants

Contaminants in hermetic systems constantly play a role in plugging orifices in refrigerant expansion devices. Expansion devices can be capillary tubes, thermostatic expansion valves that control refrigerant superheat, and, as in this study, constant pressure expansion valves (CPEV). Therefore, an investigation of some of the components of the CPEV was undertaken.

The internal construction of the Model A CPEV is seen in Figure 5. The parts visually examined for the query sheet database and photographed were the front side of the stainless steel diaphragm, the end threaded to the diaphragm, the zinc plated body spring, the power piston needle, and the ball used to control the refrigerant orifice. The ball, pin, and seat were also photomicrographed.

The zinc-plated spring and the power piston have been selected to illustrate the effects of contaminants. Both of these parts were exposed to the full flow of the refrigerant/lubricant mixture for the duration of the test. The spring is zinc plated and more sensitive to many aspects of the contaminants and the pin is in direct contact with the liquid prior to expansion.

Figure 5
Model A Constant Pressure Expansion Valve



An example of a spring with no residue is from a low temperature R-134a compressor (unit 134) (SP134) that was exposed to low acid and water (see Table H.4). A spring with a very slight amount of residue is seen in a low temperature R-407C machine (unit 52) (SP52) that was exposed to contaminant acid and water and had a high water content of 369ppm (see Table H.2). The spring from unit 137 (SP137) had a hard gray scale. Unit 137 (SP137) was a low temperature R-134a compressor contaminated with air, water, and R-12, but low in TAN, water,

and metals (see Table H.4). A medium amount of gummy gray residue on the spring was produced by a low temperature R-507A machine (unit 36) (SP36) that had only water as a contaminant, but a higher TAN value and 59ppm moisture (see Table H.1). A heavy amount of gummy black residue was produced on the spring in unit 8 (SP8), a high temperature R-507A unit contaminated with R-502, but having a high TAN of .35 and a high metals content (see Table H.1). The worst case example is the very heavy black residue produced by unit 142 (SP142), a high temperature R-134a unit contaminated with R-12 and found to have high metals content (see Table H.4).

The pin examples are equally puzzling. They range from no residue to heavy gummy black residue. The medium and heavy levels of black residue are principally observed in the presence of contaminant organic acid, water, R-22, and R-502.

This section of the report has presented a summarized description of the observed effects of refrigerants and contaminants on the appearance criterion that was used to develop the statistical evaluation.

STATISTICAL ANALYSIS

Introduction

A statistical analysis was performed on selected contaminants in air conditioning and refrigeration systems. This is a numerical analysis based on visual observations. In this study, four refrigerants were studied, along with two lubricants, several reactive contaminants (presence of other refrigerants, organic acids and/or inorganic acids, moisture and air) at a variety of discharge, return gas, and sump temperature levels and a variety of discharge and suction pressure levels. A multi-factorial experiment was performed. In light of the limited availability of machines and resources, it was decided that some combinations would be included at a smaller sample size.

The statistical methods employed included chi-squared tests of homogeneity of the proportion of normal machines at various levels of the independent variables and logistic regression analysis (Rosner 1995).

Following is a detailed list of the outcome and independent variables, an explanation of how the outcome variables were coded as normal or abnormal at the conclusion of the study, and a detailed description of the statistically significant results of the analysis (p-value <0.05 is deemed significant).

The outcome variables analyzed with respect to the statistical significance of the independent variables upon them were the visual observation of:

- suction muffler appearance,
- discharge plate appearance,
- top stator windings' appearance,
- shell bottom appearance,
- qualitative amount of bearing chips (not cam cuttings) in the shell bottom,
- crank journals' appearance,
- level of wear on the crank journals,
- lower crank bearing journal appearance,
- level of wear on the lower crank bearing journal,
- lower bronze bearings' appearance,
- level of wear on the lower bronze bearings,
- piston top appearance,

- cylinder bore appearance,
- magnitude of a varnish ring in the cylinder bore,
- connecting rod (large end) appearance,
- level of wear on the connecting rod (large end),
- connecting rod (small end) appearance,
- level of wear on the connecting rod (small end),
- piston pin washers' appearance,
- piston pin (removed) appearance,
- level of wear on the piston pin,
- valve plate assembly:
- suction side (reed backer) appearance,
- suction side surface appearance,
- suction reed (removed) appearance,
- magnitude of trepanning on suction reed,
- magnitude of varnish ring on suction reed,
- discharge side (reed backer) appearance,
- discharge side surface appearance,
- discharge reed (removed) appearance,
- magnitude of trepanning on discharge reed, and
- magnitude of varnish ring on discharge reed.

The independent variables whose statistical significance on the outcome variables was analyzed were:

- compressor refrigerants,
  - R-507A
  - R-407C
  - R-22
  - R-134a
- compressor lubricants,
  - RL32S
  - 3GS

- contaminants added,
  - acid
  - air
  - water
  - R-12 in R-134a
  - R-22 in R-407C
  - R-502 in R-507A
- discharge pressure (psig),
- suction pressure (psig),
- discharge temperature (°F),
- return gas temperature (°F), and
- sump temperature (°F)

This report also includes several sections that treat certain observations as "normal" with R-22. The formation of HCl on metal surfaces and the appearance of trace amounts of copper plating in some analyses were considered normal. Therefore, the first analysis treated all refrigerants and contaminants equally. However, in sections where evidence of copper plating was expected, it was considered "normal."

Please remember that all of the test machines were dried with molecular sieve drier, but the driers were removed prior to the introduction of contaminants. Therefore, all machines wet with water could form organic acid from the POE and, in the case of R-22, the formation of HCl gas. No contaminant control or filtering mechanism was used except for a 150 mesh screen at the input to the CPEV.

Results

Suction Muffler Appearance

Response Codes	
Normal	Abnormal
clean	black
gray	metal chips
	rust

None of the independent variables was statistically related to the appearance of the suction muffler.

Discharge Plate Appearance

Response Codes	
Normal	Abnormal
clean	black
gray	soot
	copper
	brown

Only the contaminant air was statistically related to the appearance of the discharge plate.

Contaminant	Compressors with normal discharge plate appearance
control	46%
air	26%

Top Stator Windings' Appearance

Response Codes	
Normal	Abnormal
clean	black
gray	copper trace
	stator top green
	stator top copper
	stator top discolored
	green under black

Only temperature was statistically related to the appearance of the top stator windings; discharge, return gas, and sump temperatures were lower in compressors with normal top stator windings than with abnormal.

The temperatures reported are the average temperatures for the machines with normal and abnormal top stator windings appearance. Such means will change for subsequent variables because they will involve different machines.

Temperature Variable	Top stator windings' appearance	
	Normal	Abnormal
Discharge	182°F	193°F
Return gas	60°F	62°F
Sump	148°F	169°F

Shell Bottom Appearance

Response Codes	
Normal	Abnormal
clean	black
	copper plating
	oil green
	corrosion
	oxidized

Shell bottom appearance was statistically related to refrigerant, lubricant, temperature, and pressure. Compressors with normal shell bottoms had higher suction pressure and lower discharge, return gas, and sump temperatures as compared to those with an abnormal shell bottom appearance.

Refrigerant	Compressors with normal shell bottom appearance	Lubricant	Compressors with normal shell bottom appearance
R-407C	89%	RL32S	67%
R-134a	64%		
R-507A	47%		
R-22	47%	3GS	47%

Variable	Shell bottom appearance	
	Normal	Abnormal
Suction pressure	44 psig	26 psig
Discharge temperature	175°F	208°F
Return gas temperature	60°F	63°F
Sump temperature	139°F	192°F

Shell Bottom Appearance Revised for R-22

Response Codes (revised)	
Normal	Abnormal
clean	black
copper plating	oil green
	corrosion
	oxidized

Statistically Significant Relationships Using Revised Response Codes

Refrigerant	Compressors with normal shell bottom appearance	Contaminant	Compressors with normal shell bottom appearance
R-407C	89%	Control	75%
R-22	75%		
R-134a	64%	R-502 in R-507A	44%
R-507A	47%		

Amount of Bearing Chips in Shell Bottom

Response Codes	
Normal	Abnormal
trace	medium
slight	heavy

None of the independent variables was statistically related to the amount of bearing chips in the shell bottom.

Crank Journals' Appearance

Response Codes	
Normal	Abnormal
clean	scored
copper plating	corrosion
	heavily discolored

The appearance of the crank journals was statistically related to refrigerant, the contaminant R-12, pressure, and temperature. Compressors with crank journals that appeared normal had higher discharge and suction pressure and lower discharge, return gas, and sump temperatures as compared to those with abnormal-appearing crank journals.

Refrigerant	Compressors with normal crank journal appearance	Contaminant	Compressors with normal crank journal appearance
R-407C	56%	control	71%
R-22	53%		
R-507A	50%	R-12 in R-134a	13%
R-134a	14%		

Variable	Crank journals' appearance	
	Normal	Abnormal
Discharge pressure	247 psig	217 psig
Suction pressure	47 psig	30 psig
Discharge temperature	176°F	197°F
Return gas temperature	59°F	62°F
Sump temperature	139°F	175°F

Crank Journal Wear

Response Codes	
Normal	Abnormal
polish	medium
slight	heavy

Crank journal wear was statistically related to refrigerant, lubricant, and the contaminant water.

Refrigerant	Compressors with normal crank journal wear	Lubricant	Compressors with normal crank journal wear	Contaminant	Compressors with normal crank journal wear
R-407C	97%	RL32S	94%	control	100%
R-507A	97%				
R-134a	89%			water	77%
R-22	61%	3GS	61%		

Lower Crank Bearing Journal Appearance

Response Codes	
Normal	Abnormal
clean	scored
	copper plating
	bronze plating
	corrosion
	heavily discolored
	varnish

The appearance of the lower crank bearing journal was statistically related to refrigerant, lubricant, pressure, and temperature. Compressors with a normal lower crank bearing journal appearance had higher suction pressure and lower discharge, return gas, and sump temperatures as compared to those with an abnormal lower crank bearing journal appearance.

Refrigerant	Compressors with normal lower crank bearing journal appearance	Lubricant	Compressors with normal lower crank bearing journal appearance
R-407C	81%	RL32S	59%
R-507A	50%		
R-134a	47%		
R-22	33%	3GS	33%

Variable	Lower crank bearing journal appearance	
	Normal	Abnormal
Suction pressure	43 psig	31 psig
Discharge temperature	176°F	200°F
Return gas temperature	59°F	63°F
Sump temperature	141°F	180°F

Lower Crank Bearing Journal Appearance Revised for R-22

Response Codes (revised)	
Normal	Abnormal
clean	scored
copper plating	bronze plating
	corrosion
	heavily discolored
	varnish

Statistically Significant Relationships Using Revised Response Codes

Refrigerant	Compressors with normal lower crank bearing journal appearance	Contaminant	Compressors with normal lower crank bearing journal appearance
R-407C	81%	Control	92%
R-22	72%		
R-134a	64%	R-12 in R-134a	38%
R-507A	47%		

Lower Crank Bearing Journal Wear

Response Codes	
Normal	Abnormal
polish	medium
slight	heavy

None of the independent variables was statistically related to the level of wear on the lower crank bearing journal.

Lower Bronze Bearings' Appearance

Response Codes	
Normal	Abnormal
clean	scored
	corrosion

Only the contaminant acid was statistically related to the appearance of the lower bronze bearings.

Contaminant	Compressors with normal lower bronze bearing appearance
control	46%
acid	26%

Lower Bronze Bearings Wear

Response Codes	
Normal	Abnormal
none	medium
polish	heavy
slight	

Only temperature was statistically related to the level of wear on the lower bronze bearings; discharge and sump temperatures were lower in compressors having a normal level of wear on the lower bronze bearings.

Variable	Lower bronze bearings wear	
	Normal	Abnormal
Discharge temperature	186°F	223°F
Sump temperature	157°F	222°F

Piston Top Appearance

Response Codes	
Normal	Abnormal
clean	carbon
	damaged
	corrosion
	bronze
	varnish

The appearance of the piston top was statistically related to refrigerant, pressure, and temperature. Suction pressure was lower and return gas and sump temperatures were higher in compressors where the piston top appeared normal.

Refrigerant	Compressors with normal piston top appearance
R-507A	94%
R-22	86%
R-407C	72%
R-134a	27%

Variable	Piston top appearance	
	Normal	Abnormal
Suction pressure	34 psig	56 psig
Return gas temperature	61°F	60°F
Sump temperature	166°F	122°F

Cylinder Bore Appearance

Response Codes		
Normal	Indeterminate	Abnormal
no wear	no wear plus copper plating and/or corrosion	Any other combination of no wear, low wear, wear, scored, copper plating, corrosion, soot, or rust.
low wear	low wear plus copper plating and/or corrosion	

The appearance of the cylinder bore was statistically related to the contaminant water.

Contaminant	Compressors with normal cylinder bore appearance	Compressors with indeterminate cylinder bore appearance
control	79%	21%
water	58%	14%

Cylinder Bore Varnish Ring

Response Codes	
Normal	Abnormal
none	medium
very slight	heavy
slight	

The magnitude of a varnish ring in the cylinder bore was statistically related to refrigerants, the contaminants air and R-502, pressure, and temperature. The discharge pressure was lower and the return gas temperature was higher in compressors with a normal magnitude varnish ring.

Refrigerant	Compressors with normal magnitude cylinder bore varnish ring
R-134a	92%
R-22	86%
R-407C	78%
R-507A	53%

Contaminant	Compressors with normal cylinder bore varnish ring
control	92%
R-502 in R-507A only	88%
air only	70%
R-502 in R-507A + air	13%

Variable	Cylinder bore varnish ring	
	Normal	Abnormal
Discharge pressure	223 psig	254 psig
Return gas temperature	61°F	60°F

Connecting Rod (large end) Appearance

Response Codes	
Normal	Abnormal
none	scored
	copper plating
	corrosion

The appearance of the large end of the connecting rod was statistically related to refrigerant, lubricant, the contaminant acid, and temperature. The compressors where the large end of the connecting rod appeared normal had lower return gas temperatures than those in which the appearance was abnormal. Note: Organic acid and HCl are formed while in the presence of water when using R-22. Therefore, HCl and water, when present, are more corrosive, but the statistical analysis had no bias.

Refrigerant	Compressors with normal connecting rod (large end) appearance	Lubricant	Compressors with normal connecting rod (large end) appearance	Contaminant	Compressors with normal connecting rod (large end) appearance
R-407C	39%	RL32S	31%	control	38%
R-507A	28%				
R-134a	28%			acid	17%
R-22	8%	3GS	8%		

Variable	Connecting rod (large end) appearance	
	Normal	Abnormal
Return gas temperature	60°F	61°F

Connecting Rod (large end) Wear

Response Codes	
Normal	Abnormal
none	medium
polish	heavy
slight	

The level of wear on the large end of the connecting rod was statistically related to lubricant and the contaminant water.

Lubricant	Compressors with normal connecting rod (large end) wear	Contaminant	Compressors with normal connecting rod (large end) wear
RL32S	91%	control	100%
3GS	78%	water	77%

Connecting Rod (small end) Appearance

Response Codes	
Normal	Abnormal
none	scored
contact wear	copper plating
	corrosion

Did not separate corrosive effects of HCl and water in R-22 machines.

The appearance of the small end of the connecting rod was statistically related to refrigerant, lubricant, the contaminants water, air, acid, R-502, and R-12, pressure, and temperature.

Refrigerant	Compressors with normal connecting rod (small end) appearance	Lubricant	Compressors with normal connecting rod (small end) appearance
R-507A	78%	RL32S	76%
R-407C	78%		
R-134a	72%		
R-22	33%	3GS	33%

Contaminant	Compressors with normal connecting rod (small end) appearance
control	96%
R-502 in R-507A	69%
acid	63%
R-12 in R-134a	63%
air	59%
water	56%

Variable	Connecting rod (small end) appearance	
	Normal	Abnormal
Discharge pressure	233 psig	224 psig
Suction pressure	36 psig	40 psig
Discharge temperature	188°F	187°F
Return gas temperature	60°F	62°F
Sump temperature	160°F	159°F

Connecting Rod (small end) Wear

Response Codes	
Normal	Abnormal
polish	medium
slight	heavy

The level of wear on the small end of the connecting rod was statistically related to refrigerant, lubricant, and the contaminant R-12.

Refrigerant	Compressors with normal connecting rod (small end) wear
R-22	100%
R-507A	81%
R-134a	81%
R-407C	78%

Lubricant	Compressors with normal connecting rod (small end) wear
3GS	100%
RL32S	80%

Contaminant	Compressors with normal connecting rod (small end) wear
control	96%
R-12 in R-134a	63%

Piston Pin Washers' Appearance

Response Codes	
Normal	Abnormal
no wear	high wear
contact wear	corrosion
	copper plating

The appearance of the piston pin washers was statistically related to refrigerant, the contaminant R-12, pressure, and temperature. In compressors with piston pin washers considered normal, suction pressure was higher and discharge, return gas, and sump temperatures were lower than in compressors where the piston pin washers appeared abnormal.

Refrigerant	Compressors with normal piston pin washers' appearance	Contaminant	Compressors with normal piston pin washers' appearance
R-407C	97%	control	92%
R-507A	89%		
R-22	83%	R-12 in R-134a	63%
R-134a	75%		

Variable	Piston pin washers' appearance	
	Normal	Abnormal
Suction pressure	40 psig	20 psig
Discharge temperature	183°F	215°F
Return gas temperature	60°F	63°F
Sump temperature	153°F	199°F

Piston Pin (removed) Appearance

Response Codes	
Normal	Abnormal
clean	scored
	copper plating
	bronze plating
	corrosion
	discolored
	heavily discolored

Pressure and temperature only were statistically related to the appearance of the piston pin (removed). In compressors where the piston pin (removed) was judged normal, discharge pressure was higher and return gas temperature was lower than in compressors with an abnormal-appearing piston pin.

Variable	Piston pin (removed) appearance	
	Normal	Abnormal
Discharge pressure	261 psig	221 psig
Return gas temperature	59°F	61°F

Piston Pin Wear

Response Codes	
Normal	Abnormal
none	medium
polish	heavy
slight	

None of the independent variables was statistically related to the level of wear on the piston pin.

Suction Side (Reed Backer) Appearance

Response Codes	
Normal	Abnormal
clean	carbon
light carbon	copper plating
	corrosion
	soot
	heavy soot

Only temperature was statistically related to the appearance of the reed backer on the suction side of the valve plate assembly. In compressors where the appearance was normal, return gas temperature was higher.

	Suction side (reed backer) appearance	
Variable	Normal	Abnormal
Return gas temperature	63°F	61°F

Suction Side Surface Appearance

Response Codes	
Normal	Abnormal
carbon	black
corrosion	soot
	copper plating
	damaged

The surface appearance of the suction side of the valve plate assembly was statistically related to refrigerant, pressure, and temperature. The discharge pressure, discharge temperature, and sump temperature were all lower in compressors where the surface was normal.

Refrigerant	Compressors with normal suction side surface appearance
R-134a	94%
R-407C	89%
R-22	58%
R-507A	42%

Variable	Suction side surface appearance	
	Normal	Abnormal
Discharge pressure	209 psig	281 psig
Discharge temperature	183°F	198°F
Sump temperature	152°F	178°F

Suction Reed (removed) Appearance

Response Codes	
Normal	Abnormal
clean	carbon
corrosion	copper plating
	soot
	heavy soot

The appearance of the suction reed removed from the valve plate assembly was statistically related to refrigerant, pressure, and temperature. In compressors where the suction reed was normal, discharge pressure was lower, suction pressure was higher, and discharge and sump temperatures were lower.

Refrigerant	Compressors with normal suction reed appearance
R-407C	97%
R-134a	94%
R-22	92%
R-507A	56%

Variable	Suction reed appearance	
	Normal	Abnormal
Discharge pressure	215 psig	312 psig
Suction pressure	40 psig	24 psig
Discharge temperature	182°F	216°F
Sump temperature	150°F	211°F

Suction Reed Trepan

Response Codes	
Normal	Abnormal
none	slight
very slight	medium
	heavy

The magnitude of trepanning on the suction reed removed from the valve plate assembly was statistically related to refrigerant, the contaminants air, R-12, and R-22, discharge pressure, and discharge and sump temperatures. The discharge pressure, discharge temperature, and sump temperature were lower in compressors with a normal magnitude of trepanning on the suction reed.

Refrigerant	Compressors with normal suction reed trepan
R-407C	81%
R-134a	67%
R-22	44%
R-507A	42%

Contaminant	Compressors with normal suction reed trepan
R-22 in R-407C	81%
R-12 in R-134a	81%
control	63%
air	48%

Variable	Suction reed trepan	
	Normal	Abnormal
Discharge pressure	214 psig	252 psig
Discharge temperature	182°F	196°F
Sump temperature	150°F	174°F

Suction Reed Varnish Ring

Response Codes	
Normal	Abnormal
none	very slight
	slight
	medium
	heavy

Pressure and temperature only were statistically related to the magnitude of a varnish ring on the suction reed removed from the valve plate assembly. In compressors with no varnish ring (i.e. normal), suction pressure was higher and discharge, return gas, and sump temperatures were lower.

Variable	Suction reed varnish ring	
	Normal	Abnormal
Suction pressure	43 psig	34 psig
Discharge temperature	178°F	193°F
Return gas temperature	59°F	62°F
Sump temperature	142°F	170°F

Discharge Side (Reed Backer) Appearance

Response Codes	
Normal	Abnormal
clean	carbon
light carbon	copper plating
corrosion	blued
	black
	soot
	heavy soot

The appearance of the reed backer on the discharge side of the valve plate assembly was statistically related to refrigerant, lubricant, the contaminants air and R-502, suction pressure, and discharge and sump temperatures. In compressors with a normal reed backer appearance, suction pressure was higher and discharge and sump temperatures were lower.

Refrigerant	Compressors with normal discharge side (reed backer) appearance	Lubricant	Compressors with normal discharge side (reed backer) appearance	Contaminant	Compressors with normal discharge side (reed backer) appearance
R-22	97%	3GS	97%	control	75%
R-407C	69%	RL32S	56%	air	55%
R-134a	61%			R-502 in R-507A	38%
R-507A	39%				

Variable	Discharge side (reed backer) appearance	
	Normal	Abnormal
Suction pressure	44 psig	24 psig
Discharge temperature	178°F	207°F
Sump temperature	144°F	190°F

Discharge Side Surface Appearance

Response Codes	
Normal	Abnormal
clean	black
blued	soot
corrosion	copper plating
	carbon

The surface appearance of the discharge side of the valve plate assembly was statistically related to refrigerant, lubricant, the contaminant R-12, and discharge pressure. The discharge pressure was lower in compressors where the surface was normal.

Refrigerant	Compressors with normal discharge side surface appearance	Lubricant	Compressors with normal discharge side surface appearance	Contaminant	Compressors with normal discharge side surface appearance
R-134a	92%	RL32S	79%	R-12 in R-134a	94%
R-407C	89%				
R-507A	56%			control	83%
R-22	44%	3GS	44%		

Variable	Discharge side surface appearance	
	Normal	Abnormal
Discharge pressure	208 psig	281 psig

Discharge Side Surface Appearance Revised for R-22

Response Codes (revised)	
Normal	Abnormal
clean	black
blued	soot
corrosion	carbon
copper plating	

Statistically Significant Relationships Using Revised Response Codes

Refrigerant	Compressors with normal discharge side surface appearance	Lubricant	Compressors with normal discharge side surface appearance	Contaminant	Compressors with normal discharge side surface appearance
R-22	100%	3GS	100%	control	92%
R-134a	92%	RL32S	79%		
R-407C	89%			R-502 in R-507A	50%
R-507A	56%				

Discharge Reed (removed) Appearance

Response Codes	
Normal	Abnormal
clean	blued
very light carbon	copper plating
corrosion	carbon
	heavy carbon
	black
	soot

None of the independent variables was statistically related to the appearance of the discharge reed removed from the valve plate assembly.

Discharge Reed (removed) Appearance Revised for R-22

Response Codes (revised)	
Normal	Abnormal
clean	blued
very light carbon	carbon
corrosion	heavy carbon
copper plating	black
	soot

Statistically Significant Relationships Using Revised Response Codes

Refrigerant	Compressors with normal discharge reed appearance	Contaminant	Compressors with normal discharge reed appearance
R-22	100%	control	79%
R-407C	81%	air	64%
R-134a	67%	R-502 in R-507A	38%
R-507A	42%		

Discharge Reed Trepan

Response Codes	
Normal	Abnormal
none	slight
very slight	medium
	heavy

The magnitude of trepanning on the discharge reed removed from the valve plate assembly was statistically related to refrigerant, lubricant, suction pressure, and discharge, return gas, and sump temperatures. Compressors with a normal magnitude of trepanning had higher suction pressure and lower discharge, return gas, and sump temperatures.

Refrigerant	Compressors with normal discharge reed trepan	Lubricant	Compressors with normal discharge reed trepan
R-407C	97%	RL32S	84%
R-134a	89%		
R-507A	67%		
R-22	53%	3GS	53%

Variable	Discharge reed trepan	
	Normal	Abnormal
Suction pressure	40 psig	29 psig
Discharge temperature	180°F	211°F
Return gas	60°F	63°F
Sump temperature	150°F	192°F

Discharge Reed Varnish Ring

Response Codes	
Normal	Abnormal
none	slight
very slight	medium
	heavy

The magnitude of a varnish ring on the discharge reed removed from the valve plate assembly was statistically related to refrigerant, the contaminants air and R-502, suction pressure, and discharge and sump temperatures. In compressors with no varnish ring (i.e. normal), suction pressure was higher and discharge and sump temperatures were lower.

Refrigerant	Compressors with normal discharge reed varnish ring
R-134a	89%
R-22	86%
R-407C	78%
R-507A	58%

Contaminant	Compressors with normal discharge reed varnish ring
control	83%
air	69%

Variable	Discharge reed varnish ring	
	Normal	Abnormal
Suction pressure	43 psig	31 psig
Discharge temperature	176°F	201°F
Sump temperature	143°F	179°F

TAN (Total Acid Number)

The final TAN of the compressor lubricant was statistically related to refrigerant, lubricant, and the contaminants water and R-502. TAN was also statistically significant and positively related to discharge pressure and discharge and sump temperature. TAN was negatively related to suction pressure.

Refrigerant	Mean TAN	Lubricant	Mean TAN
R-507A	.45	RL32S	.25
R-134a	.17		
R-407C	.13		
R-22	.13	3GS	.13

Contaminant	Mean TAN
R-502 in R-507A	.49
water	.28
control	.13

Variable	r
Discharge pressure	.42
Suction pressure	-.33
Discharge temperature	.47
Sump temperature	.54

Water

The final amount of water (ppm) in the compressor lubricant was statistically related to refrigerant, lubricant, and the contaminants air and R-22. There was no statistical relation between water measurement and pressure or temperature.

Refrigerant	Mean Water (ppm)	Lubricant	Mean Water (ppm)
R-407C	167	RL32S	125
R-507A	123		
R-134a	87		
R-22	33	3GS	33

Contaminant	Mean Water (ppm)
R-22 in R-407C	200
control	148
air	82

Total Metals

The total amount of metals (ppm) present in the final compressor lubricant was statistically related to refrigerant and the contaminant R-502. The amount of total metals was

also statistically significant and positively related to discharge pressure and discharge and sump temperature. The amount of total metals was negatively related to suction pressure.

Refrigerant	Mean Total Metals (ppm)
R-507A	40
R-22	13
R-134a	11
R-407C	8

Contaminant	Mean Total Metals (ppm)
R-502 in R-507A	41
control	17

Variable	r
Discharge pressure	.43
Suction pressure	-.18
Discharge temperature	.32
Sump temperature	.38

Trash in Liquid Screen

The amount of trash in the liquid screen (g) of the compressor at the end of the run was statistically related to refrigerant and the contaminant R-502. The amount of trash was statistically significant and positively related to discharge and sump temperature and negatively related to return gas temperature and suction pressure.

Refrigerant	Mean Trash in Liquid Screen (g)
R-507A	.09
R-22	.04
R-134a	.04
R-407C	.03

Contaminant	Mean Trash in Liquid Screen (g)
R-502 in R-507A	.11
control	.04

Variable	r
Suction pressure	-.20
Discharge temperature	.21
Return gas temperature	-.21
Sump temperature	.22

Debris in Compressor Bottom

The amount of debris (g) in the compressor bottom at the end of the run was statistically related to refrigerant, lubricant, and the contaminant R-502. The amount of debris was

statistically significant and positively related to discharge and sump temperature and negatively related to suction pressure.

Refrigerant	Mean Debris in Bottom (g)	Lubricant	Mean Debris in Bottom (g)
R-507A	.97	RL32S	.78
R-407C	.69		
R-134a	.67		
R-22	.50	3GS	.50

Contaminant	Mean Debris in Bottom (g)
R-502 in R-507A	.92
control	.57

Variable	r
Suction pressure	-.27
Discharge temperature	.20
Sump temperature	.24

Fluoride Ion

The level of fluoride ion (ppm) in the final lubricant was statistically related to refrigerant, lubricant, and the contaminant R-502. The fluoride ion level was statistically significant and positively related to discharge pressure and negatively related to return gas temperature.

Refrigerant	Mean Fluoride Ion (ppm)	Lubricant	Mean Fluoride Ion (ppm)
R-507A	1.6	RL32S	1.2
R-407C	1.2		
R-134a	.93		
R-22	.93	3GS	.93

Contaminant	Mean Fluoride Ion (ppm)
R-502 in R-507A	1.6
control	1.2

Variable	r
Discharge pressure	.31
Return gas temperature	-.46

Chloride Ion

The level of chloride ion (ppm) in the final lubricant was statistically related to refrigerant and the contaminants R-12 and R-502. The chloride ion level was statistically significant and positively related to discharge, return gas, and sump temperature and negatively related to discharge and suction pressure.

Refrigerant	Mean Chloride Ion (ppm)	Contaminant	Mean Chloride Ion (ppm)
R-134a	15	R-12 in R-134a	16
R-22	13	control	12
R-407C	11	R-502 in R-507A	11
R-507A	10		

Variable	r
Discharge pressure	-.32
Suction pressure	-.26
Discharge temperature	.26
Return gas temperature	.46
Sump temperature	.29

Conclusions From Statistical Analysis

In brief, R-507A and R-22 were associated with a higher percentage of abnormal machines than R-407C and R-134a. 3GS was associated with a substantially higher number of abnormal machines than RL32S. Machines that had contaminant acid, air, and water added were declared abnormal far more than control machines. Performance of machines that had refrigerant added as a contaminant was mixed; some machines were worse than controls, others were better. Discharge pressure tended to be lower for outcome variables that were declared normal. Suction pressure tended to be higher for outcome variables that were declared normal. Discharge, return gas, and sump temperatures tended to be lower for outcome variables that were declared normal.

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DISCUSSION OF SEALED TUBE RESULTS

The conclusions drawn from the visual observations of the sealed tube tests are summarized in Table 4. There are two chemistry aspects to remember when reviewing the observations and measurements of sealed tubes. When RL32S decomposes by either hydrolysis or oxidation, the acid produced is considered a weak acid whether it is in the non or ionized state if oxygen or water is present. When reviewing the results of the effects of water, organic acid, and air on the tubes containing the mineral oil, Suniso 3GS, a different set of circumstances exist. It is well known that R-22 is easily hydrolyzed by water to form HCl gas.

R-507A

The contaminant refrigerant in the R-507A tubes was R-502. It is thought that R-507A and R-404a could be used as retrofit refrigerants and that retrofitted systems may contain small amounts of the CFC and HCFC component.

The reaction of R-507A and contaminants are presented in Table 5 and Table 6. Both temperatures seem to track as expected for the addition of water, while the higher temperature produces a slightly higher TAN value. Remarkably however, air alone produces an acid response, which is not increased by the addition of contaminant organic acid or water. Oxidation of RL32S is an obvious response factor as it is seen with the appearance of CO and CO_2 at apparently equal levels.

In this refrigerant case, air plays a dominant role in organic acid and some HCl formation that appears not to be catalyzed by the presence of R-502.

R-407C and R-134a

Both R-407C with contaminant R-22 and R-134a with contaminant R-12 show a similar chemical and acid formation to R-507A (see Table 7, Table 8, Table 11, and Table 12). More noteworthy, however, is the proportionately higher level of CO_2 at both temperatures, but with similar and proportionate levels of CO being produced. The presence of R-22 and R-12 may possibly increase the amount of ferric salts catalyzing the slightly greater level of carbon monoxide measured. Again, the most striking response are the high TAN values in the presence of contaminant air.

R-22

The chemistry that appears to be different is the response of contaminants to the R-22 and mineral oil combination of reactants (Table 9 and Table 10). A possible indicator as to why R-22 and mineral oil systems are tolerant to system contaminants is that the presence of air does not affect the production of significant levels of organic acids as compared to POE lubrication. Higher temperatures (Table 10) cause an increase in TAN level and higher carbon dioxide levels. Yet when compared to POEs at both temperatures and the elevation of organic acid or HCl formed in the mineral oil tubes, the levels are still a magnitude of seven less.

Table 4
Conclusions Drawn from Sealed Tube Visual Observations

System Refrigerant	System Temperature	
	135°C (275°F)	**165°C (329°F)**
R-507A (Appendix I)	• ***Acid*** corrodes copper in gas phase. • ***Air*** generates precipitate.	• ***Acid*** corrodes copper in gas phase and corrodes valve steel. • ***Air*** generates precipitate.
R-407C (Appendix J)	• ***Air*** corrodes valve steel and generates precipitate. • ***Water***, ***acid***, and ***R-22*** corrode copper.	• ***Air*** generates precipitate. • ***Water***, ***acid***, and ***R-22*** corrode valve steel.
R-22* (Appendix K)	• ***Air*** corrodes all metals and generates precipitate.	• ***Air*** corrodes all metals and generates precipitate.
R-134a (Appendix L)	• ***Water*** and ***acid*** corrode copper. • ***Acid*** and ***air*** generate precipitate.	• ***Air*** generates precipitate.

* The R-22 system generated significantly more corrosion than others did.

Table 5
Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1)
Reacted at 135°C (275°F) for 224 days

Sample Contaminants				GC Vapor Composition						RL32S
Water* (ppm)	**Acids (TAN)**	**Air (%)**	**R-502 (%)**	**N_2 (%)**	**O_2 (%)**	**CO (%)**	**CO_2 (%)**	**R-507A (%)**	**R-502 (%)**	**TAN****
<20	-	-	-	-	-	-	-	100	-	.10
200	-	-	-	-	-	-	-	100	-	2.0
<20	0.1	-	-	-	-	-	-	100	-	.78
<20	-	-	4	-	-	-	-	96.5	3.5	.15
<20	-	4	-	2.3	-	.10	.20	97.4	-	9.9
200	0.1	-	-	-	-	-	-	99.8	.20	2.1
200	-	-	4	-	-	-	-	95.8	4.2	2.0
200	-	4	-	3.4	.15	.10	.20	96.2	-	11
<20	0.1	-	4	-	-	-	-	95.7	4.3	.76
<20	0.1	4	-	3.2	.10	.10	.30	96.3	-	12
<20	-	4	4	3.1	.15	.10	.20	93.0	3.5	15
200	0.1	-	4	-	-	-	-	96.4	3.6	2.1
200	0.1	4	-	3.0	-	.15	.25	96.6	-	12
200	-	4	4	2.6	-	.19	.22	93.5	3.4	15
<20	0.1	4	4	2.9	-	.20	.28	93.2	3.3	14
200	0.1	4	4	2.4	-	.18	.25	93.9	3.2	15

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / RL32S (g)

Table 6
Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1)
Reacted at 165°C (329°F) for 28 days

Sample Contaminants				GC Vapor Composition						RL32S
Water* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	-	-	-	-	-	-	-	99.9	.10	.53
200	-	-	-	-	-	-	-	99.8	.20	2.1
<20	0.1	-	-	-	-	-	-	99.9	.10	.77
<20	-	-	4	-	-	-	-	98.7	1.3	.12
<20	-	4	-	3.7	.12	.27	.88	94.8	.07	12
200	0.1	-	-	-	-	-	-	99.8	.20	NA
200	-	-	4	-	-	-	-	95.7	4.3	NA
200	-	4	-	3.3	.14	.25	1.0	94.1	.05	14
<20	0.1	-	4	-	-	-	-	96.1	3.9	.61
<20	0.1	4	-	3.5	.14	.27	.77	95.3	.05	11
<20	-	4	4	2.3	-	.17	.25	94.3	3.0	16
200	0.1	-	4	-	-	-	-	96.0	4.0	2.2
200	0.1	4	-	2.0	-	.09	.19	97.7	-	13
200	-	4	4	3.0	-	.07	1.6	92.0	3.3	20
<20	0.1	4	4	3.2	.15	.10	.50	92.6	3.5	18
200	0.1	4	4	3.5	.10	.51	.75	91.8	3.3	16

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / RL32S (g)
NA = not available/tube failure

Table 7
Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1)
Reacted at 135°C (275°F) for 224 days

Sample Contaminants				GC Vapor Composition						RL32S
Water* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	-	-	-	-	-	-	-	100	-	.17
200	-	-	-	-	-	-	-	100	-	NA
<20	0.1	-	-	-	-	-	-	100	-	.78
<20	-	-	4	-	-	-	-	97.5	2.5	NA
<20	-	4	-	3.5	.70	.10	.50	95.2	-	12
200	0.1	-	-	-	-	-	.48	99.5	-	2.0
200	-	-	4	-	-	-	-	97.2	2.8	1.9
200	-	4	-	3.4	.39	.30	.86	95.0	.11	15
<20	0.1	-	4	-	-	-	.41	96.4	3.2	NA
<20	0.1	4	-	3.9	.48	.29	.78	94.6	-	14
<20	-	4	4	3.6	.43	.31	.54	92.4	2.7	13
200	0.1	-	4	-	-	-	-	97.1	2.9	NA
200	0.1	4	-	3.9	.46	.12	.96	94.6	.09	16
200	-	4	4	3.8	.62	.27	.59	92.4	2.4	15
<20	0.1	4	4	3.7	.57	.28	.81	92.2	2.4	14
200	0.1	4	4	3.7	.55	.27	.62	92.4	2.5	15

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / RL32S (g)
NA = not available/tube failure

Table 8
Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1)
Reacted at 165°C (329°F) for 28 days

Sample Contaminants				GC Vapor Composition						RL32S
Water* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	-	-	-	-	-	-	-	100	-	.12
200	-	-	-	-	-	-	-	100	-	2.1
<20	0.1	-	-	-	-	-	-	100	-	.70
<20	-	-	4	-	-	-	.32	96.7	2.9	.28
<20	-	4	-	3.4	.41	.32	1.2	94.5	.16	14
200	0.1	-	-	-	-	-	-	100	-	2.0
200	-	-	4	-	-	-	-	96.7	3.3	NA
200	-	4	-	3.8	.70	.28	.75	94.5	-	7.3
<20	0.1	-	4	-	-	-	-	97.0	3.0	.04
<20	0.1	4	-	3.4	1.1	-	1.3	94.1	.11	15
<20	-	4	4	3.7	.58	.30	.78	92.2	2.4	14
200	0.1	-	4	-	-	-	-	96.7	3.3	NA
200	0.1	4	-	3.6	.54	.17	.73	94.9	-	15
200	-	4	4	4.0	.83	.25	.68	92.0	2.2	14
<20	0.1	4	4	3.5	.47	.33	.88	92.3	2.6	12
200	0.1	4	4	3.8	.75	.28	.74	91.9	2.5	12

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / RL32S (g)
NA = not available/tube failure

Table 9
Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1)
Reacted at 135°C (275°F) for 224 days

Sample Contaminants			GC Vapor Composition					3GS
Water* (ppm)	Acids (TAN)	Air (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
<20	-	-	-	-	-	-	100	.04
200	-	-	-	-	-	-	100	.01
<20	0.1	-	-	-	-	-	100	.11
<20	-	4	3.4	.47	-	.12	96.0	1.1
200	0.1	-	-	-	-	-	100	.10
200	-	4	3.5	.40	.10	.20	95.8	1.7
<20	0.1	4	3.6	.13	.12	.23	95.9	1.5
200	0.1	4	3.4	.12	.18	.21	96.1	1.5

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / 3GS (g)

Table 10
Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1)
Reacted at 165°C (329°F) for 28 days

Sample Contaminants			GC Vapor Composition					3GS
Water* (ppm)	Acids (TAN)	Air (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
<20	-	-	-	-	-	-	100	.04
200	-	-	-	-	-	-	100	.03
<20	0.1	-	-	-	-	-	100	.13
<20	-	4	.68	<.05	.06	.76	98.5	1.8
200	0.1	-	-	-	-	.28	99.7	.13
200	-	4	3.3	.21	.18	.28	96.0	2.9
<20	0.1	4	3.2	.10	.10	.40	96.2	2.1
200	0.1	4	3.0	<.05	.22	.63	96.1	2.6

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / 3GS (g)

Table 11
Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1)
Reacted at 135°C (275°F) for 224 days

Sample Contaminants				GC Vapor Composition						RL32S
Water* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	-	-	-	-	-	-	-	100	-	.18
200	-	-	-	-	-	-	-	100	-	2.0
<20	0.1	-	-	-	-	-	-	100	-	.63
<20	-	-	4	-	-	-	-	97.6	2.4	.18
<20	-	4	-	3.5	0.9	<.05	.58	95.9	-	14
200	0.1	-	-	-	-	-	-	100	-	1.9
200	-	-	4	-	-	-	-	97.6	2.4	2.1
200	-	4	-	3.8	-	.28	-	95.9	-	15
<20	0.1	-	4	-	-	-	-	97.7	2.3	.69
<20	0.1	4	-	3.5	-	0.10	0.50	95.9	-	12
<20	-	4	4	3.5	-	0.10	0.50	93.4	2.5	10
200	0.1	-	4	-	-	-	-	96.1	3.9	.72
200	0.1	4	-	3.9	-	.37	.66	95.1	-	2.7
200	-	4	4	3.7	-	.41	.65	92.0	3.2	13
<20	0.1	4	4	3.6	-	.53	.79	91.8	3.2	12
200	0.1	4	4	4.0	-	.57	.83	91.6	3.1	14

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / RL32S (g)

Table 12
Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1)
Reacted at 165°C (329°F) for 28 days

Sample Contaminants				GC Vapor Composition						RL32S
Water* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	-	-	-	-	-	-	-	100	-	.14
200	-	-	-	-	-	-	-	100	-	2.4
<20	0.1	-	-	-	-	-	-	100	-	.59
<20	-	-	4	-	-	-	-	97.6	2.4	.27
<20	-	4	-	3.3	-	.15	.50	96.0	-	12
200	0.1	-	-	-	-	-	-	100	-	2.3
200	-		4	-	-	-	-	97.6	2.4	2.0
200	-	4	-	2.7	-	.13	.53	96.7	-	15
<20	0.1	-	4	-	-	-	-	97.2	2.8	.74
<20	0.1	4	-	3.5	-	.15	.40	96.0	-	12
<20	-	4	4	3.6	-	.28	.56	92.6	3.0	13
200	0.1	-	4	-	-	-	-	97.8	2.8	1.9
200	0.1	4	-	4.0	-	.28	.71	95.0	-	10
200	-	4	4	3.2	-	.24	.53	93.0	3.0	16
<20	0.1	4	4	4.2	-	.31	.72	91.7	3.1	16
200	0.1	4	4	3.5	-	.26	.59	92.7	3.0	16

*Water in lubricant and refrigerant
**Expressed as KOH (mg) / RL32S (g)

CONCLUSION

This comprehensive study indeed proves that low levels of water, organic acid, and especially air contribute to the degradation of compressor performance and compressor life. Sealed tube tests at two different temperatures and duration also clearly identify the effects of water and organic acid as corrodant, but most importantly show that the presence of air accelerates refrigerant and lubricant decomposition. Clearly, the lubricant type plays an extraordinary role in tolerance to contaminant levels. Polyolesters are significantly more susceptible to water and the presence of air. This is clearly shown by both the compressor and sealed tube studies.

All of the R-22 compressor test units survived the duration of the study and contained contaminants identical to the other HFC machines. The primary difference was that the R-22 units were a chlorinated refrigerant lubricated with a mineral oil, whereas the HFC machines were lubricated with a polyolester. Statistically, lubricant degradation was positively related to the contaminant R-502. We have statistically shown that increased TAN and water formation are indicators of lubricant degradation.

We used the TAN value and water formation as partial indicators of lubricant degradation. Using these two parameters, we have statistically shown that the contaminants of R-502 and water and refrigerant type cause lubricant degradation. An increase in TAN and water is also positively related to discharge pressure and discharge and sump temperature. The positive degradation effect was perhaps accelerated because bearing loads were greater with R-507A, causing increase in contaminant formation. The pressures and bearing loads are similar for R-134a, R-407C, and R-22, but the Suniso 3GS mineral oil shows minimal effects. The presence of contaminant R-502 may have further accelerated the degradation process when combined with the increased bearing loads of R-507A.

One interesting outcome is the statistical significance of fluoride ion formation in the lubricant, suggesting that HFC refrigerant decomposition can be associated with increased temperature and compression ratio. Coupled with the concept of refrigerant decomposition, lubricant degradation is part of the reaction path. Machine failure is inevitable if *in situ* formation of contaminants, such as organic acids, water, soluble metal carboxylate salts, and air oxidation products, are not controlled.

The visual appearance of copper plating, the blush color of copper on iron surfaces, is an unusual effect in mechanical machines. However, with hermetic systems wherein the operating fluid is highly halogenated, copper blush or copper plating is frequently observed.

In this study, R-22 was compared to R-507A, R-407C, and R-134a for its propensity to elicit a copper plating response. 97% of all R-22 units had a slight copper plating response upon hot bearing surfaces and discharge reed contact surfaces. However, a more severe response has been seen with high compression ratio R-507A units to the point of copper or bronze flakes, independent of contaminant and dependent on temperature. R-407C had the lowest response to copper plating but the response was dependent on both acid and water, with temperature being less important.

Refrigerant 134a, when compared to R-22, had nearly equal levels of chloride ion in the lubricant. The copper plating response rate was nearly the same, but most prevalent on bearing surfaces and independent of any contaminant level or temperature.

Bear in mind that all of the test stands were operated without any kind of contaminant control such as a filter drier or some component in the liquid line prior to the expansion valve. The results reported for compressor can bottom residue, trash in the in-line screen, and residue in the expansion valve could possibly have been eliminated with a filter drier.

The type and construction of the filter drier is an important concept to keep in mind, but more importantly is the contaminant needing to be trapped by the drier. Solid debris, water, acids, and varnish causing issues can be effectively controlled. Therefore, reactive components and solid debris can be retained. What cannot be retained in a filter drier is circulating air contamination. As evidenced in the sealed tube testing, air is consumed, producing carbon monoxide and carbon dioxide, as well as increasing organic acid content. Naturally, a filter drier equipped to handle quantities of organic acid would be superior. In mineral oil and R-22 systems, air has less of a negative effect and the traditional use of drying-only filter driers may be ideal. In fact, R-22 test stands also show the tolerance of contaminants with chlorinated mineral oil systems.

In conclusion, organic acid contaminants can be formed *in situ* with the presence of water. The presence of water is shown to be a negative factor in lubrication as well. Each refrigerant has its own particular mechanism of contaminant formation and, if run without halogen ion removal, it further accelerates machine degradation. Friction and wear are attributed to increased acid content in some machines. The inclusion of air in HFC and polyolester systems should be considered the most serious of contaminants. Circulating levels of air in new systems should be kept at lower levels than recommended in current industry guidelines. Further examination is needed to evaluate the best contaminant control mechanism and how it can control wear and further extend machine life.

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Rosner, B. 1995. Fundamentals of Biostatistics. Wadsworth Publishing Co. Belmont, CA. Chapters 10 and 11.

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Appendix A
Visual Inspection, Laboratory Analysis, and Photographic Documentation of Test Compressors after Tear Down

The report for each compressor is comprised of a two page query sheet based on the visual inspection and laboratory analysis conducted after tear down and two pages of macroscopic and microscopic digital photographs taken of key parts of the compressor after tear down.

Report for R-507A Control Compressor

TEST HISTORY OF:

Unit Number 5

Model # RS43C1E-CAV-250 **Serial #** 96F16428

Run Time (hr.) 10525 **Failed?** Yes

Refrigerant R-507A

Lubricant RL32S

Contaminants:

Control Unit? Yes

Acid? No **R-12?** No

Air? No **R-22?** No

H_2O? No **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	Cu
Cluster block condition	good
Wire to cluster block appearance	black
Suction ring top appearance	black

Remaining torque of discharge muffler

(1) ND **(2)** ND **(3)** ND **(4)** ND

Remaining torque of stator bolts

(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	black
OEM flux?	No
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	black
Rotor rub marks present?	Yes
Was rotor loose?	Yes
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed

(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts

(1) 5 **(2)** 7 **(3)** 7.5 **(4)** 5

Crank journals

Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470

Lower crank bearing journal

Appearance	scored/Cu plating/bronze plating	
Wear	slight	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995

Bottom thrust washer (crank side)

Appearance	bronze plating
Wear	slight

Bottom washer (casting side)

Appearance	bronze plating
Wear	polish

Lower bronze bearings

Appearance	scored	
Wear	heavy	
Dimensions	**Loaded**	1.0340
	Unloaded	1.0115

Shaft in cage bearing

Appearance	scored
Wear	polish

Piston top appearance clean

Piston skirt

Appearance	low wear/bronze plating	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740

Cylinder bore

Appearance	no wear/Cu plating	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760

Connecting rod (large end)

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2520
	Unloaded	1.2525

TEST HISTORY OF:
Unit Number 5
Contaminants:

Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)
- **Appearance** contact wear/incorrect washer
- **Wear** medium
- **Dimensions** **Loaded** 0.5195
  Unloaded 0.5035

Piston pin washers appearance
high wear (4 contact points)

Piston pin
- **Appearance** scored/bronze plating
- **Wear** medium
- **Dimensions** **Loaded** 0.4980
  Unloaded 0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.50
Water (ppm)	100
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	12
Aluminum (ppm)	10
Copper (ppm)	4
Iron (ppm)	73
Lead (ppm)	3
Silicon (ppm)	6
Tin (ppm)	4
Zinc (ppm)	1

Trash in liquid screen (g) 0.019

Number of screens 2

Debris in compressor bottom (g) 1.579

Valve Plate Assembly Inspection

Suction side (reed backer)
- **Condition** good
- **Appearance** corrosion/carbon

Suction surface appearance
black/soot

Suction reed
- **Condition** good
- **Appearance** corrosion/carbon
- **Trepan** slight
- **Varnish ring** heavy

Discharge side (reed backer)
- **Condition** good
- **Appearance** blued/carbon

Discharge surface appearance
black/soot

Discharge reed
- **Condition** good
- **Appearance** corrosion/blued/carbon
- **Trepan** slight
- **Varnish ring** medium

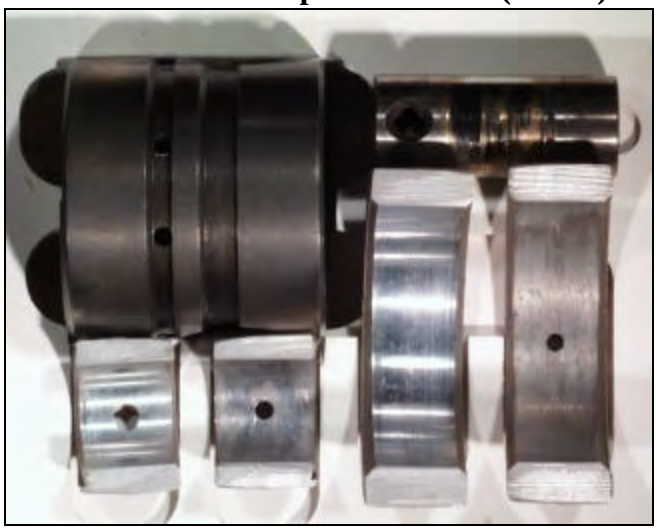
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	heavy	black	hard
Spring Seat	medium	black	hard
Ball	medium	black	hard
Front Side	slight	black	hard

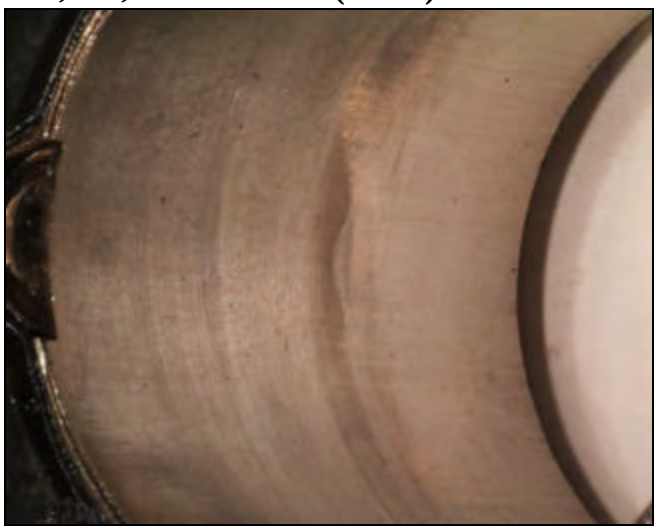
Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

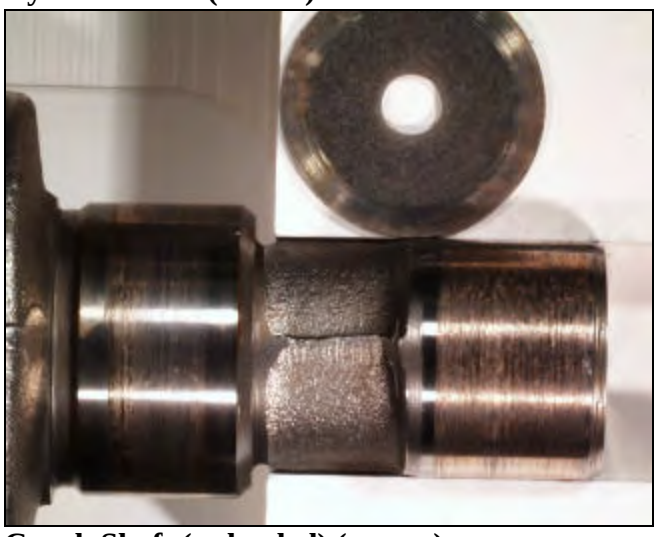


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

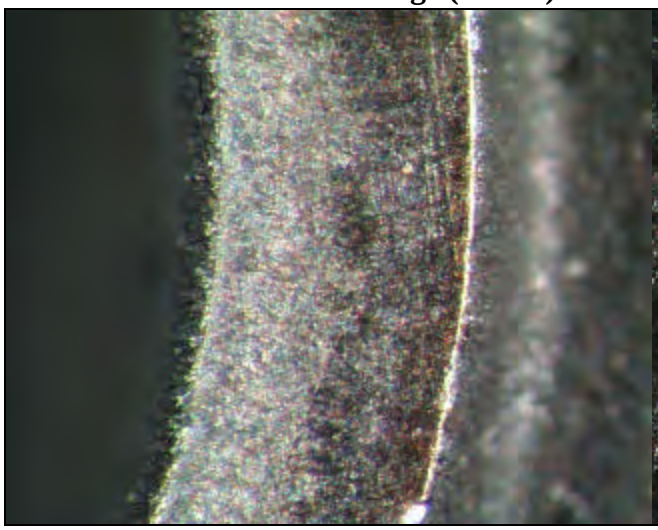


Crank Shaft (unloaded) (macro)

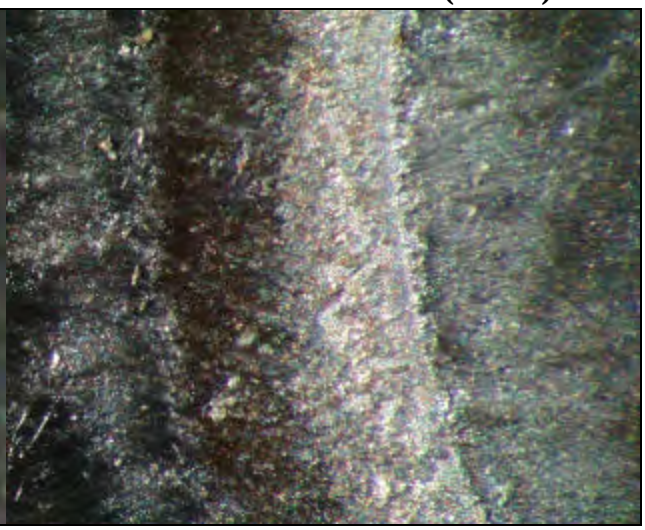
Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

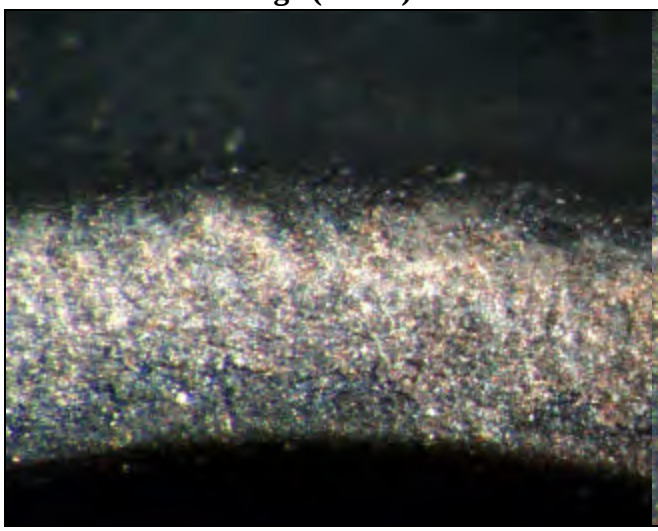
Valve Plate and Reed/Suction (macro)



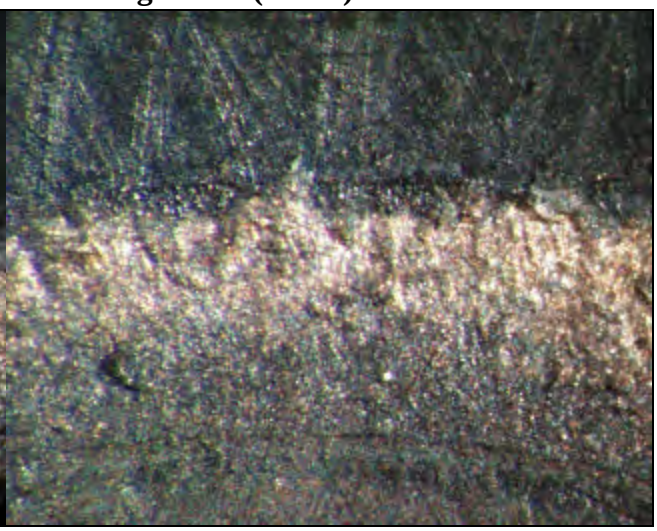
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Control Compressor

TEST HISTORY OF:

Unit Number 6
Model # RS40C1E-CAV-250 **Serial #** 96F16487
Run Time (hr.) 12009 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	black
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	black
Suction ring top appearance	black

Remaining torque of discharge muffler
(1) 5.8 **(2)** 4.2 **(3)** 2.9 **(4)** 3.8
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	black
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	green under black
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 14 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4 **(2)** 3 **(3)** 3 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	clean	
Wear	slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 6
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5440
	Unloaded	0.5110

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.23
Water (ppm)	187
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	11
Aluminum (ppm)	106
Copper (ppm)	1
Iron (ppm)	46
Lead (ppm)	0
Silicon (ppm)	12
Tin (ppm)	11
Zinc (ppm)	4

Trash in liquid screen (g)	0.108
Number of screens	1
Debris in compressor bottom (g)	0.590

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/carbon

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	heavy

Discharge side (reed backer)

Condition	good
Appearance	corrosion/soot

Discharge surface appearance
corrosion/soot

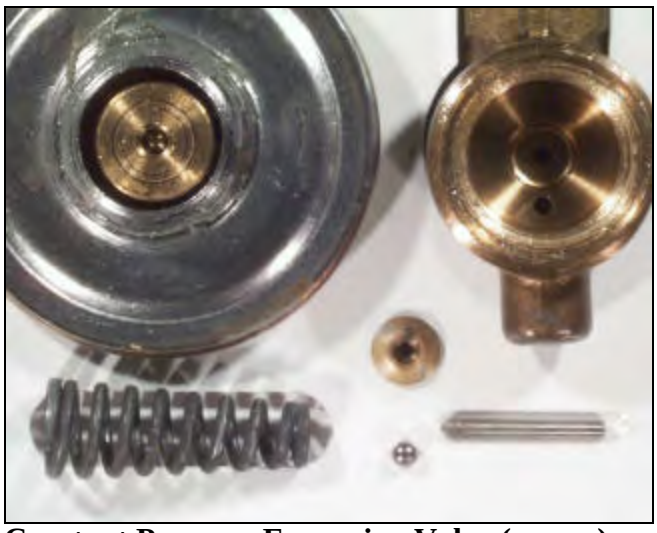
Discharge reed

Condition	good
Appearance	corrosion/heavy carbon
Trepan	very slight
Varnish ring	heavy

Expansion Valve Inspection Observations

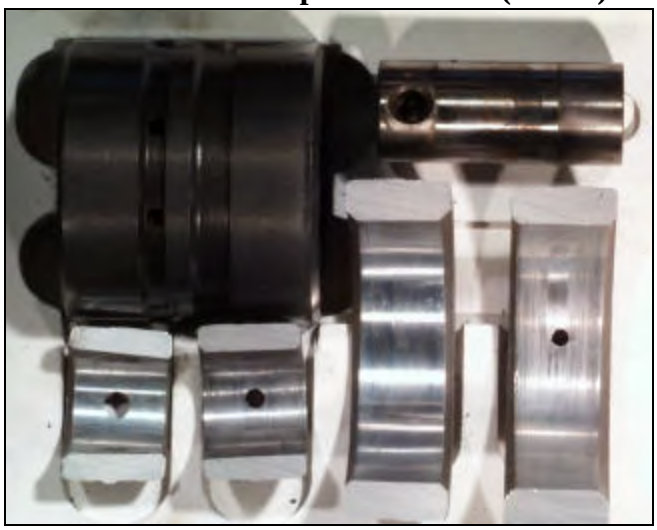
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	medium	black	gummy
Spring Seat	slight	gray	hard
Ball	very slight	gray	hard
Front Side	slight	gray	hard

Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

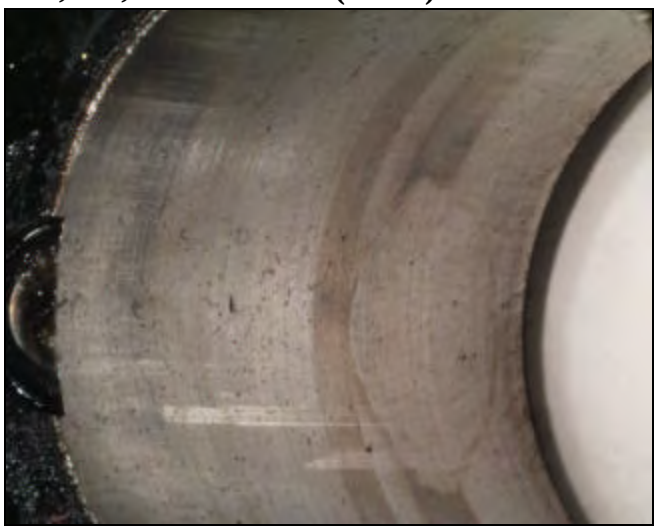


Constant Pressure Expansion Valve (macro)

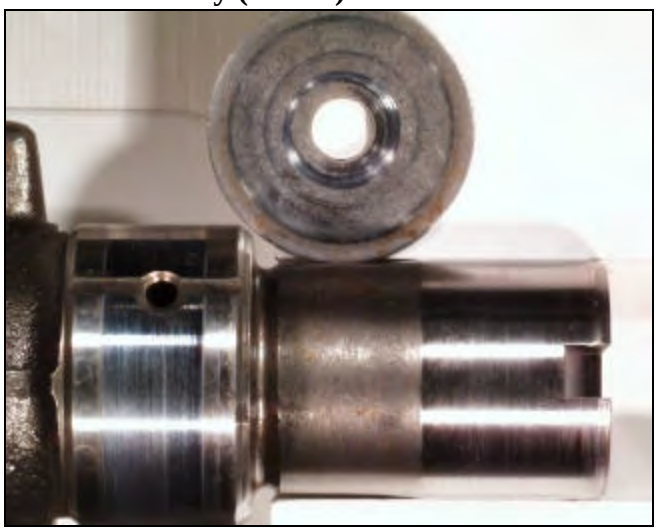
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



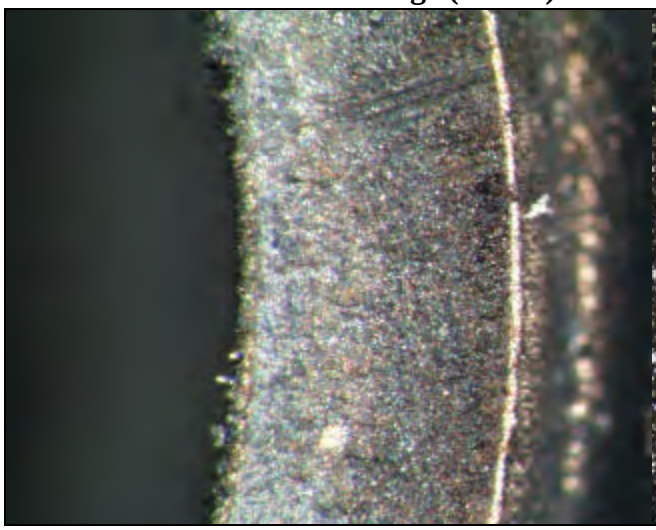
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

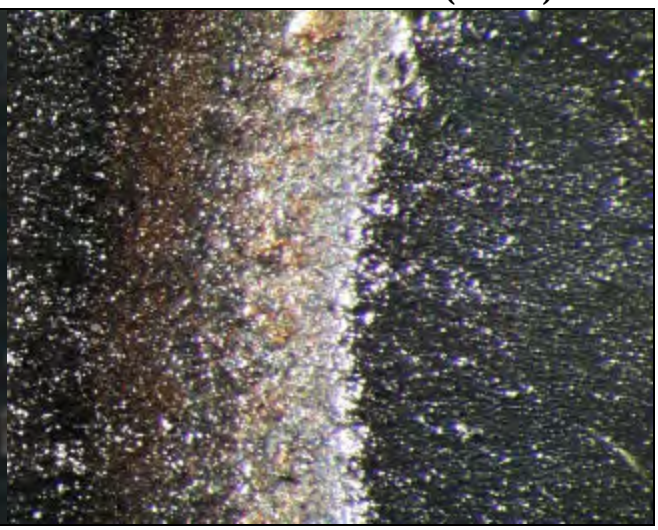
Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

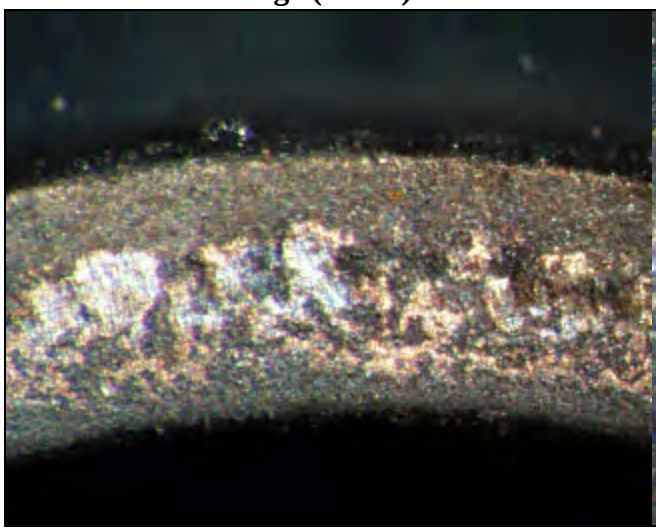
Valve Plate and Reed/Suction (macro)



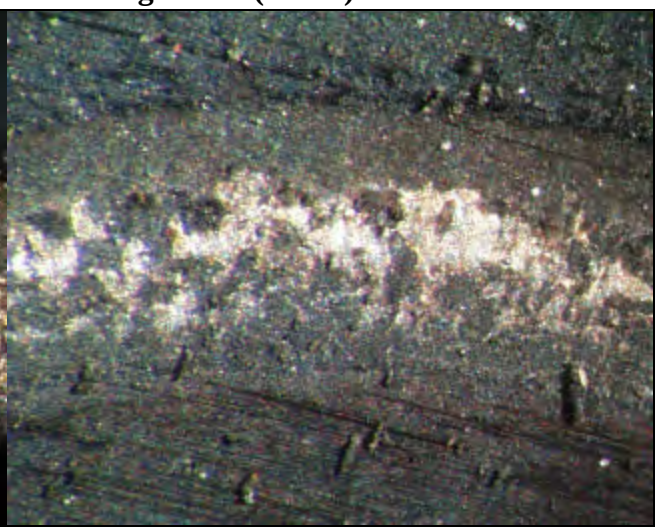
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Control Compressor

TEST HISTORY OF:

Unit Number 7
Model # RS40C1E-CAV-250 **Serial #** 96F16415
Run Time (hr.) 12004 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	none
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 3 **(4)** 3
Remaining torque of stator bolts
(1) 14 **(2)** 13 **(3)** 13 **(4)** 14

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 16 **(3)** 16 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals
Appearance scored/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2460
Unloaded 1.2460

Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance Cu plating
Wear polish

Bottom washer (casting side)
Appearance scored
Wear polish

Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear/Cu plating
Varnish ring medium
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance none
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

TEST HISTORY OF:

Unit Number 7
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.43
Water (ppm)	202
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	3
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	13
Zinc (ppm)	1

Trash in liquid screen (g)	0.050
Number of screens	1
Debris in compressor bottom (g)	0.564

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	medium
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
clean

Discharge reed

Condition	good
Appearance	corrosion/v. light carbon
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

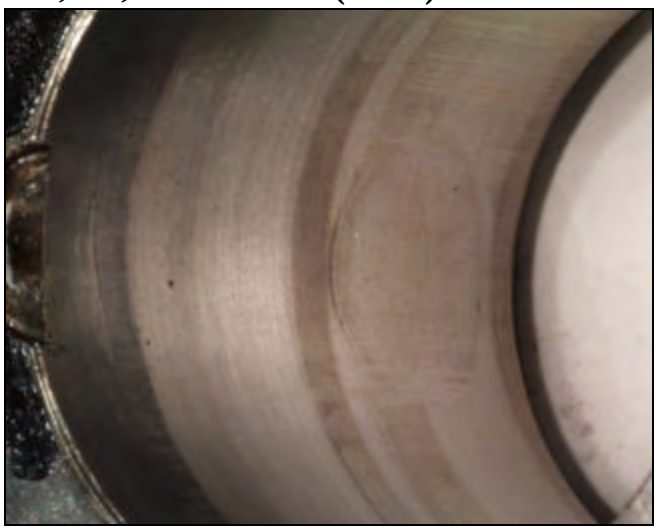
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	medium	black	gummy
Spring Seat	slight	gray	hard
Ball	medium	black	gummy
Front Side	slight	gray	hard

Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

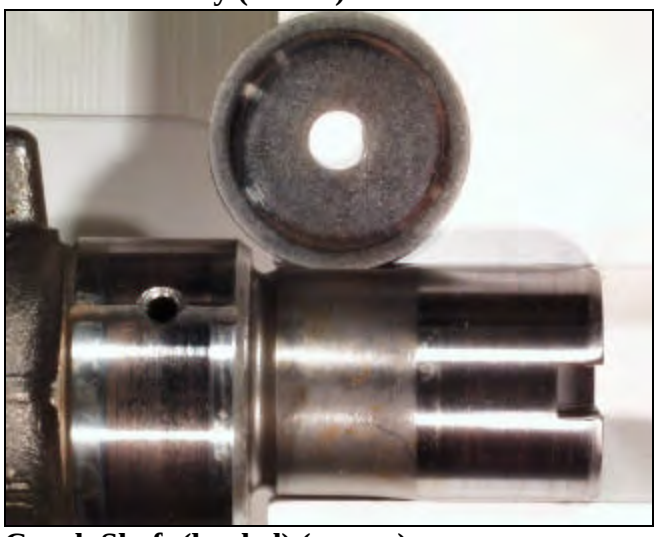
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

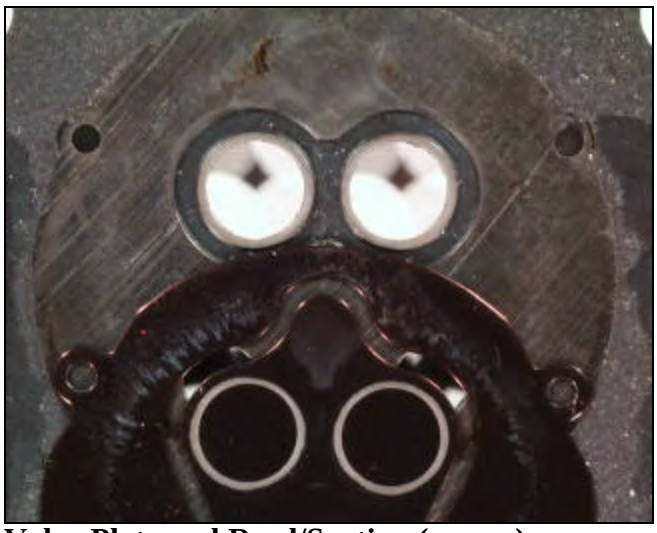


Crank Shaft (loaded) (macro)

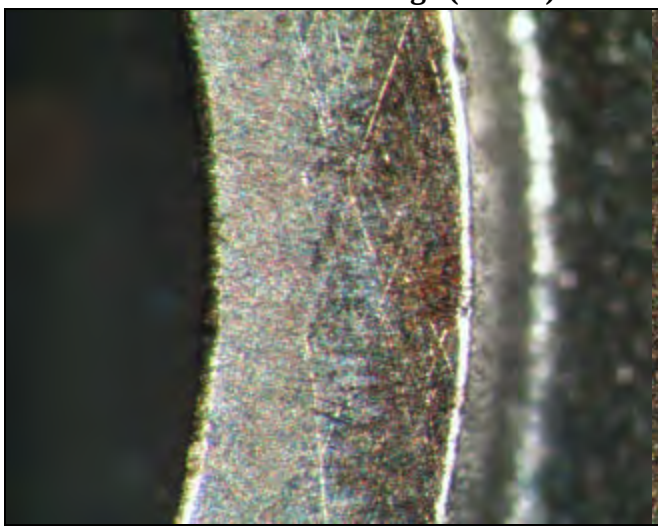
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

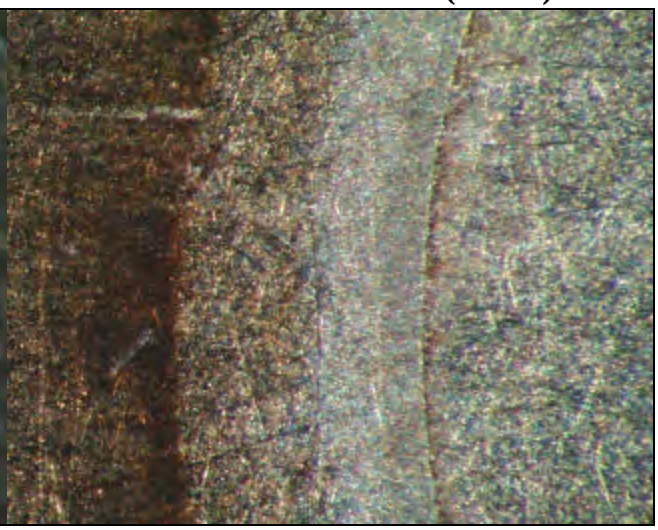
Valve Plate and Reed/Discharge (macro)



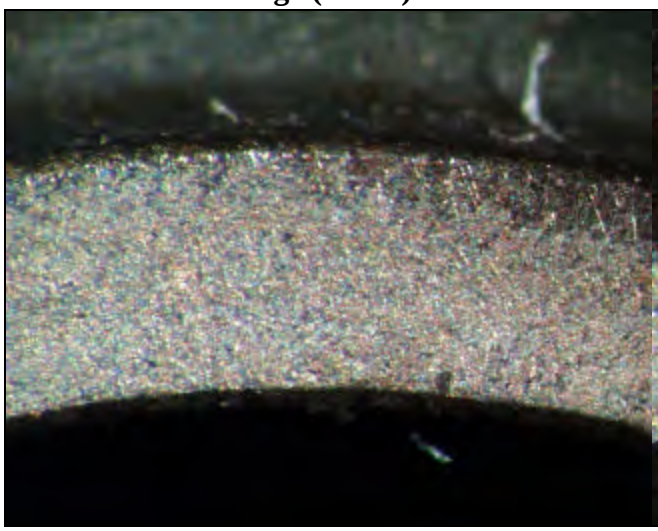
Valve Plate and Reed/Suction (macro)



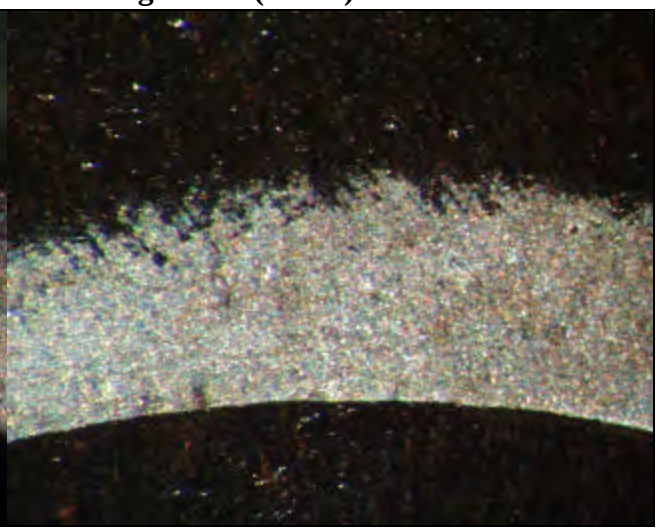
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant R-502

TEST HISTORY OF:

Unit Number 8
Model # RS43C1E-CAV-250 **Serial #** 96F16432
Run Time (hr.) 12018 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	fail
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 12 **(2)** 2.5 **(3)** 2 **(4)** 2.5
Remaining torque of stator bolts
(1) 9 **(2)** 10 **(3)** 10 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	soot
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) 12 **(2)** 13 **(3)** 13 **(4)** 12

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 3 **(2)** 4 **(3)** 4 **(4)** 4

Crank journals		
Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2450
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0010
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean/scored	
Wear	polish	
Lower bronze bearings		
Appearance	clean/scored	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2480

TEST HISTORY OF:

Unit Number 8
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5110
	Unloaded	0.5020

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4960
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.35
Water (ppm)	69
Fluoride ion (ppm)	0.90
Chloride ion (ppm)	8.8
Aluminum (ppm)	6
Copper (ppm)	0
Iron (ppm)	14
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	15
Zinc (ppm)	2

Trash in liquid screen (g)	0.182
Number of screens	1
Debris in compressor bottom (g)	0.516

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/soot

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion/soot
Trepan	very slight
Varnish ring	medium

Discharge side (reed backer)

Condition	good
Appearance	heavy soot

Discharge surface appearance
corrosion/soot

Discharge reed

Condition	good
Appearance	corrosion/carbon
Trepan	very slight
Varnish ring	medium

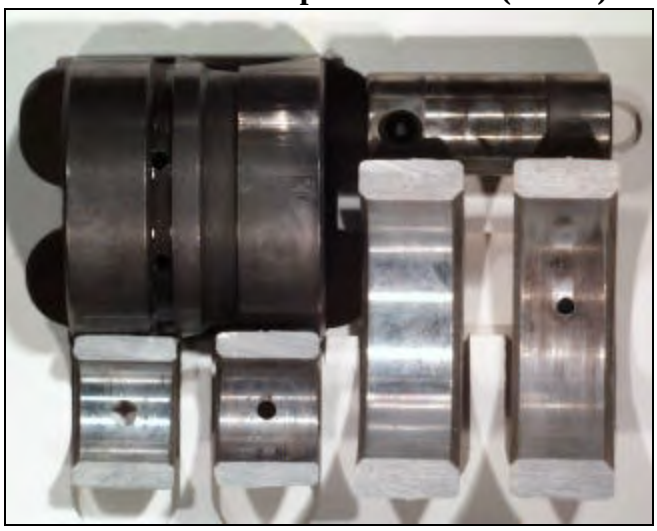
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	slight	brown	gummy
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	heavy	black	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant R-502
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

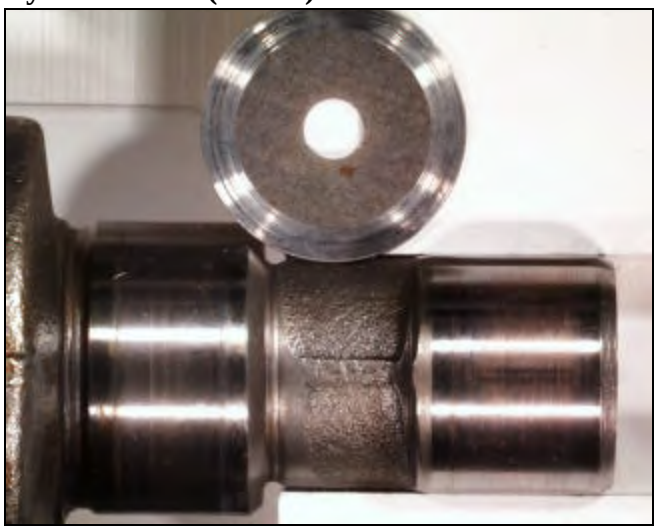
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

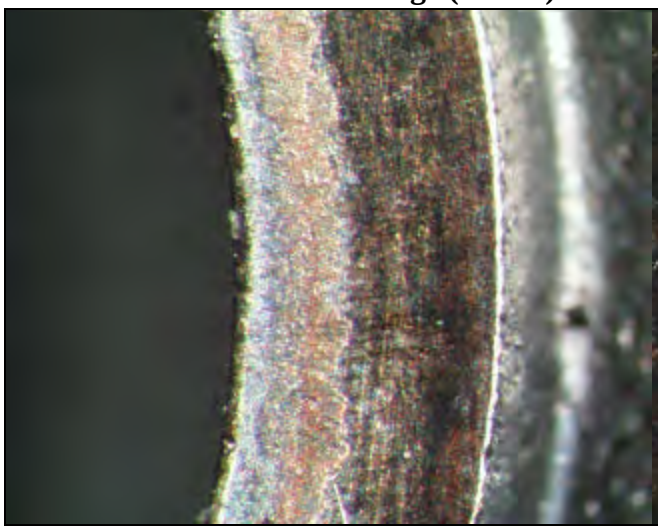


Crank Shaft (unloaded) (macro)

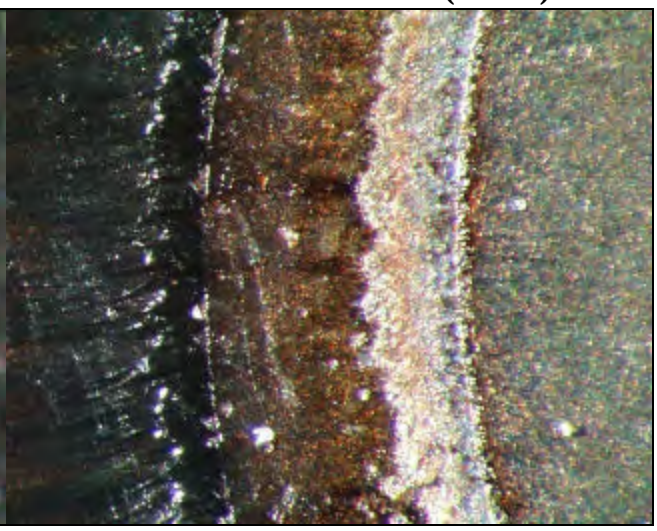
Photographic Documentation of R-507A Compressor with Contaminant R-502
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

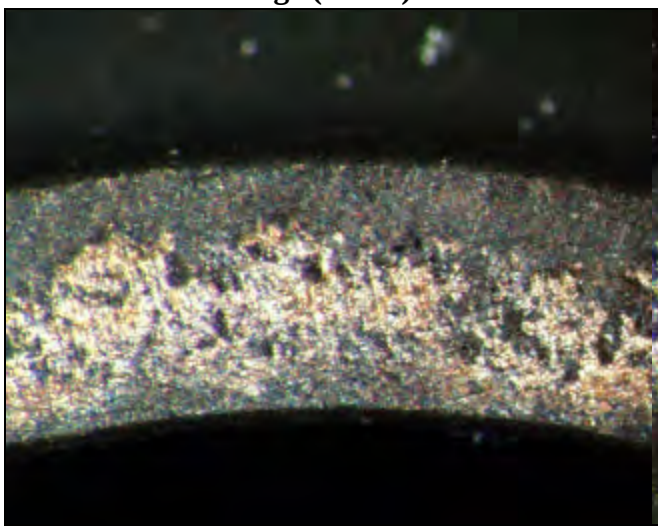
Valve Plate and Reed/Suction (macro)



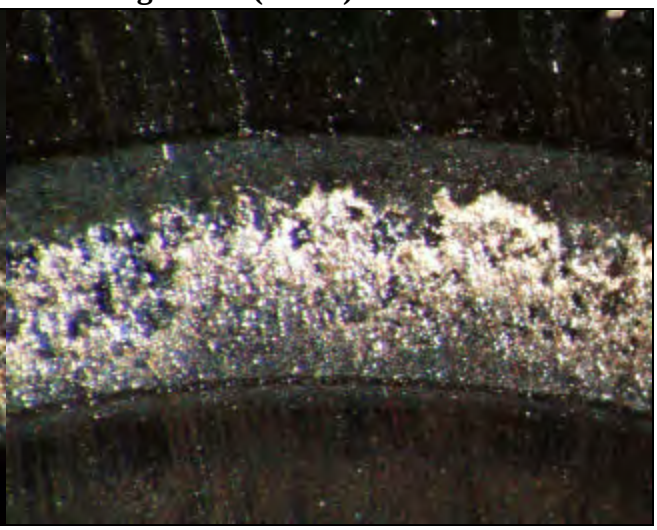
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 9
Model # RS43C1E-CAV-250 **Serial #** 96F16443
Run Time (hr.) 5369 **Failed?** Yes
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) ND **(2)** ND **(3)** ND **(4)** ND
Remaining torque of stator bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	Yes
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty/heavy bearing wear

Remaining torque of cage bearing bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2460
Unloaded 1.2460

Lower crank bearing journal
Appearance scored/Cu plating/bronze plating
Wear slight
Dimensions **Loaded** 0.9985
Unloaded 0.9985

Bottom thrust washer (crank side)
Appearance scored/bronze plating
Wear polish

Bottom washer (casting side)
Appearance clean
Wear polish

Lower bronze bearings
Appearance scored/corrosion
Wear heavy
Dimensions **Loaded** 1.0260
Unloaded 1.0115

Shaft in cage bearing
Appearance scored
Wear slight

Piston top appearance clean

Piston skirt
Appearance low wear/bronze plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored
Wear polish
Dimensions **Loaded** 1.2520
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 9
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5095
	Unloaded	0.5030

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/bronze plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.40
Water (ppm)	100
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	10
Aluminum (ppm)	14
Copper (ppm)	2
Iron (ppm)	26
Lead (ppm)	4
Silicon (ppm)	5
Tin (ppm)	4
Zinc (ppm)	1

Trash in liquid screen (g)	0.045
Number of screens	1
Debris in compressor bottom (g)	1.636

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/heavy soot

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion/heavy soot
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued/soot

Discharge surface appearance
corrosion/soot

Discharge reed

Condition	good
Appearance	corrosion/blued/carbon
Trepan	very slight
Varnish ring	none

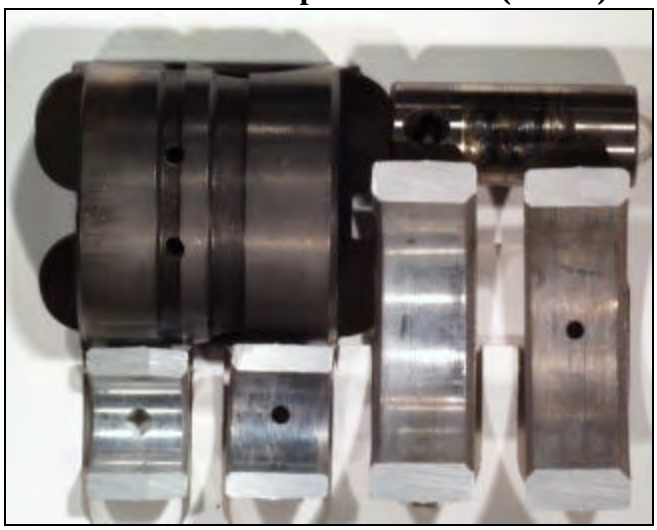
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	heavy	black	gummy
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

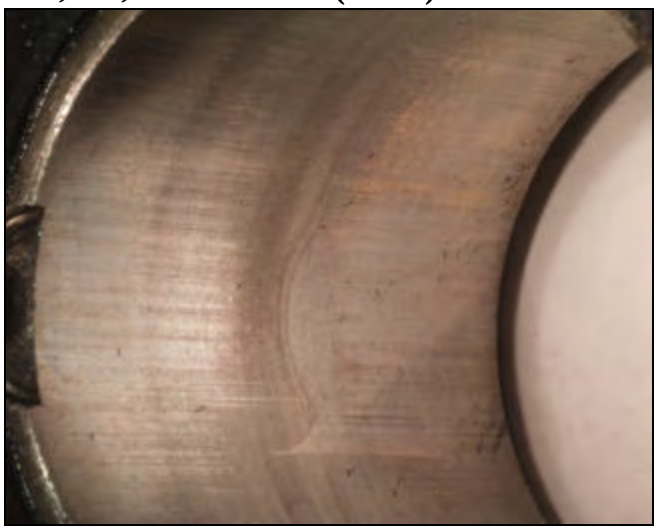
Photographic Documentation of R-507A Compressor with Contaminant Acid
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

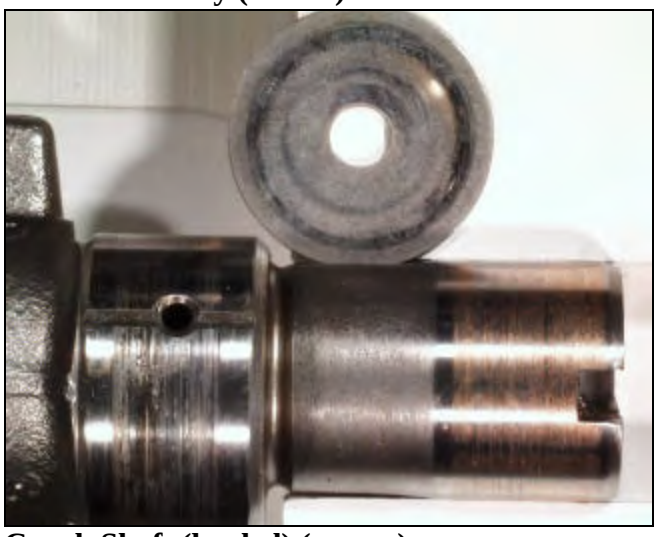
Ball, Pin, Seat of CPEV (micro)



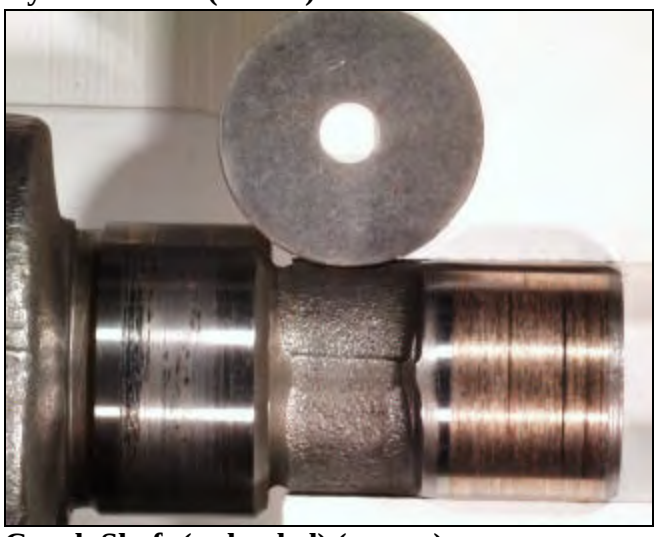
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

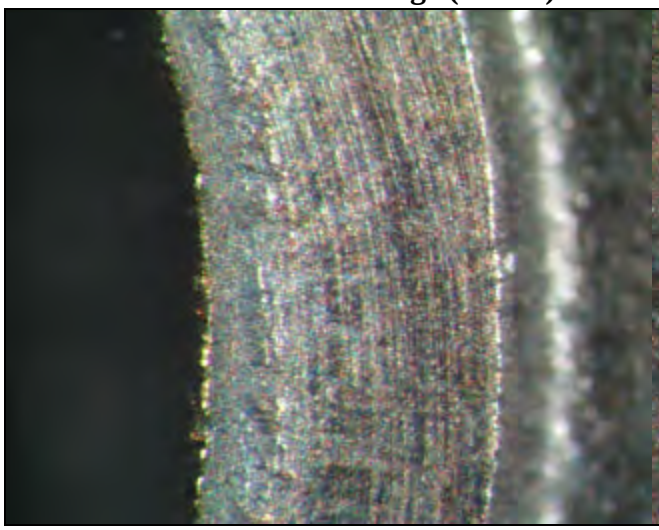


Crank Shaft (unloaded) (macro)

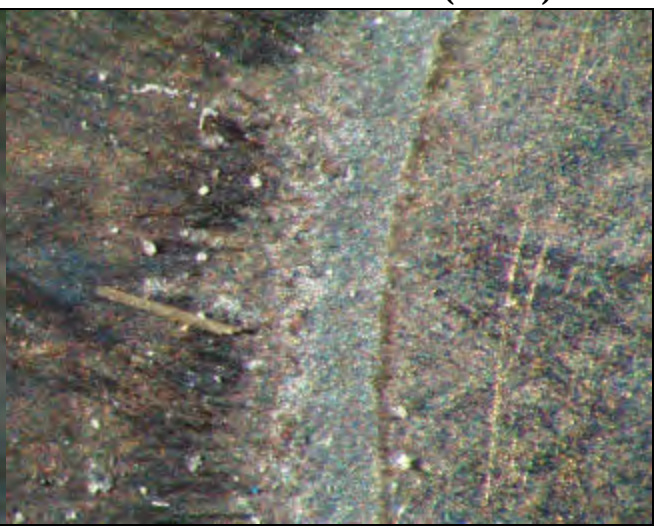
Photographic Documentation of R-507A Compressor with Contaminant Acid
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

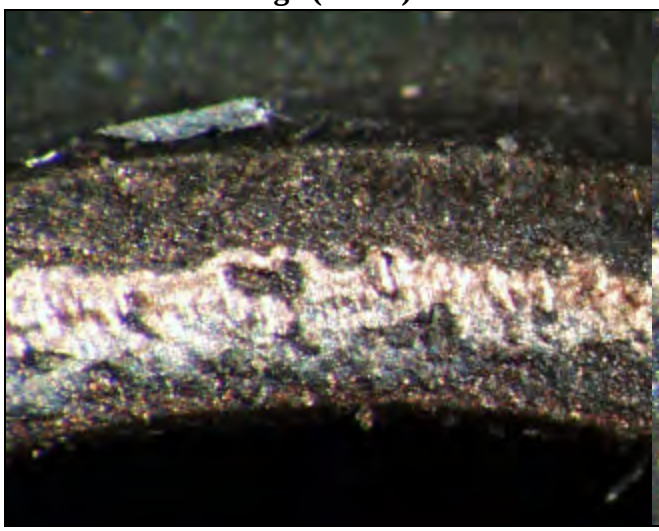
Valve Plate and Reed/Suction (macro)



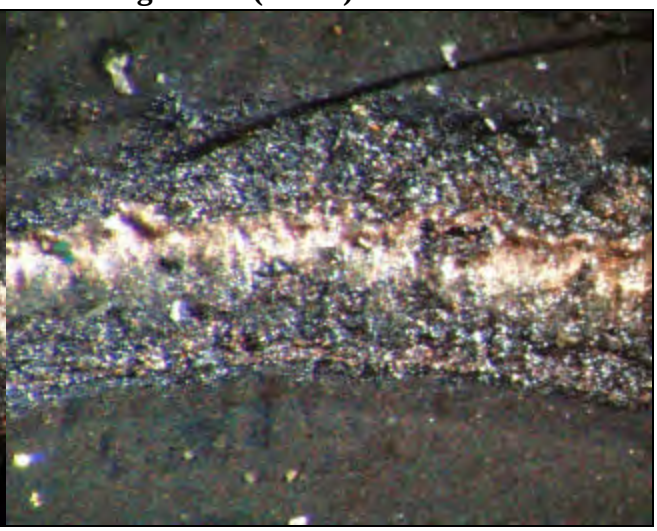
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 10
Model # RS43C1E-CAV-250 **Serial #** 96F16430
Run Time (hr.) 12065 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 355
Suction Pressure (psig) 14
Discharge Temp (°F) 235
Return Gas Temp (°F) 62
SumpTemp (°F) 242

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 5
Remaining torque of stator bolts
(1) 13 **(2)** 14 **(3)** 14 **(4)** 13
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 15 **(4)** 15
Head gasket brittle? no/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean/bronze plating
Wear polish, slight
Dimensions **Loaded** 1.0020
Unloaded 1.0030
Bottom thrust washer (crank side)
Appearance clean/scored/Cu plating
Wear medium
Bottom washer (casting side)
Appearance clean
Wear polish
Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance clean
Wear polish, slight
Piston top appearance clean
Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3670
Unloaded 1.3670
Cylinder bore
Appearance low wear
Varnish ring heavy
Dimensions **Loaded** 1.3680
Unloaded 1.3700
Connecting rod (large end)
Appearance none
Wear slight
Dimensions **Loaded** 1.2480
Unloaded 1.2480

TEST HISTORY OF:

Unit Number 10
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4980

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.61
Water (ppm)	50
Fluoride ion (ppm)	1.8
Chloride ion (ppm)	9.9
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	9
Zinc (ppm)	0

Trash in liquid screen (g)	0.018
Number of screens	1
Debris in compressor bottom (g)	0.572

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/black

Suction reed

Condition	good
Appearance	corrosion
Trepan	medium
Varnish ring	heavy

Discharge side (reed backer)

Condition	good
Appearance	blued/carbon

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued/carbon
Trepan	medium
Varnish ring	heavy

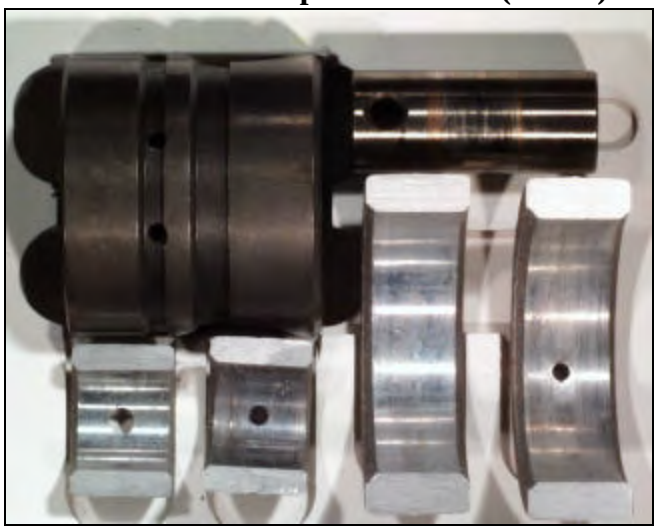
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	black	hard
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	slight	black	gummy
Front Side	slight	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Air
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

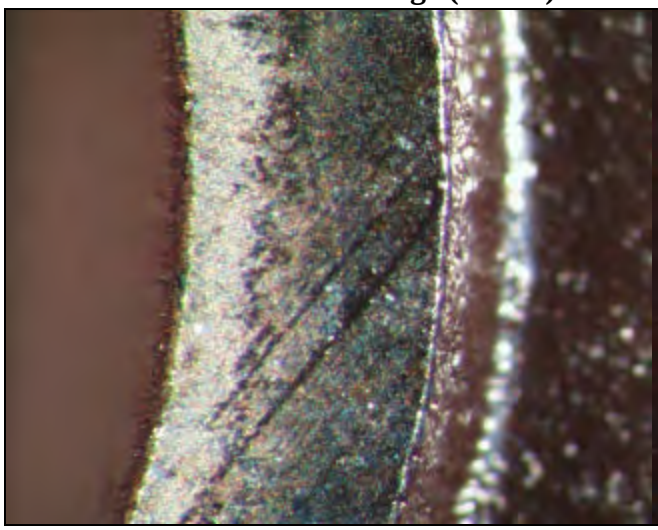
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

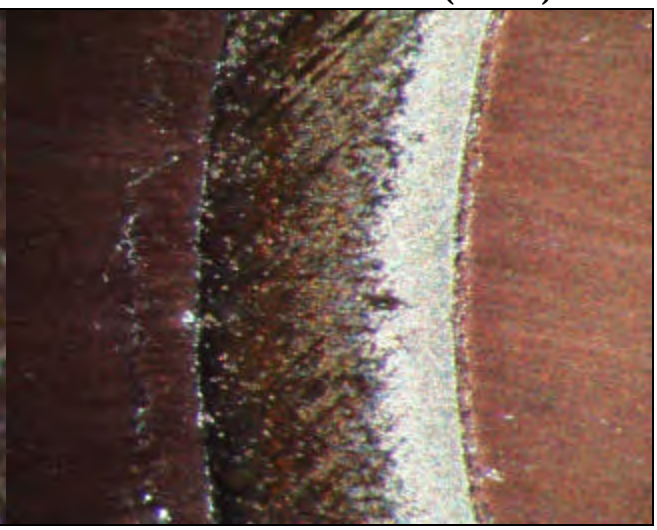
Photographic Documentation of R-507A Compressor with Contaminant Air
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

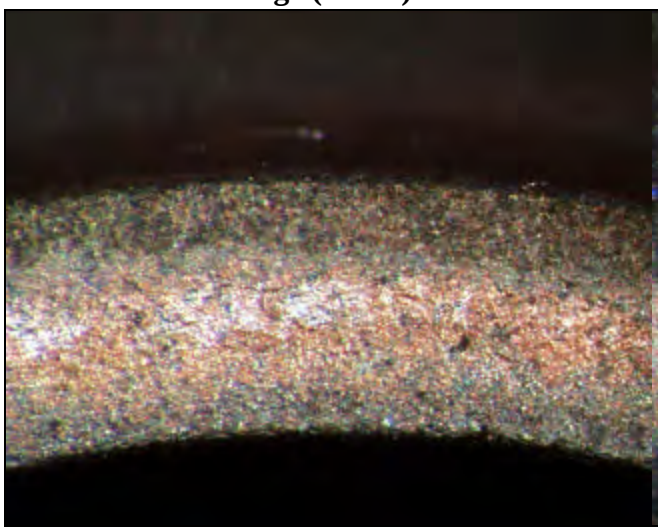
Valve Plate and Reed/Suction (macro)



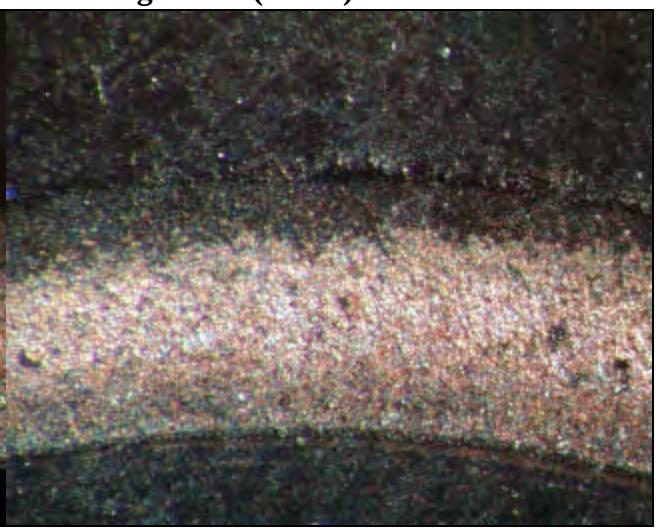
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid and R-502

TEST HISTORY OF:

Unit Number 11
Model # RS43C1E-CAV-250 **Serial #** 96F16429
Run Time (hr.) 12046 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 5 **(2)** 4 **(3)** 4 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 10 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean/gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored/Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.9950
	Unloaded	0.9960
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean/scored	
Wear	none	
Dimensions	**Loaded**	0.9970
	Unloaded	0.9970
Shaft in cage bearing		
Appearance	clean/scored/Cu plating	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3650
	Unloaded	1.3650
Cylinder bore		
Appearance	low wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3660
	Unloaded	1.3660
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2450
	Unloaded	1.2440

TEST HISTORY OF:

Unit Number 11
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)
Appearance correct washer
Wear slight
Dimensions **Loaded** 0.4980
Unloaded 0.4980

Piston pin washers appearance
contact wear

Piston pin
Appearance clean
Wear polish, slight
Dimensions **Loaded** 0.4960
Unloaded 0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.45
Water (ppm)	581
Fluoride ion (ppm)	2.5
Chloride ion (ppm)	17
Aluminum (ppm)	1
Copper (ppm)	0
Iron (ppm)	17
Lead (ppm)	3
Silicon (ppm)	2
Tin (ppm)	31
Zinc (ppm)	2

Trash in liquid screen (g)	0.059
Number of screens	1
Debris in compressor bottom (g)	0.878

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion/black
Suction reed
Condition good
Appearance corrosion/carbon
Trepan medium
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance blued
Discharge surface appearance
corrosion/black

Discharge reed
Condition good
Appearance corrosion/carbon
Trepan medium
Varnish ring very slight

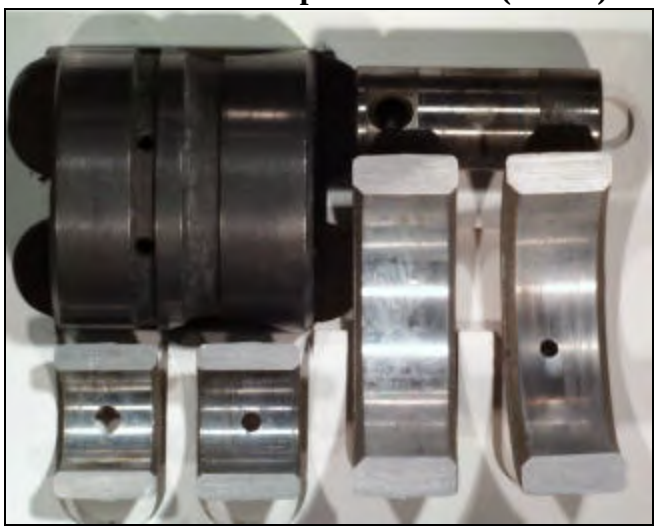
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	very slight	brown	hard
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

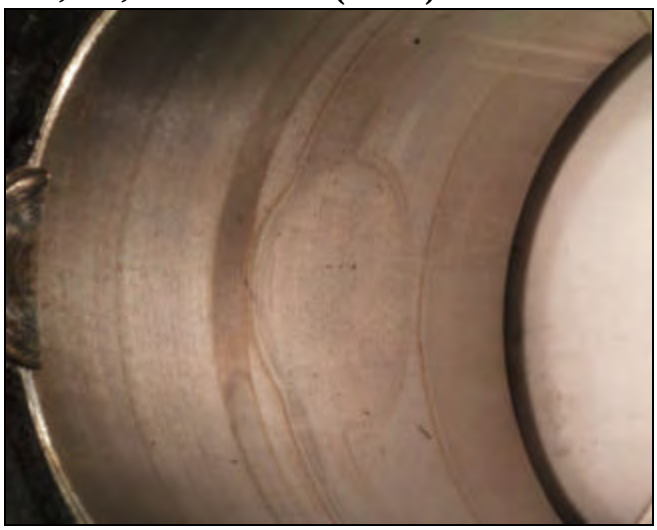
Photographic Documentation of R-507A Compressor with Contaminant Acid and R-502
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

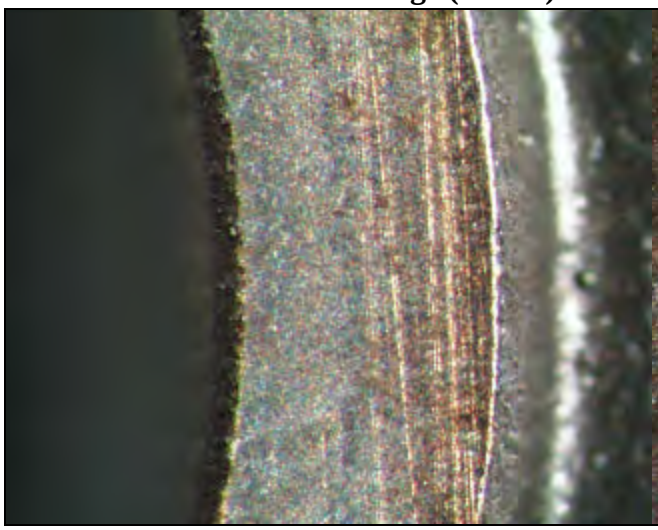
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

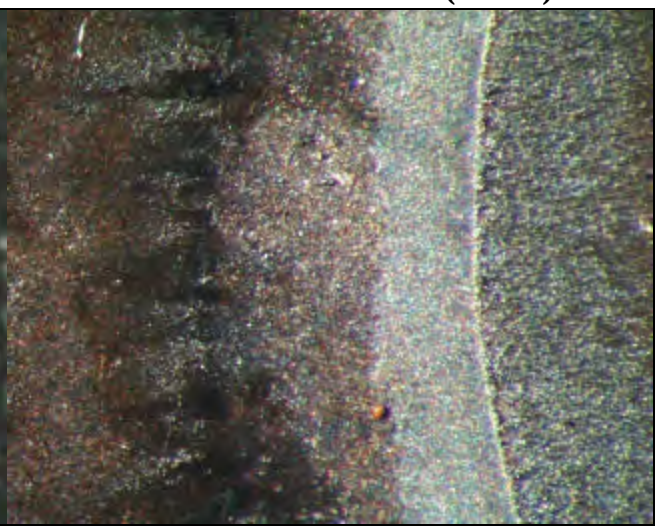
Photographic Documentation of R-507A Compressor with Contaminant Acid and R-502
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

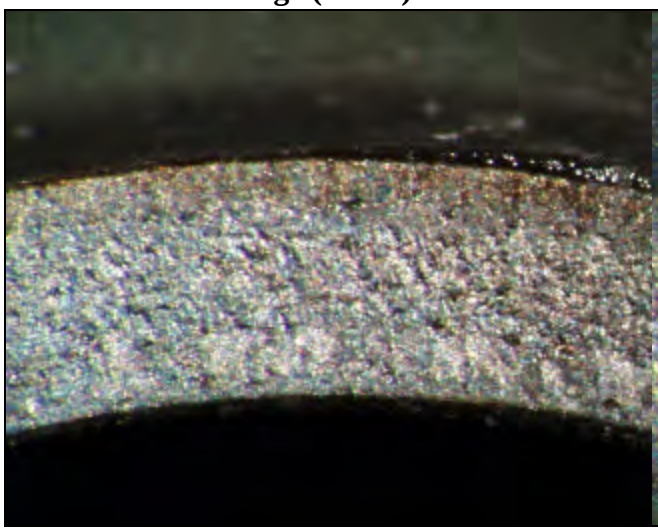
Valve Plate and Reed/Suction (macro)



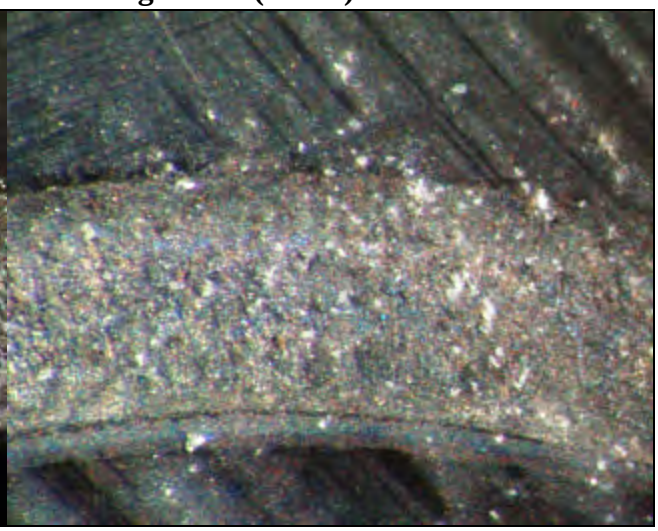
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Air, and R-502

TEST HISTORY OF:

Unit Number 12
Model # RS43C1E-CAV-250 **Serial #** 96F16442
Run Time (hr.) 12035 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 3 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 11 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 16 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 6 **(4)** 5

Crank journals		
Appearance	scored/Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored/Cu plating	
Wear	slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0010
Shaft in cage bearing		
Appearance	scored/Cu plating	
Wear	slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/Cu plating	
Dimensions	**Loaded**	1.3680
	Unloaded	1.3680
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3690
	Unloaded	1.3690
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2450
	Unloaded	1.2850

TEST HISTORY OF:

Unit Number 12
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5080
	Unloaded	0.5020

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.4960
	Unloaded	0.4960

Final Lubricant Values

Total Acid Number (TAN)	0.62
Water (ppm)	247
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	10
Aluminum (ppm)	1
Copper (ppm)	0

plating/carbon

Iron (ppm)	6
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	15
Zinc (ppm)	1

Trash in liquid screen (g)	0.154
Number of screens	1
Debris in compressor bottom (g)	0.874

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/light carbon

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating/carbon
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	blued/light carbon

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/blued/Cu
Trepan	medium
Varnish ring	heavy

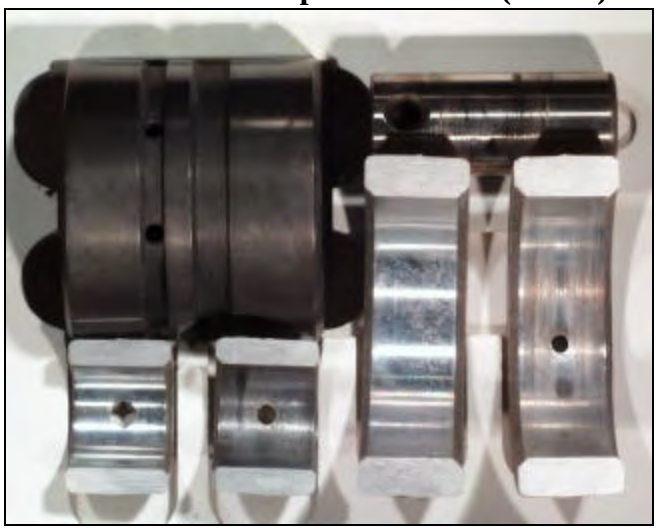
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	very slight	gray	hard
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	heavy	black	gummy
Spring Seat	heavy	black	gummy
Ball	heavy	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and R-502
355 psig/14 psig

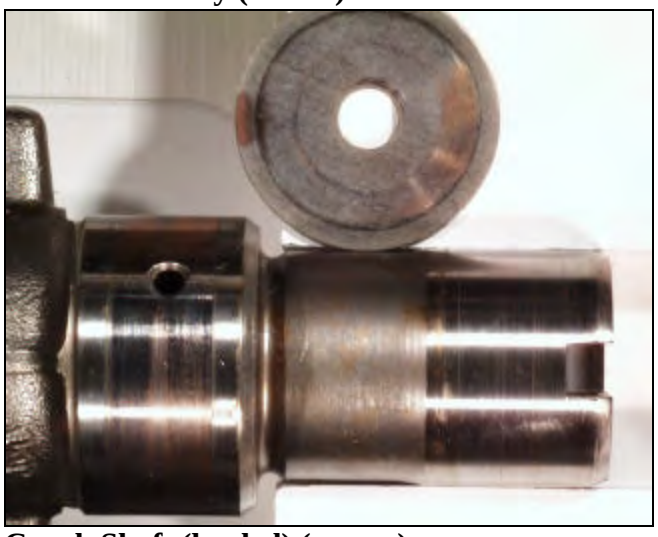
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

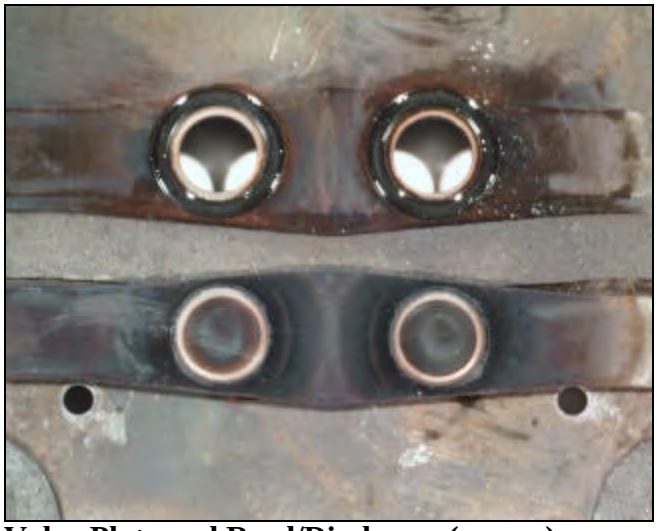
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

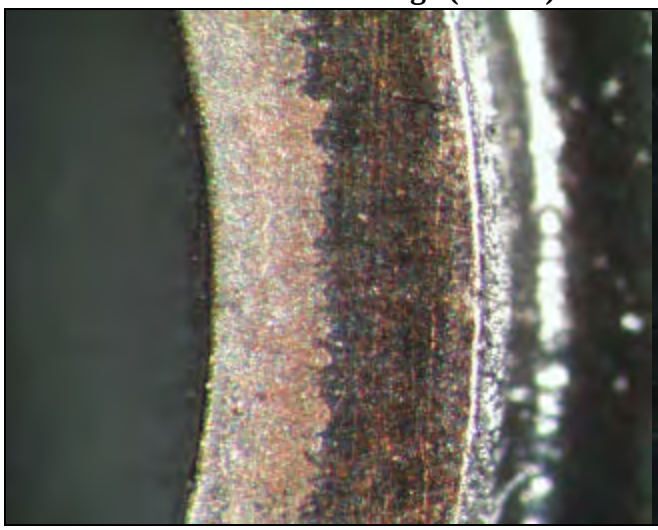
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and R-502
355 psig/14 psig

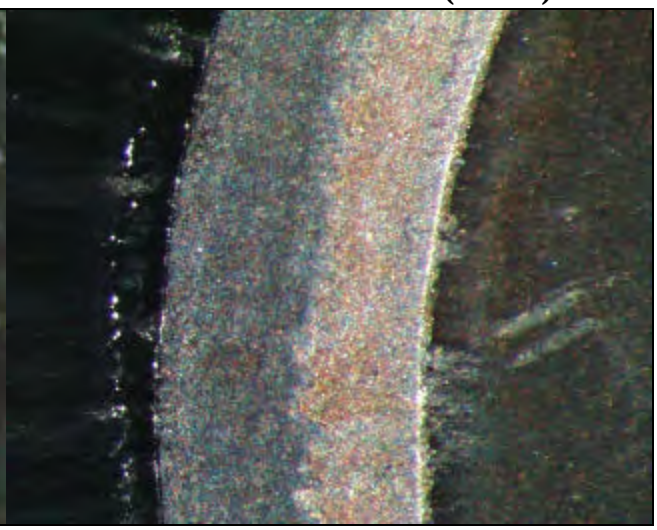


Valve Plate and Reed/Discharge (macro)

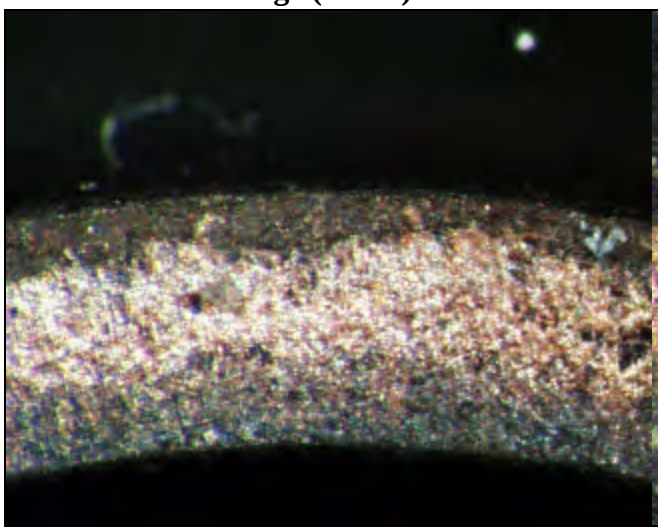
Valve Plate and Reed/Suction (macro)



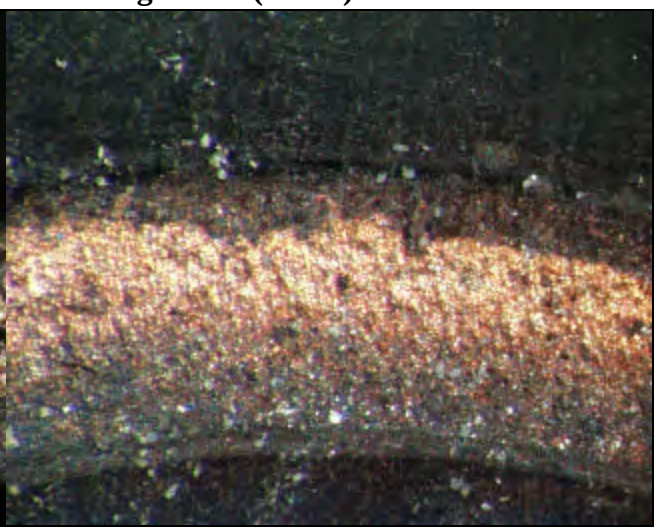
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air and R-502

TEST HISTORY OF:

Unit Number 13
Model # RS43C1E-CAV-250 **Serial #** 96F16416
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 3 **(3)** 4 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 11 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	oil green
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 14 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 6

Crank journals
Appearance scored/Cu plating
Wear slight
Dimensions **Loaded** 1.2460
Unloaded 1.2470

Lower crank bearing journal
Appearance scored/Cu plating
Wear slight
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear slight

Bottom washer (casting side)
Appearance scored/Cu plating
Wear slight

Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0000
Unloaded 1.0000

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3720
Unloaded 1.3720

Cylinder bore
Appearance no wear/Cu plating
Varnish ring heavy
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2500
Unloaded 1.2500

TEST HISTORY OF:

Unit Number 13
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.5060
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.98
Water (ppm)	89
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	11
Aluminum (ppm)	3
Copper (ppm)	1
Iron (ppm)	8
Lead (ppm)	3
Silicon (ppm)	4
Tin (ppm)	41
Zinc (ppm)	9

Trash in liquid screen (g)	0.062
Number of screens	1
Debris in compressor bottom (g)	0.714

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/carbon

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	medium
Varnish ring	heavy

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued/carbon

Discharge surface appearance
corrosion/Cu plating/black

Discharge reed

Condition	good
Appearance	corrosion/blued/carbon
Trepan	very slight
Varnish ring	heavy

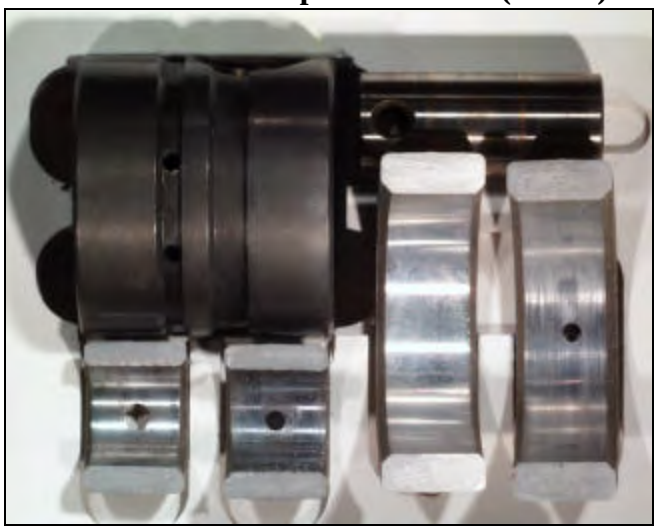
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	hard
Rear Pin	slight	brown	gummy
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	heavy	black	gummy
Spring Seat	slight	gray	hard
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Air and R-502
355 psig/14 psig

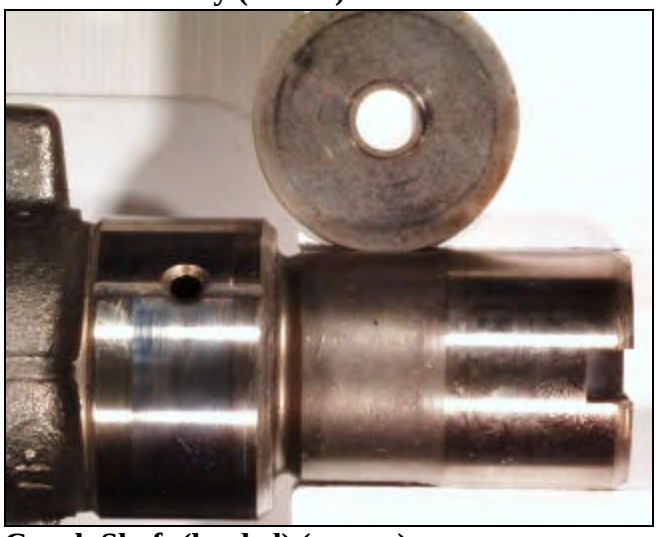
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



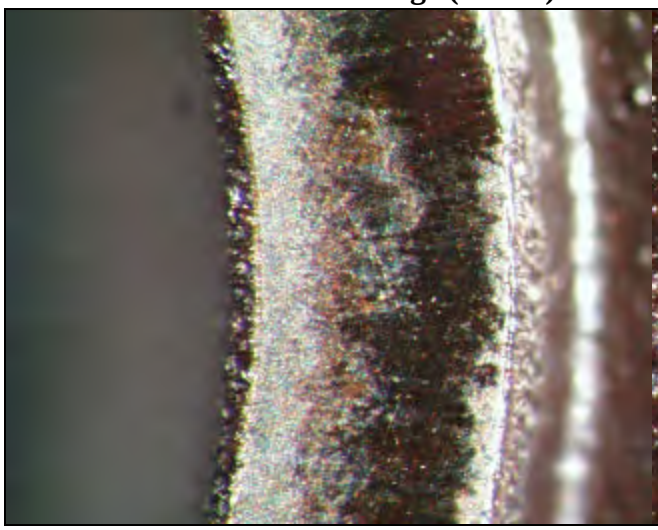
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

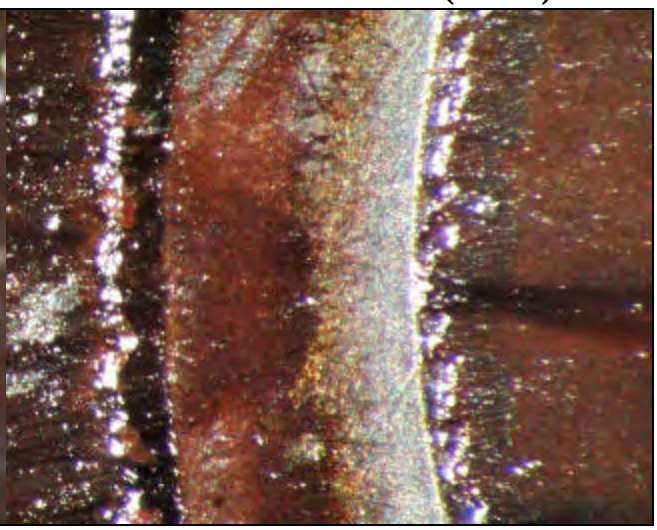
Photographic Documentation of R-507A Compressor with Contaminant Air and R-502
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

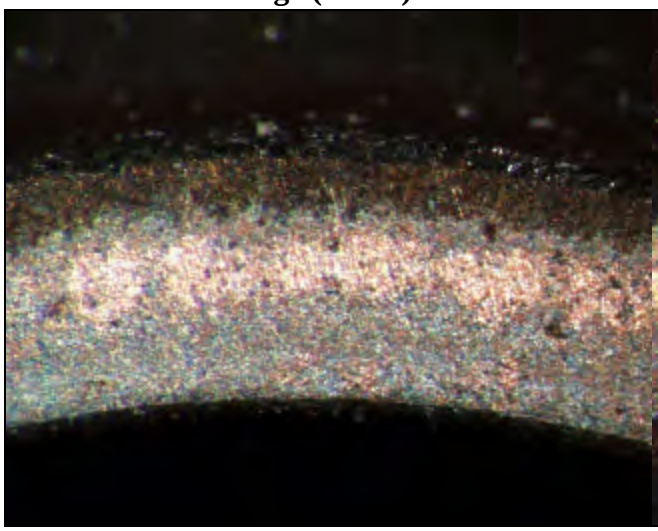
Valve Plate and Reed/Suction (macro)



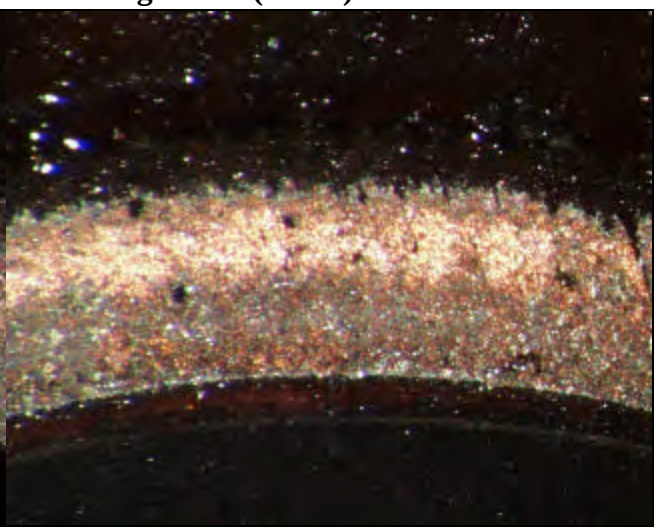
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 14
Model # RS43C1E-CAV-250 **Serial #** 96F16421
Run Time (hr.) 9822 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) ND **(2)** ND **(3)** ND **(4)** ND
Remaining torque of stator bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	black/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	Cu plate
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion
Wear polish

Bottom washer (casting side)
Appearance clean
Wear polish

Lower bronze bearings
Appearance clean/scored/corrosion
Wear medium
Dimensions **Loaded** 1.0240
Unloaded 1.0105

Shaft in cage bearing
Appearance scored/Cu plating
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/scored/Cu plating/corrosion
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear/Cu plating
Varnish ring heavy
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2525
Unloaded 1.2595

TEST HISTORY OF:

Unit Number 14
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5060
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.64
Water (ppm)	157
Fluoride ion (ppm)	2.0
Chloride ion (ppm)	9.4
Aluminum (ppm)	11
Copper (ppm)	0
Iron (ppm)	90
Lead (ppm)	31
Silicon (ppm)	6
Tin (ppm)	19
Zinc (ppm)	6

Trash in liquid screen (g)	0.045
Number of screens	1
Debris in compressor bottom (g)	1.901

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/carbon

Suction surface appearance
corrosion/soot/carbon

Suction reed

Condition	good
Appearance	corrosion/carbon
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued/carbon

Discharge surface appearance
corrosion/carbon/black/soot

Discharge reed

Condition	good
Appearance	corrosion/blued/carbon
Trepan	very slight
Varnish ring	slight

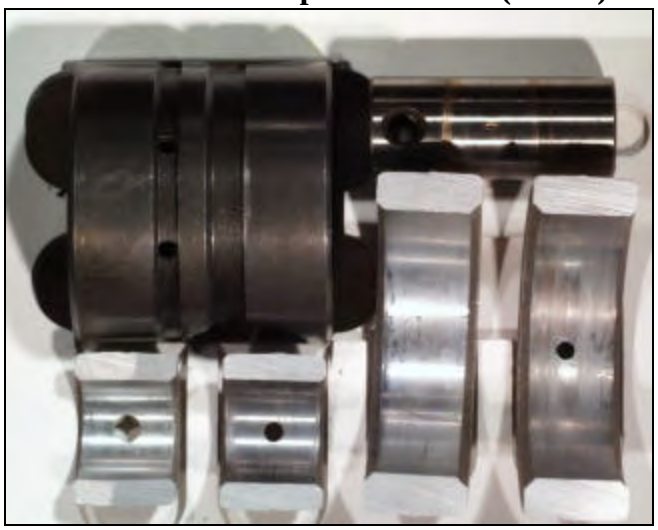
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	gummy
Rear Pin	very slight	gray	hard
Equalizer Hole	very slight	black	gummy
Tip of Pin	heavy	black	gummy
Spring	very heavy	black	gummy
Spring Seat	heavy	black	gummy
Ball	heavy	black	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid and Air
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

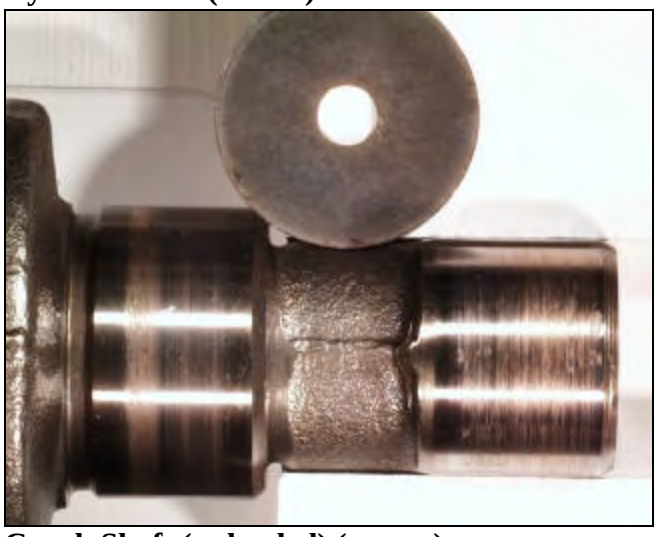
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

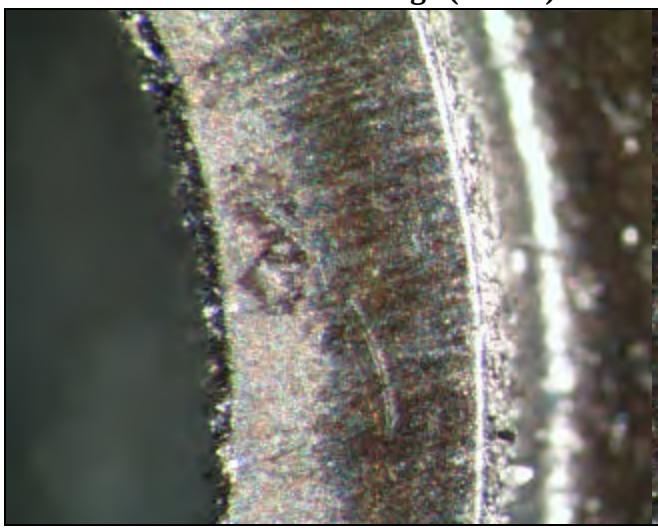


Crank Shaft (unloaded) (macro)

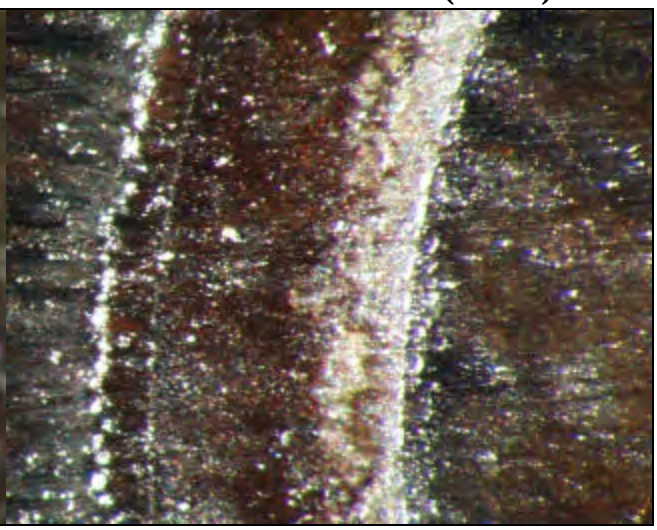
Photographic Documentation of R-507A Compressor with Contaminant Acid and Air
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

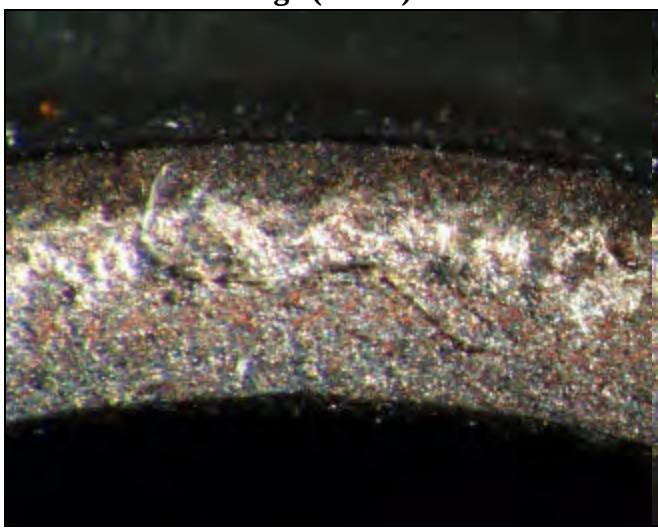
Valve Plate and Reed/Suction (macro)



Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)

Suction Reed (micro)

Report for R-507A Compressor with Contaminant Water and R-502

Unit Number 15
Model # RS43C1E-CAV-250 **Serial #** 96F16431
Run Time (hr.) 12037 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	black

Remaining torque of discharge muffler

(1) 3	**(2)** 4	**(3)** 3	**(4)** 4

Remaining torque of stator bolts

(1) 10	**(2)** 11	**(3)** 10	**(4)** 12

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed

(1) 13	**(2)** 14	**(3)** 13	**(4)** 13

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts

(1) 4	**(2)** 5	**(3)** 4	**(4)** 4

Crank journals

Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2480
	Unloaded	1.2460

Lower crank bearing journal

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9990

Bottom thrust washer (crank side)

Appearance	scored/Cu plating	
Wear	medium	

Bottom washer (casting side)

Appearance	scored/Cu plating	
Wear	slight	

Lower bronze bearings

Appearance	clean/scored	
Wear	none	
Dimensions	**Loaded**	1.0000
	Unloaded	1.0000

Shaft in cage bearing

Appearance	clean	
Wear	polish, slight	

Piston top appearance clean

Piston skirt

Appearance	low wear	
Dimensions	**Loaded**	1.3660
	Unloaded	1.3660

Cylinder bore

Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3670
	Unloaded	1.3680

Connecting rod (large end)

Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2420
	Unloaded	1.2410

TEST HISTORY OF:

Unit Number	15		
Contaminants:			
Control Unit?	No		
Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Trash in liquid screen (g)	0.075
Number of screens	1
Debris in compressor bottom (g)	0.785

Connecting rod (small end)

Appearance	correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/light carbon

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating/carbon
Trepan	medium
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/soot

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	blued/Cu plating/carbon
Trepan	slight
Varnish ring	medium

Final Lubricant Values

Total Acid Number (TAN)	0.96
Water (ppm)	35
Fluoride ion (ppm)	1.7
Chloride ion (ppm)	11
Aluminum (ppm)	9
Copper (ppm)	1
Iron (ppm)	15
Lead (ppm)	1
Silicon (ppm)	4
Tin (ppm)	19
Zinc (ppm)	2

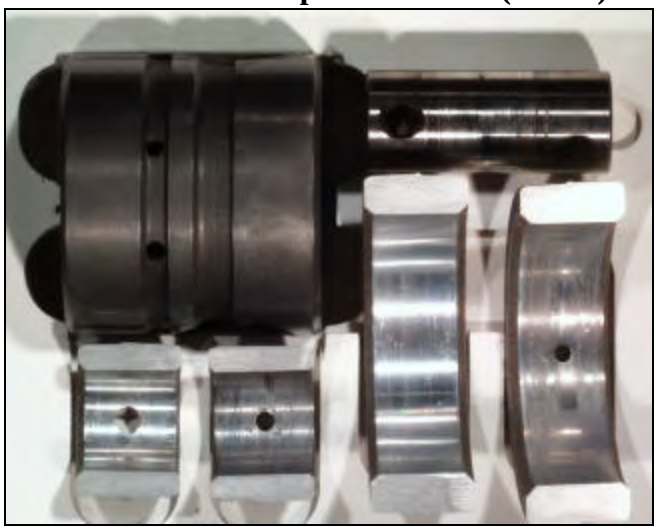
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	gummy
Rear Pin	very slight	brown	hard
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	slight	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

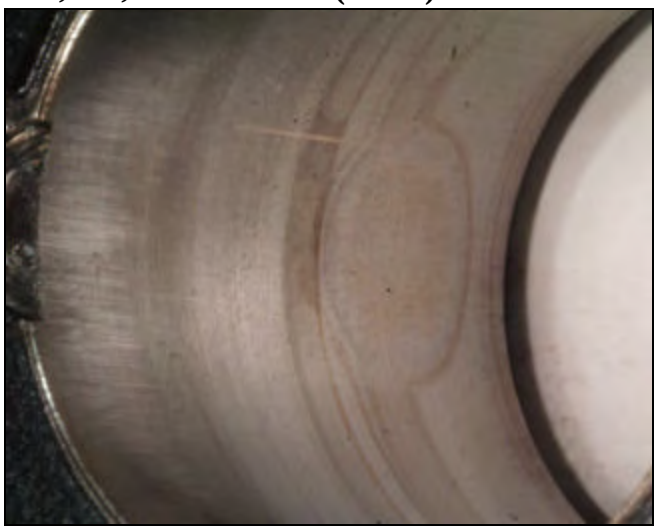
Photographic Documentation of R-507A Compressor with Contaminant Water and R-502
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

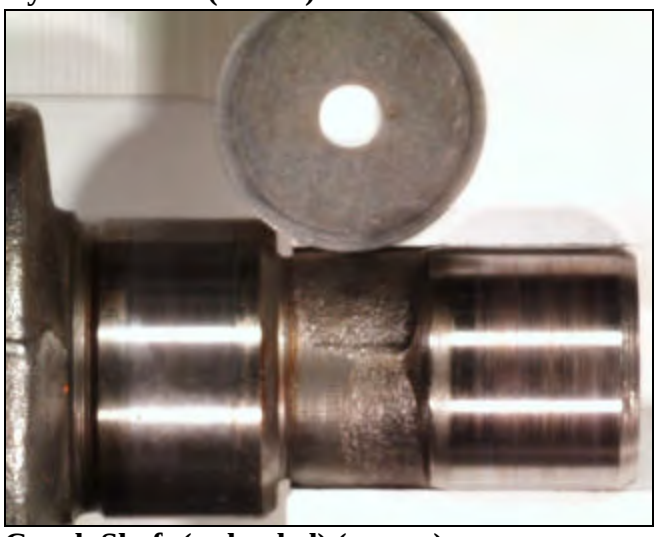


Piston Assembly (macro)



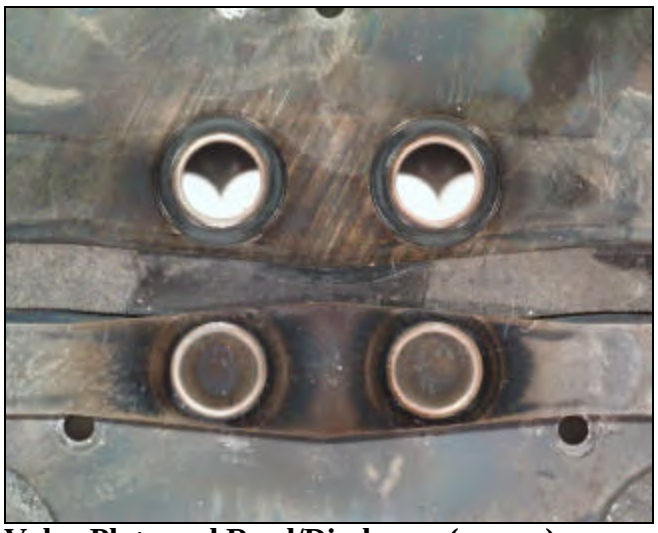
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



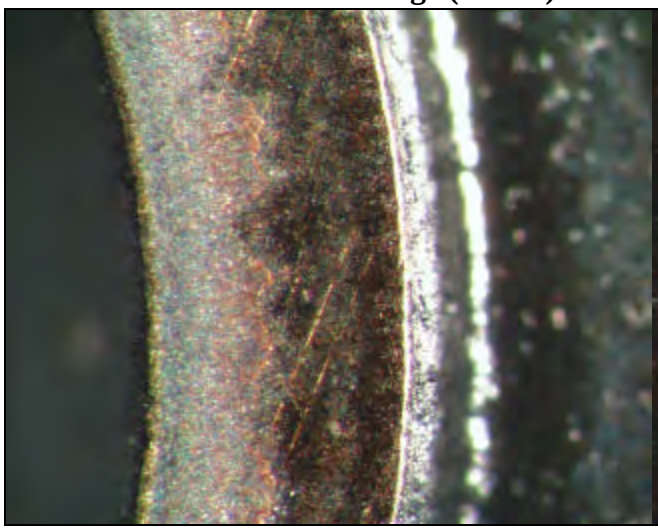
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Water and R-502
355 psig/14 psig

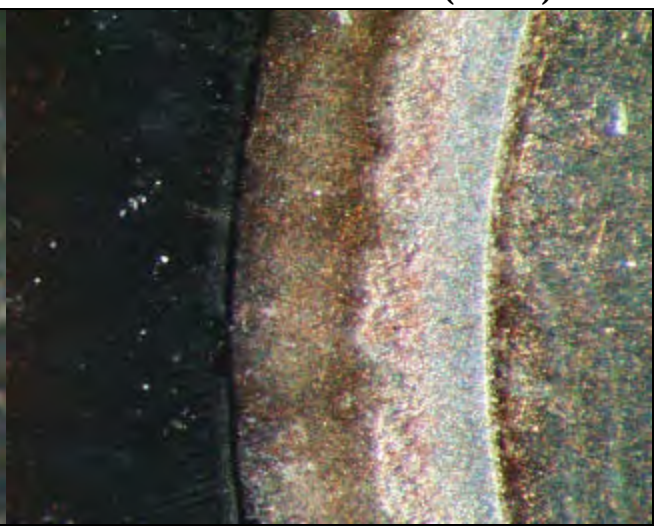


Valve Plate and Reed/Discharge (macro)

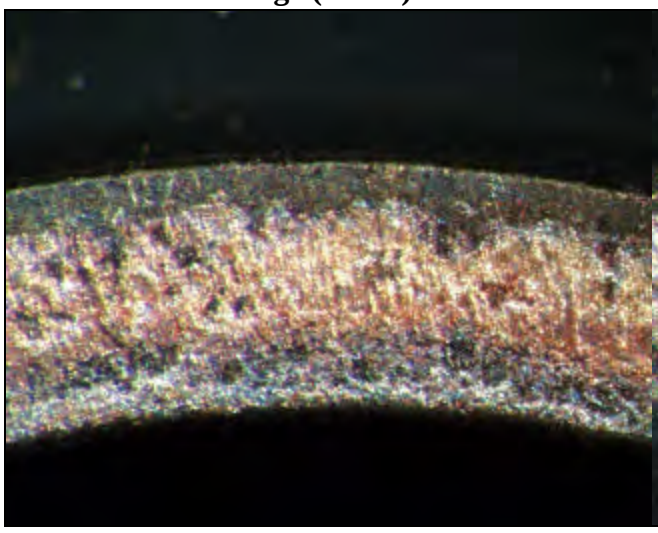
Valve Plate and Reed/Suction (macro)



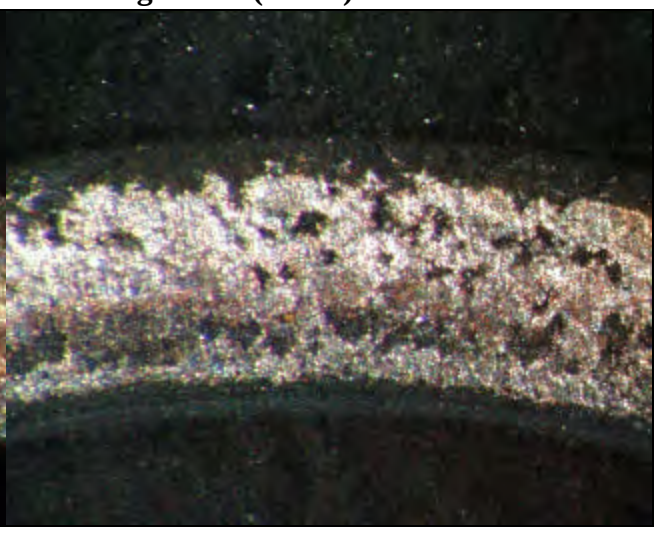
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 16
Model # RS43C1E-CAV-250 **Serial #** 96F16477
Run Time (hr.) 12008 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 355
Suction Pressure (psig) 14
Discharge Temp (°F) 235
Return Gas Temp (°F) 62
SumpTemp (°F) 242

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 3 **(4)** 4
Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 9 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance soot
Top stator windings appearance gray
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance black/Cu plate/oil green
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 15 **(2)** 14 **(3)** 15 **(4)** 15
Head gasket brittle? yes
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals
Appearance scored/Cu plating
Wear medium
Dimensions **Loaded** 1.2450
Unloaded 1.2450
Lower crank bearing journal
Appearance scored/Cu plating
Wear medium
Dimensions **Loaded** 0.9940
Unloaded 0.9940
Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear medium
Bottom washer (casting side)
Appearance scored/Cu plating
Wear slight
Lower bronze bearings
Appearance clean
Wear none
Dimensions **Loaded** 1.0000
Unloaded 1.0000
Shaft in cage bearing
Appearance Cu plating
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3660
Unloaded 1.3660
Cylinder bore
Appearance low wear/scored
Varnish ring slight
Dimensions **Loaded** 1.3680
Unloaded 1.3680
Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2460
Unloaded 1.2450

TEST HISTORY OF:

Unit Number 16
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)
Appearance correct washer
Wear slight
Dimensions **Loaded** 0.4970
Unloaded 0.4960

Piston pin washers appearance
contact wear

Piston pin
Appearance scored
Wear polish, slight
Dimensions **Loaded** 0.4950
Unloaded 0.4950

Final Lubricant Values

Total Acid Number (TAN)	1.0
Water (ppm)	54
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	11
Aluminum (ppm)	1
Copper (ppm)	1
Iron (ppm)	17
Lead (ppm)	1
Silicon (ppm)	1
Tin (ppm)	27
Zinc (ppm)	2

Trash in liquid screen (g)	0.071
Number of screens	1
Debris in compressor bottom (g)	0.633

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion/Cu plating/soot
Suction reed
Condition good
Appearance corrosion/Cu plating
Trepan medium
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance corrosion
Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion/carbon
Trepan slight
Varnish ring slight

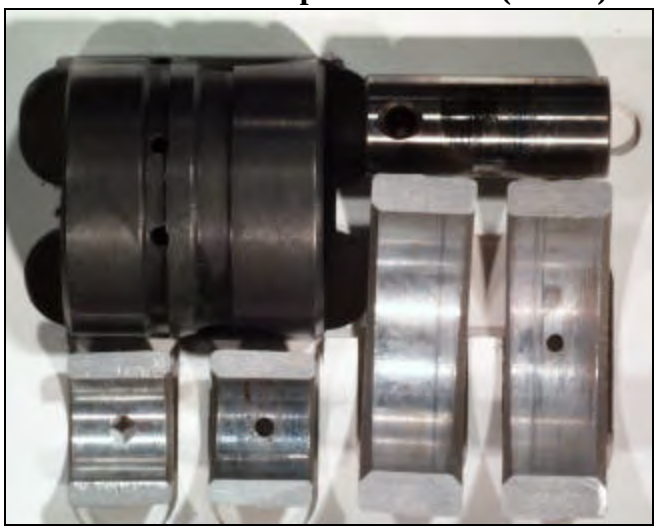
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid and Water
355 psig/14 psig

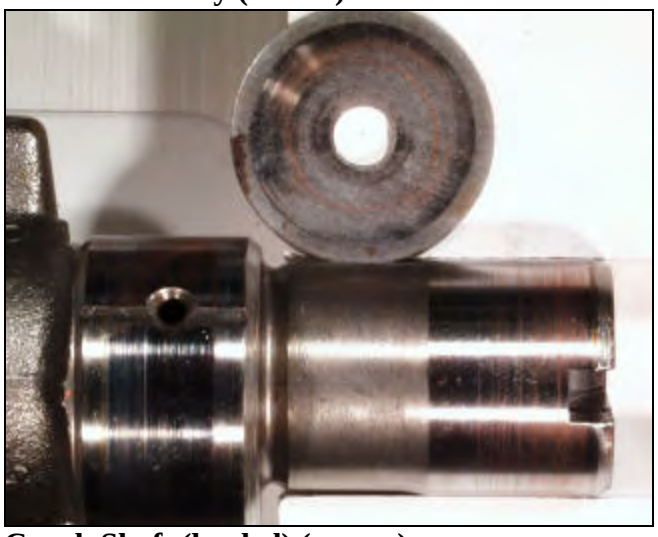
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

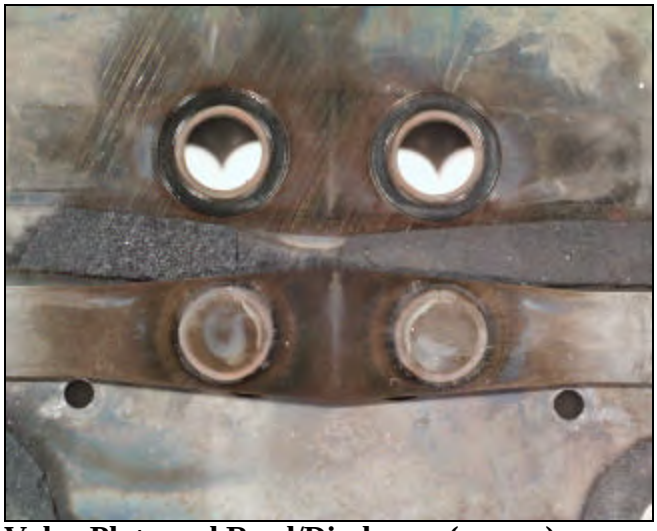
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

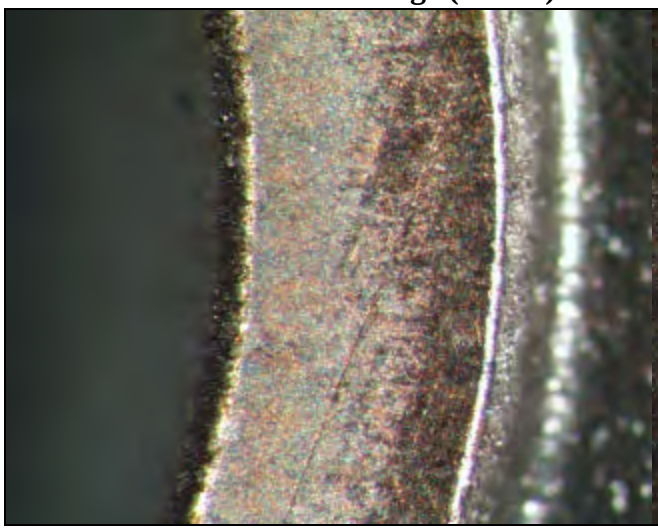
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid and Water
355 psig/14 psig

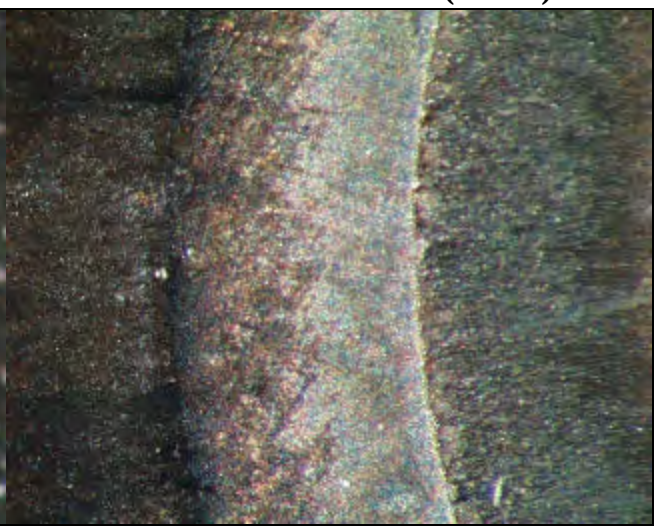


Valve Plate and Reed/Discharge (macro)

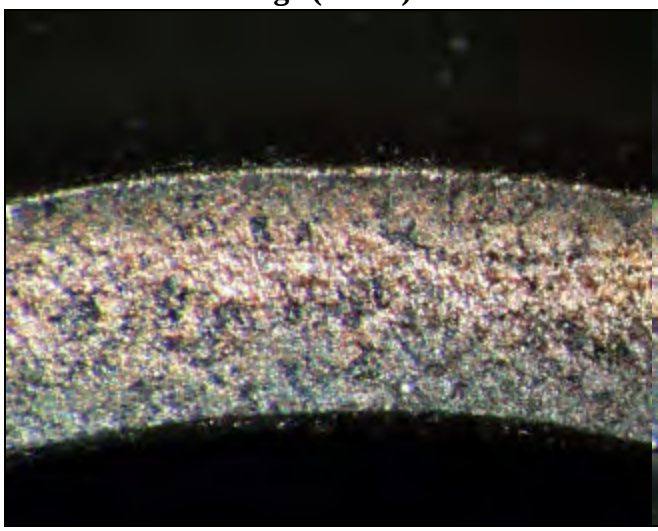
Valve Plate and Reed/Suction (macro)



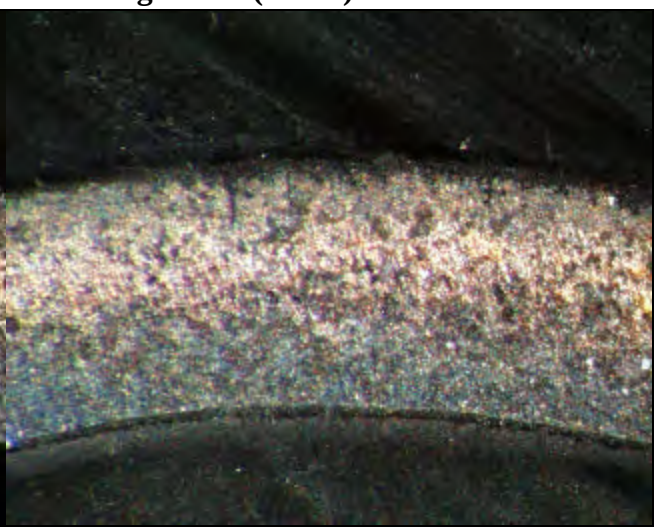
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Air and Water

TEST HISTORY OF:

Unit Number 17
Model # RS43C1E-CAV-250 **Serial #** 96F16516
Run Time (hr.) 12015 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 3 **(2)** 3 **(3)** 3 **(4)** 4
Remaining torque of stator bolts
(1) 8 **(2)** 8 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 14

Head gasket brittle?	yes
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals
Appearance scored/Cu plating
Wear slight
Dimensions **Loaded** 1.2480
Unloaded 1.2480

Lower crank bearing journal
Appearance scored/Cu plating
Wear slight
Dimensions **Loaded** 1.0000
Unloaded 1.0000

Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear medium

Bottom washer (casting side)
Appearance scored
Wear slight

Lower bronze bearings
Appearance clean
Wear slight
Dimensions **Loaded** 1.0030
Unloaded 1.0020

Shaft in cage bearing
Appearance Cu plating
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3730
Unloaded 1.3730

Cylinder bore
Appearance low wear
Varnish ring slight
Dimensions **Loaded** 1.3750
Unloaded 1.3740

Connecting rod (large end)
Appearance none
Wear slight
Dimensions **Loaded** 1.2500
Unloaded 1.2500

TEST HISTORY OF:

Unit Number 17
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)
Appearance correct washer
Wear polish, slight
Dimensions **Loaded** 0.5120
Unloaded 0.5050

Piston pin washers appearance
contact wear

Piston pin
Appearance clean
Wear polish, slight
Dimensions **Loaded** 0.4990
Unloaded 0.4990

Final Lubricant Values
plating/blued/carbon

Total Acid Number (TAN)	0.51
Water (ppm)	54
Fluoride ion (ppm)	2.0
Chloride ion (ppm)	10
Aluminum (ppm)	8
Copper (ppm)	0

plating/carbon

Iron (ppm)	16
Lead (ppm)	1
Silicon (ppm)	5
Tin (ppm)	12
Zinc (ppm)	2

Trash in liquid screen (g) 0.172
Number of screens 1
Debris in compressor bottom (g) 1.123

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed
Condition good
Appearance corrosion/Cu plating/carbon
Trepan slight
Varnish ring heavy

Discharge side (reed backer)
Condition good
Appearance corrosion/Cu

Discharge surface appearance
corrosion/Cu plating

Discharge reed
Condition good
Appearance corrosion/blued/Cu

Trepan slight
Varnish ring medium

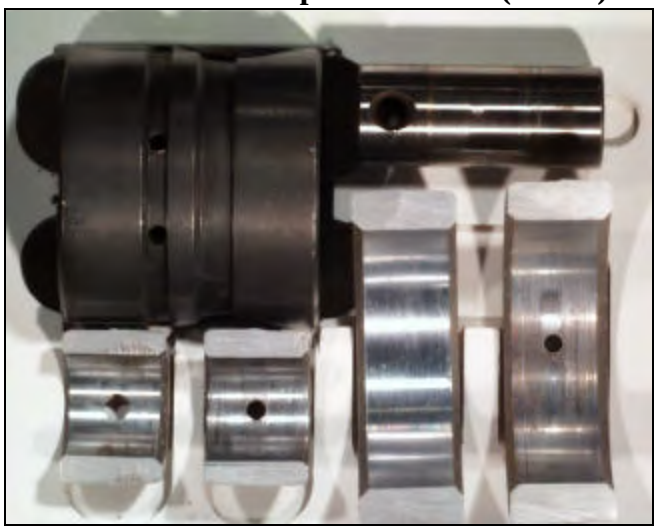
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	none	none	none
Equalizer Hole	slight	green	hard
Tip of Pin	medium	gray	gummy
Spring	heavy	black	gummy
Spring Seat	medium	green	gummy
Ball	slight	black	gummy
Front Side	heavy	green, black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Air and Water
355 psig/14 psig

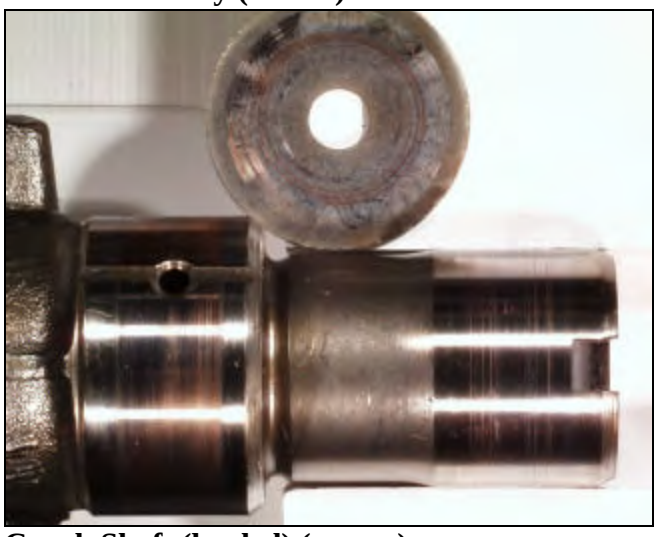
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

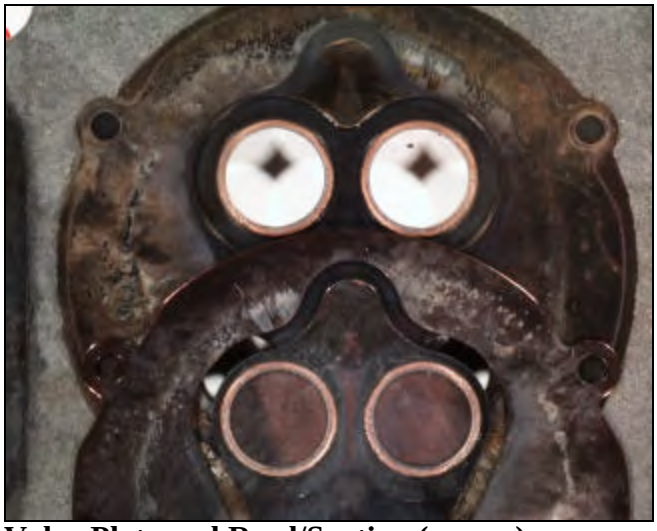


Crank Shaft (loaded) (macro)

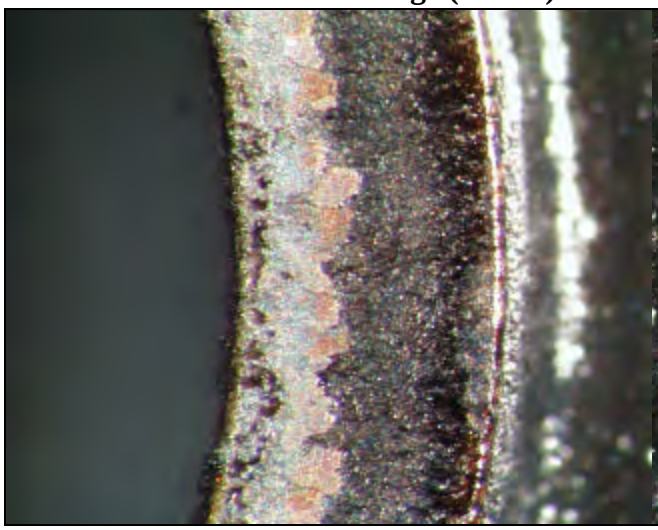
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Air and Water
355 psig/14 psig

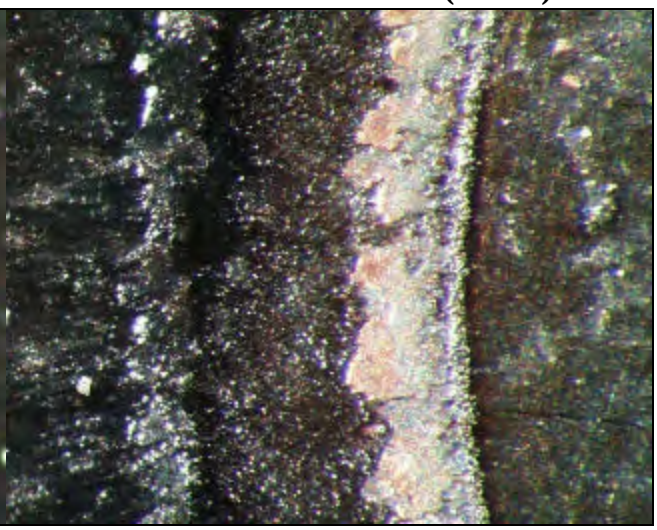
Valve Plate and Reed/Discharge (macro)



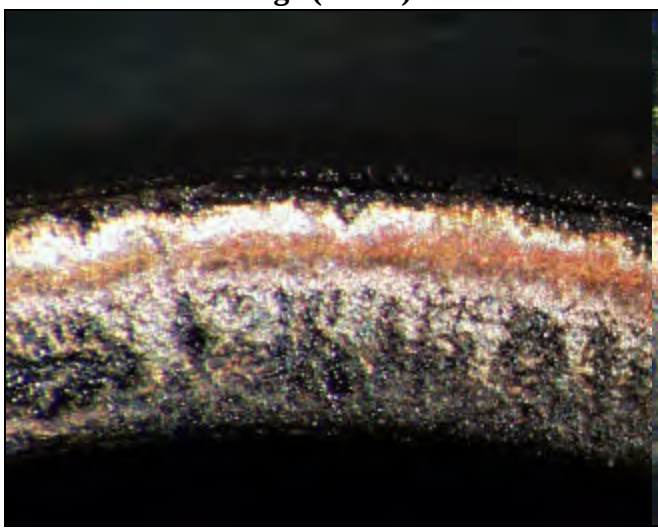
Valve Plate and Reed/Suction (macro)



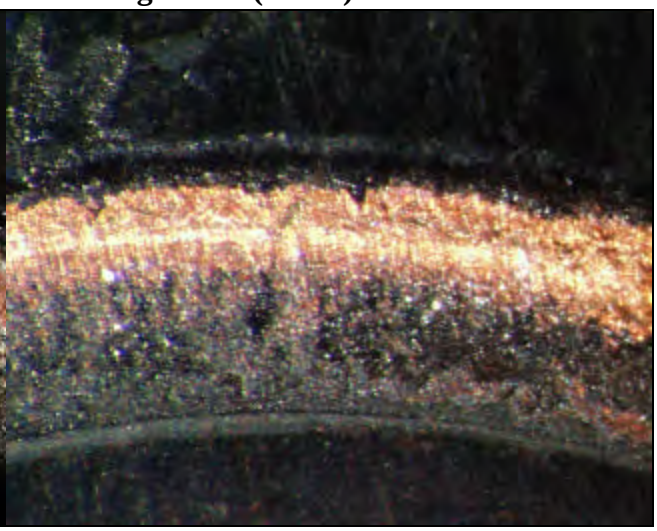
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 18
Model # RS43C1E-CAV-250 **Serial #** 96F16498
Run Time (hr.) 12015 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 3 **(2)** 3 **(3)** 3 **(4)** 3

Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 9 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	scored/corrosion	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0010
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 18
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)
Appearance correct washer/corrosion
Wear medium

Dimensions	**Loaded**	0.5070
	Unloaded	0.5030

Piston pin washers appearance
contact wear
Piston pin
Appearance scored
Wear slight

Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.87
Water (ppm)	44
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	10
Aluminum (ppm)	5
Copper (ppm)	1
Iron (ppm)	19
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	33
Zinc (ppm)	4

Trash in liquid screen (g)	0.075
Number of screens	2
Debris in compressor bottom (g)	1.307

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion/Cu plating
Suction reed
Condition good
Appearance corrosion/Cu plating
Trepan medium
Varnish ring none

Discharge side (reed backer)
Condition good
Appearance corrosion
Discharge surface appearance
corrosion/Cu plating

Discharge reed
Condition good
Appearance corrosion
Trepan slight
Varnish ring slight

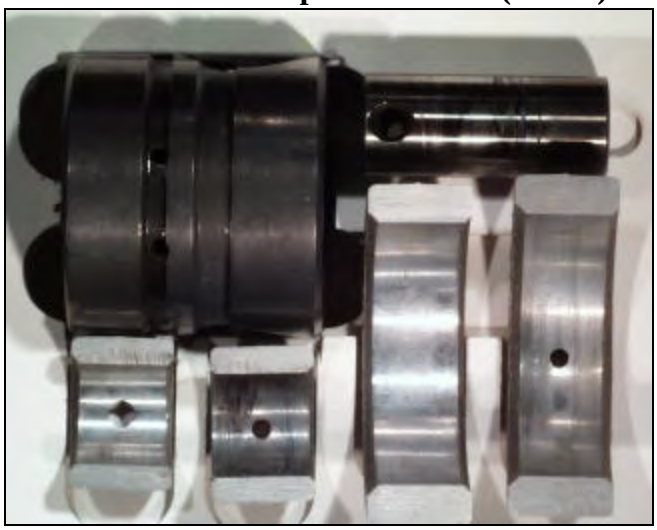
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	very slight	brown	hard
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	green, black	gummy
Ball	medium	black	gummy
Front Side	medium	green, black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Water
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

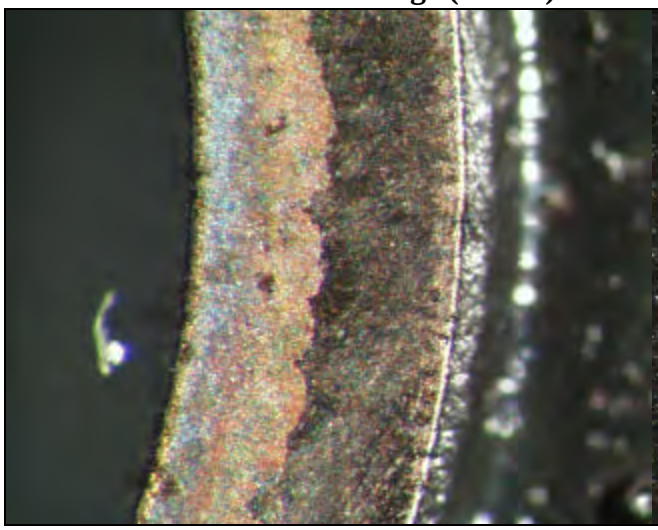
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

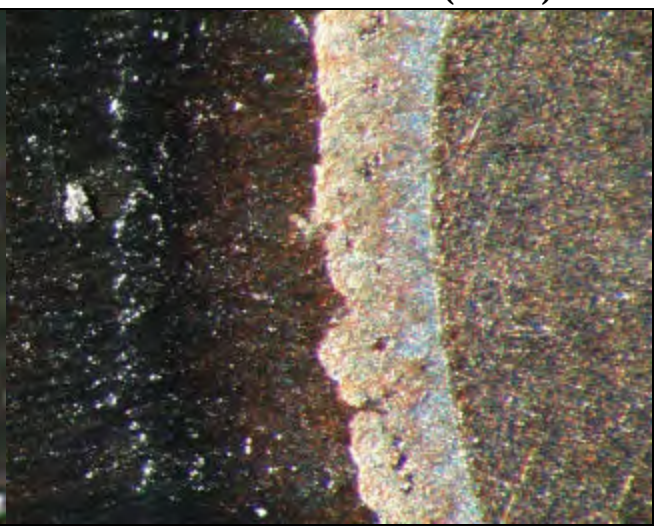
Photographic Documentation of R-507A Compressor with Contaminant Water
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

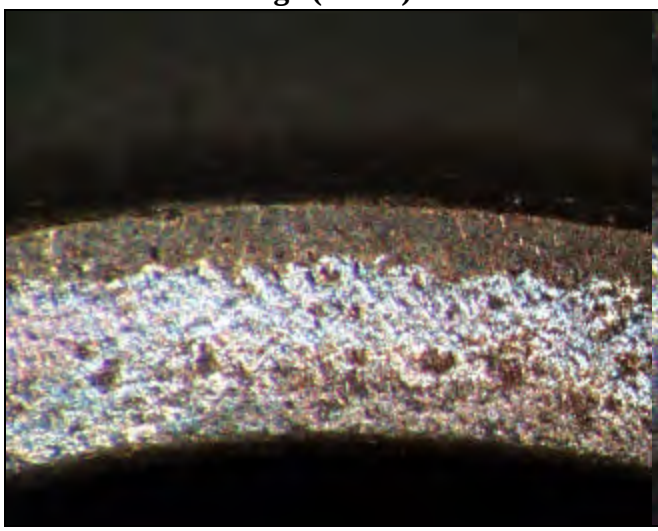
Valve Plate and Reed/Suction (macro)



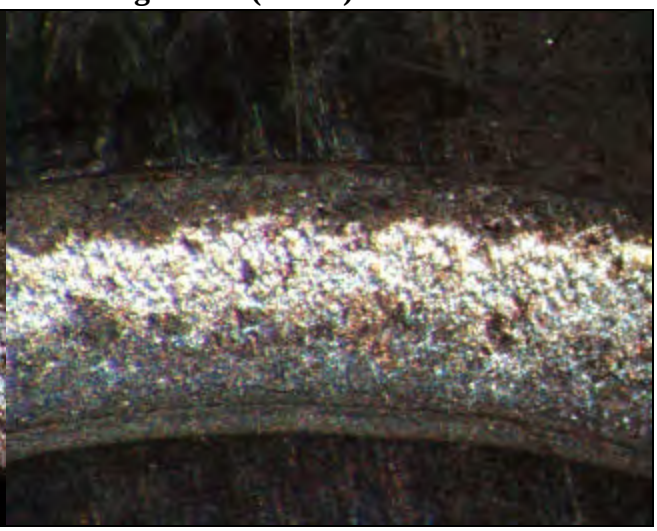
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Water, and R-502

TEST HISTORY OF:

Unit Number 19
Model # RS43C1E-CAV-250 **Serial #** 96F16515
Run Time (hr.) 12013 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 4 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 11 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	black
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate/oil green
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 14 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 4 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2480
	Unloaded	1.2480
Lower crank bearing journal		
Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/bronze plating	
Wear	medium	
Bottom washer (casting side)		
Appearance	scored	
Wear	medium	
Lower bronze bearings		
Appearance	clean	
Wear	none	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean/corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 19
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5090
	Unloaded	0.5030

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	1.2
Water (ppm)	72
Fluoride ion (ppm)	0.90
Chloride ion (ppm)	11
Aluminum (ppm)	1
Copper (ppm)	1
Iron (ppm)	15
Lead (ppm)	1
Silicon (ppm)	2
Tin (ppm)	23
Zinc (ppm)	2

Trash in liquid screen (g)	0.133
Number of screens	1
Debris in compressor bottom (g)	0.893

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion/carbon
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/soot

Discharge reed

Condition	good
Appearance	corrosion/carbon
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

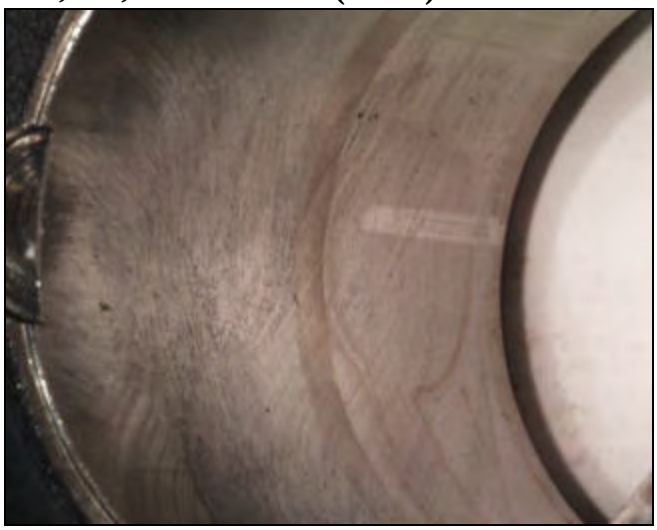
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	medium	green	gummy
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	heavy	gray	gummy
Ball	medium	black	gummy
Front Side	heavy	gray	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid, Water, and R-502
355 psig/14 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

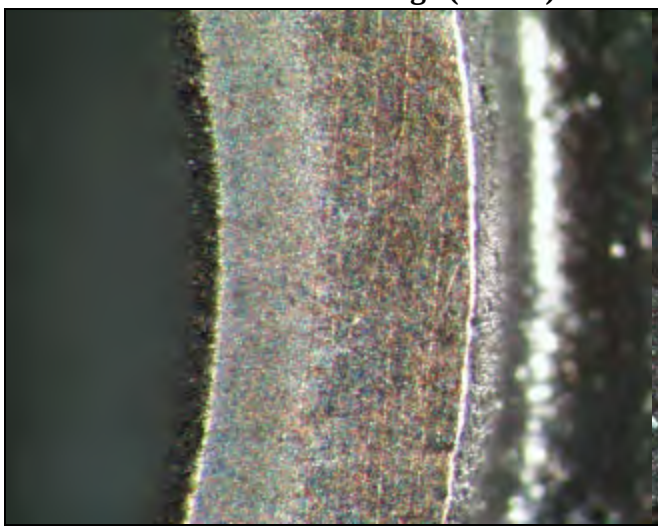
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid, Water, and R-502
355 psig/14 psig

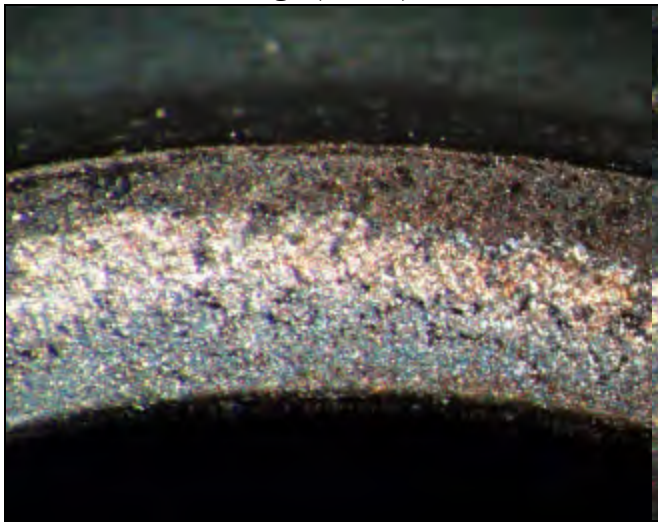
Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

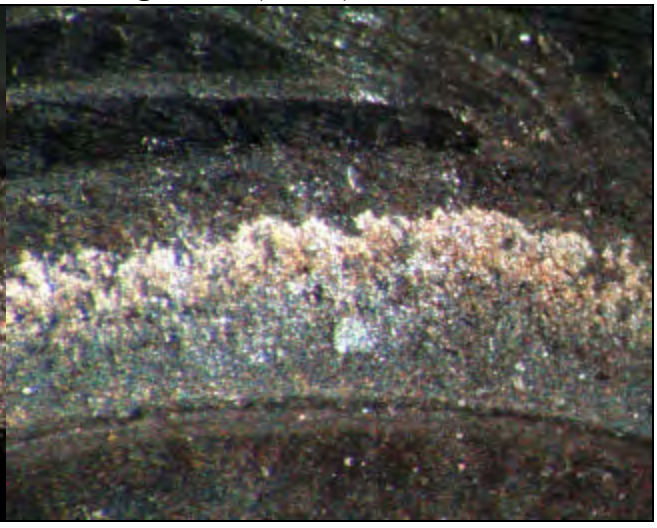


Valve Plate/Discharge (micro)

Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Air, Water, and R-502

TEST HISTORY OF:

Unit Number 20
Model # RS43C1E-CAV-250 **Serial #** 96F16500
Run Time (hr.) 12032 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig) 355
Suction Pressure (psig) 14
Discharge Temp (°F) 235
Return Gas Temp (°F) 62
SumpTemp (°F) 242

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance black
Remaining torque of discharge muffler
(1) 4 **(2)** 3 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 9 **(2)** 10 **(3)** 10 **(4)** 9
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance black
Top stator windings appearance black
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance black/Cu plate
Quantity of bearing chips heavy
Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 16 **(4)** 15
Head gasket brittle? yes
Head suction cavity appearance dirty
Head discharge cavity appearance dirty
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals
Appearance scored/Cu plating
Wear slight
Dimensions **Loaded** 1.2450
Unloaded 1.2450
Lower crank bearing journal
Appearance scored/Cu plating
Wear slight
Dimensions **Loaded** 0.9950
Unloaded 0.9980
Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear heavy
Bottom washer (casting side)
Appearance scored/Cu plating
Wear medium
Lower bronze bearings
Appearance clean/corrosion
Wear slight
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Shaft in cage bearing
Appearance clean
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3670
Unloaded 1.3670
Cylinder bore
Appearance low wear/Cu plating
Varnish ring heavy
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Connecting rod (large end)
Appearance none
Wear polish, slight
Dimensions **Loaded** 1.2500
Unloaded 1.2500

TEST HISTORY OF:

Unit Number 20
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)
Appearance correct washer/corrosion
Wear slight
Dimensions **Loaded** 0.5270
Unloaded 0.5120

Piston pin washers appearance
contact wear

Piston pin
Appearance scored/Cu plating/corrosion
Wear slight
Dimensions **Loaded** 0.4970
Unloaded 0.4970

Final Lubricant Values

Total Acid Number (TAN)	1.1
Water (ppm)	120
Fluoride ion (ppm)	2.0
Chloride ion (ppm)	13
Aluminum (ppm)	62
Copper (ppm)	1
Iron (ppm)	89
Lead (ppm)	7
Silicon (ppm)	9
Tin (ppm)	66
Zinc (ppm)	17

Trash in liquid screen (g)	0.138
Number of screens	2
Debris in compressor bottom (g)	0.902

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion/soot

Suction surface appearance
corrosion/Cu plating/soot

Suction reed
Condition good
Appearance corrosion/Cu plating/soot
Trepan medium
Varnish ring medium

Discharge side (reed backer)
Condition good
Appearance corrosion/Cu plating/blued

Discharge surface appearance
corrosion/Cu plating/soot

Discharge reed
Condition good
Appearance corrosion/Cu plating/soot
Trepan slight
Varnish ring slight

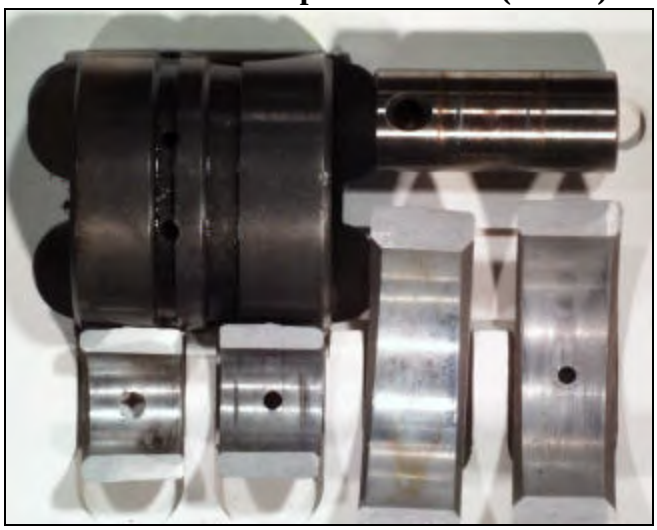
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	very slight	brown	hard
Equalizer Hole	plugged	black	gummy
Tip of Pin	slight	black, brown	gummy
Spring	medium	black	gummy
Spring Seat	medium	Cu	gummy
Ball	slight	gray	gummy
Front Side	slight	gray	hard

Photographic Documentation of R-507A Compressor with Contaminant
Acid, Air, Water, and R-502
355 psig/14 psig

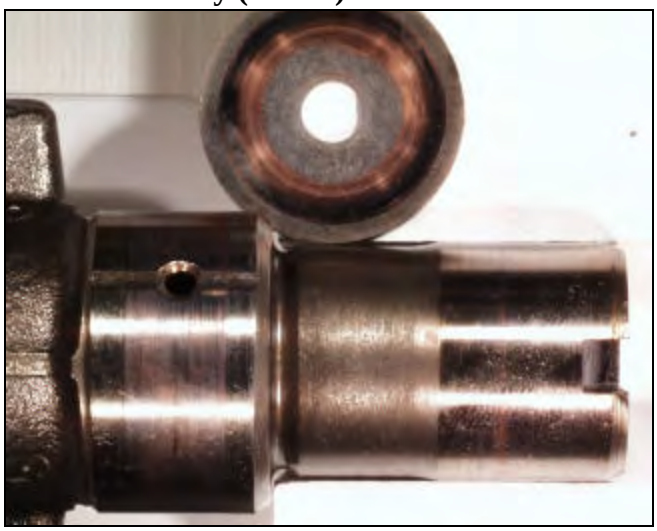
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

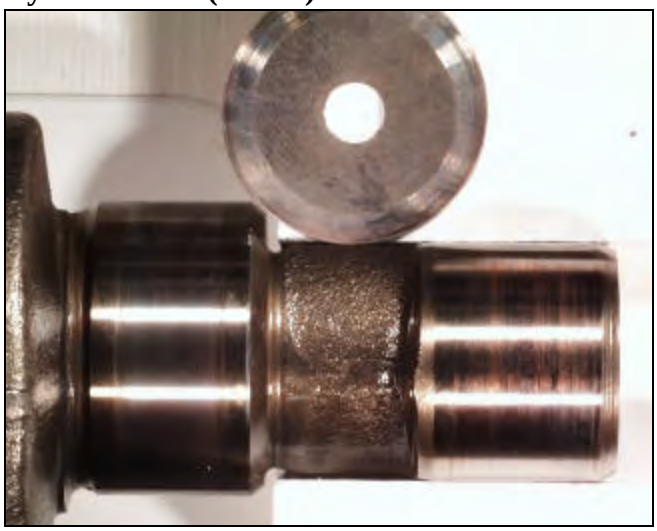


Piston Assembly (macro)

Cylinder Bore (macro)

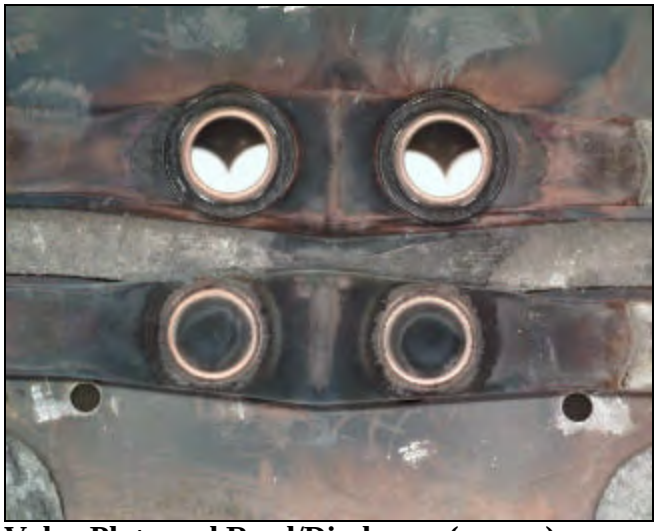


Crank Shaft (loaded) (macro)



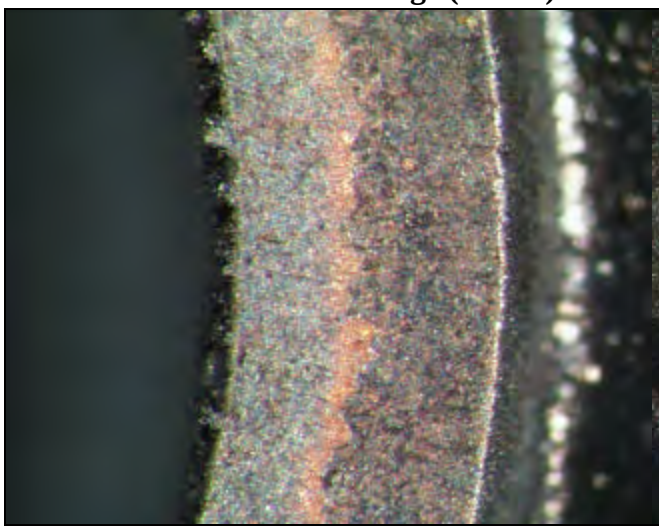
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant
Acid, Air, Water, and R-502
355 psig/14 psig

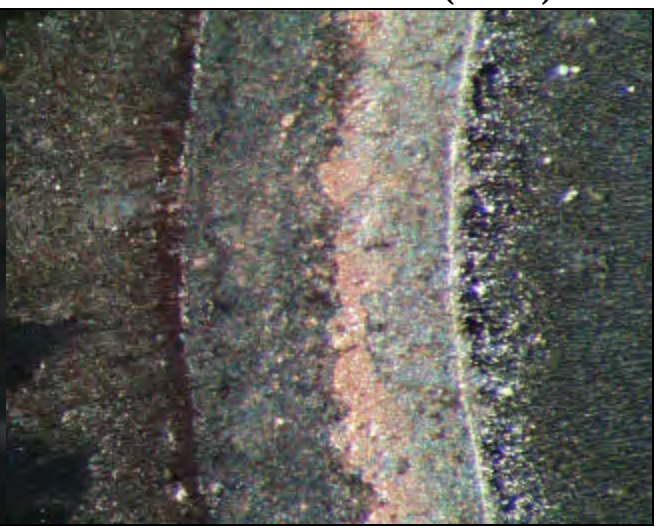


Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

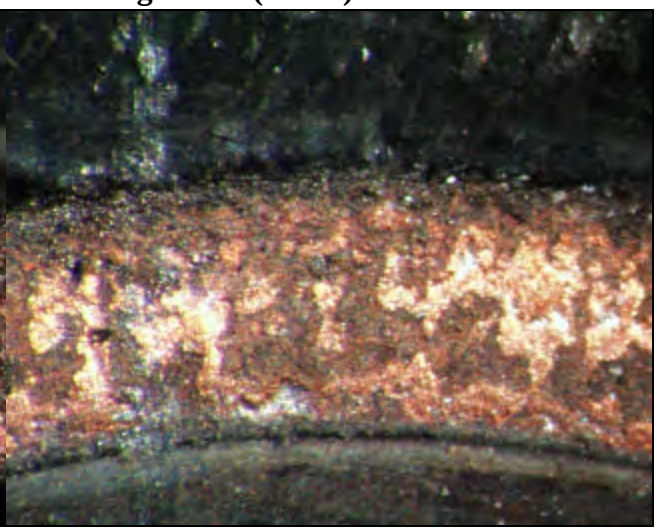


Valve Plate/Discharge (micro)



Discharge Reed (micro)

Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air, Water, and R-502

TEST HISTORY OF:

Unit Number 21
Model # RS43C1E-CAV-250 **Serial #** 96F16506
Run Time (hr.) 12024 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5
Remaining torque of stator bolts
(1) 12.5 **(2)** 15 **(3)** 12.5 **(4)** 15

Suction muffler appearance	gray
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black/soot
Top stator windings appearance	black
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) 15 **(2)** 20 **(3)** 17.5 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 1.2475
Unloaded 1.2475

Lower crank bearing journal
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 1.0000
Unloaded 0.9995

Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear medium

Bottom washer (casting side)
Appearance clean/Cu plating/corrosion
Wear polish

Lower bronze bearings
Appearance clean
Wear slight
Dimensions **Loaded** 1.0040
Unloaded 1.0035

Shaft in cage bearing
Appearance Cu plating
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3730
Unloaded 1.3740

Cylinder bore
Appearance low wear/Cu plating
Varnish ring medium
Dimensions **Loaded** 1.3755
Unloaded 1.3755

Connecting rod (large end)
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 21
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	heavy	
Dimensions	**Loaded**	0.5110
	Unloaded	0.5035

Piston pin washers appearance
contact wear/Cu plating

Piston pin

Appearance	scored/Cu plating/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	1.1
Water (ppm)	81
Fluoride ion (ppm)	2.0
Chloride ion (ppm)	17
Aluminum (ppm)	2
Copper (ppm)	1
Iron (ppm)	18
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	27
Zinc (ppm)	3

Trash in liquid screen (g)	0.101
Number of screens	1
Debris in compressor bottom (g)	1.082

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/Cu plating

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	medium
Varnish ring	medium

Discharge side (reed backer)

Condition	good
Appearance	corrosion/Cu plating/blued

Discharge surface appearance
corrosion/Cu plating

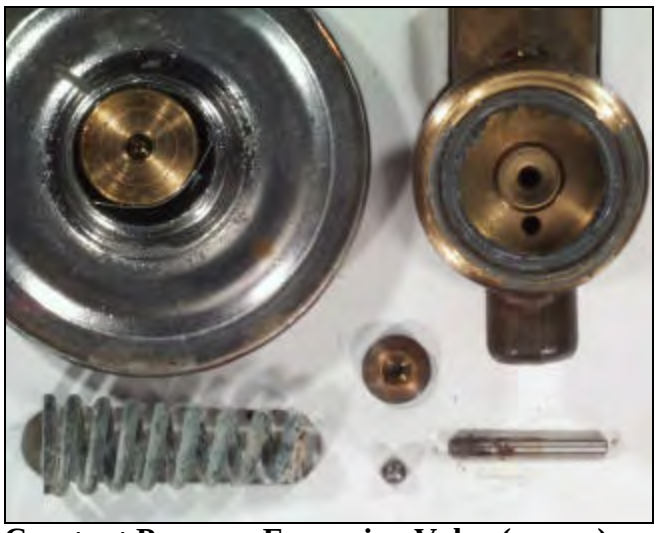
Discharge reed

Condition	good
Appearance	corrosion/blued/Cu plating
Trepan	slight
Varnish ring	slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black, brown, gray	gummy
Spring	heavy	gray, black	gummy, hard
Spring Seat	heavy	gray	gummy
Ball	slight	black	hard
Front Side	medium	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Air, Water, and R-502
355 psig/14 psig

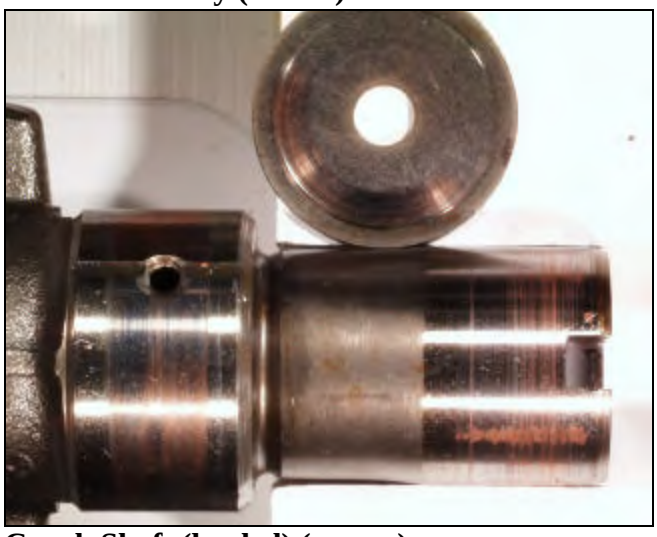


Constant Pressure Expansion Valve (macro)

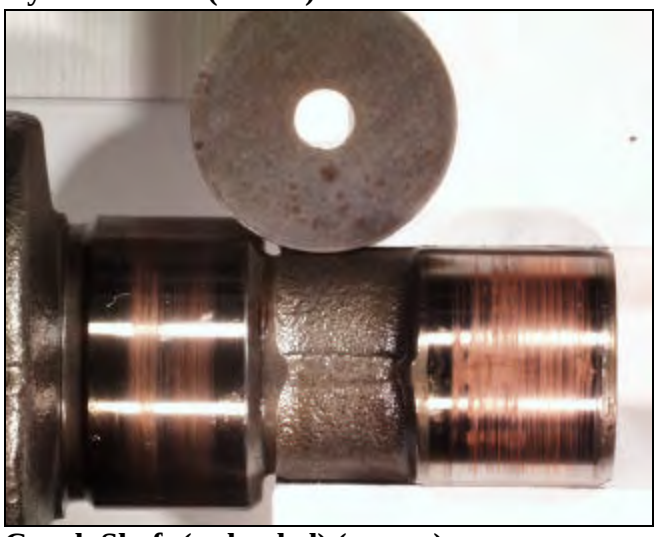
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



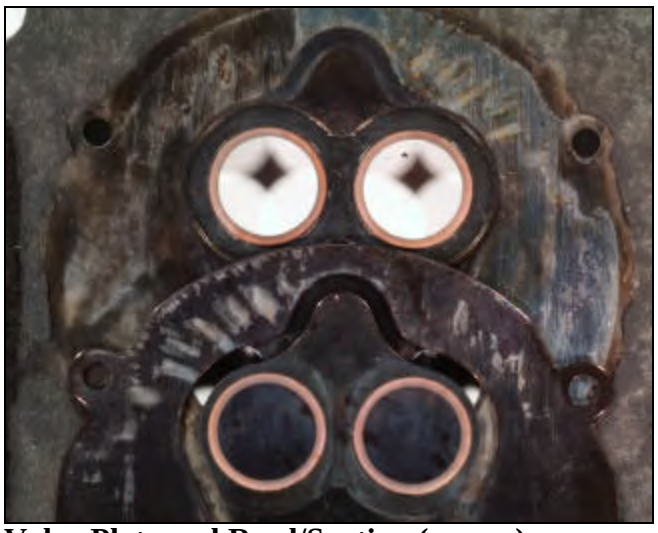
Crank Shaft (loaded) (macro)



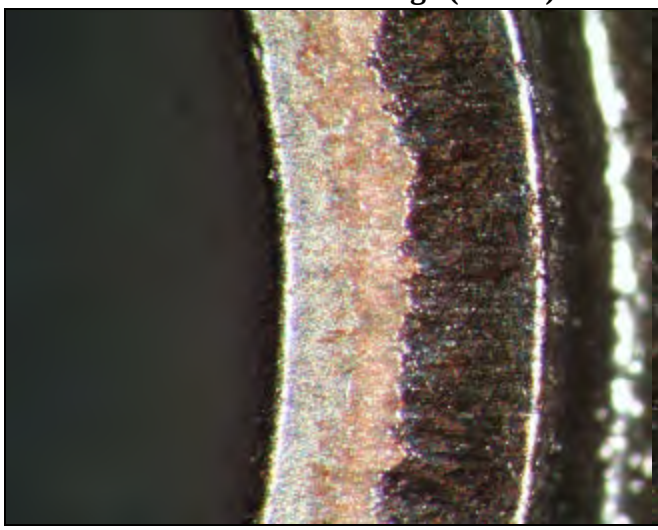
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Air, Water, and R-502
355 psig/14 psig

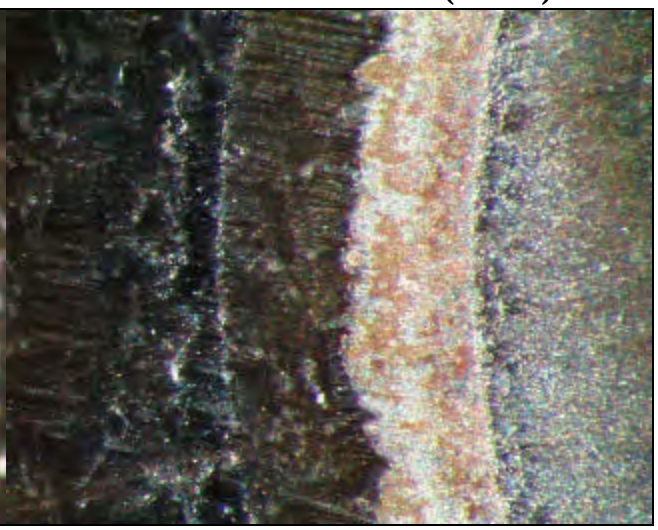
Valve Plate and Reed/Discharge (macro)



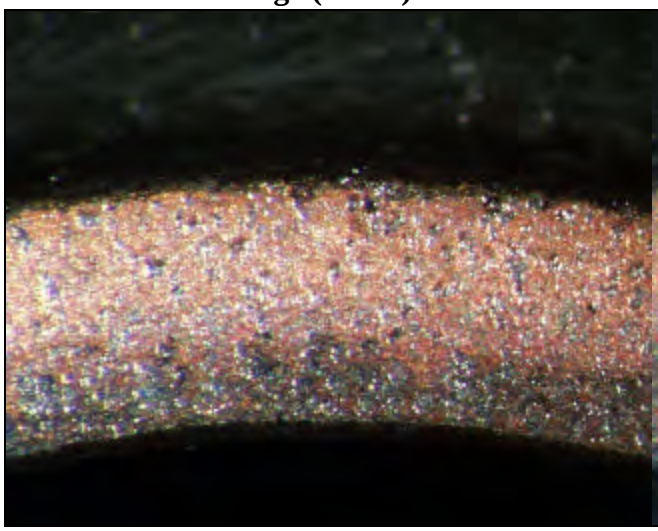
Valve Plate and Reed/Suction (macro)



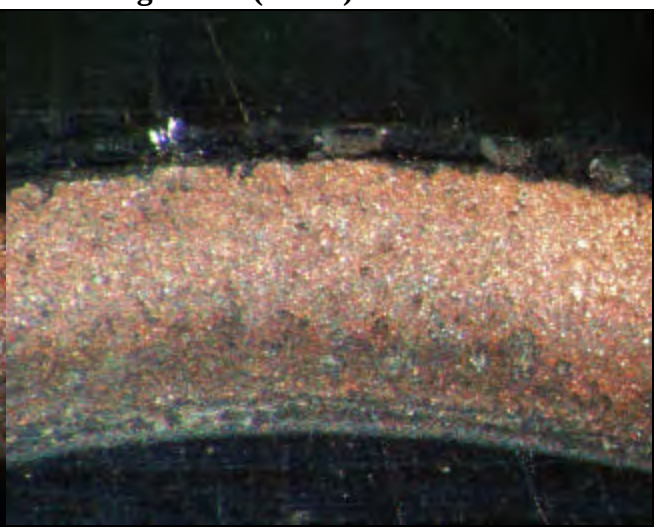
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 22
Model # RS43C1E-CAV-250 **Serial #** 96F16502
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	235
Return Gas Temp (°F)	62
SumpTemp (°F)	242
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 5

Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 12.5 **(4)** 10

Suction muffler appearance	gray
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/oil green
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) 15 **(2)** 12.5 **(3)** 12.5 **(4)** 17

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 2.5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean/Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	medium	
Bottom washer (casting side)		
Appearance	clean/Cu plating	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	medium	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 22
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	heavy	
Dimensions	**Loaded**	0.5130
	Unloaded	0.5025

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	scored/Cu plating/corrosion	
Wear	heavy	
Dimensions	**Loaded**	0.4965
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	1.8
Water (ppm)	58
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	11
Aluminum (ppm)	8
Copper (ppm)	0
Iron (ppm)	12
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	10
Zinc (ppm)	5

Trash in liquid screen (g)	0.176
Number of screens	1
Debris in compressor bottom (g)	1.220

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/Cu plating

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/Cu plating/blued

Discharge surface appearance
corrosion/Cu plating

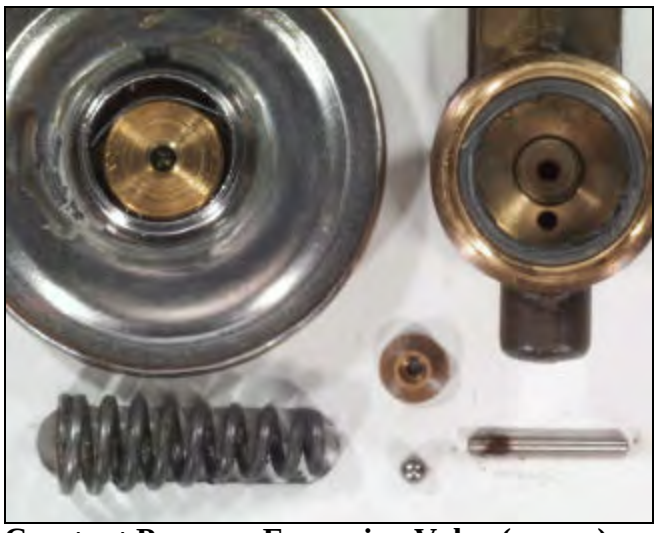
Discharge reed

Condition	good
Appearance	corrosion/blued/Cu plating
Trepan	slight
Varnish ring	medium

Expansion Valve Inspection Observations

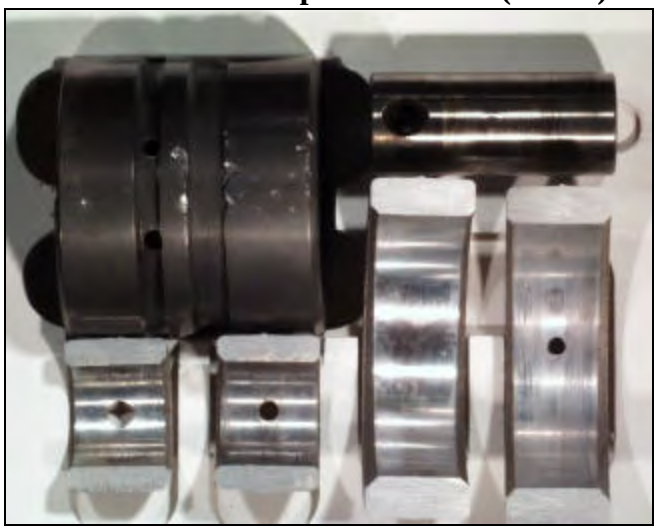
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	gray, black	gummy
Spring Seat	heavy	black, gray, brown	gummy
Ball	medium	black	gummy
Front Side	medium	gray, black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and Water 355 psig/14 psig



Constant Pressure Expansion Valve (macro)

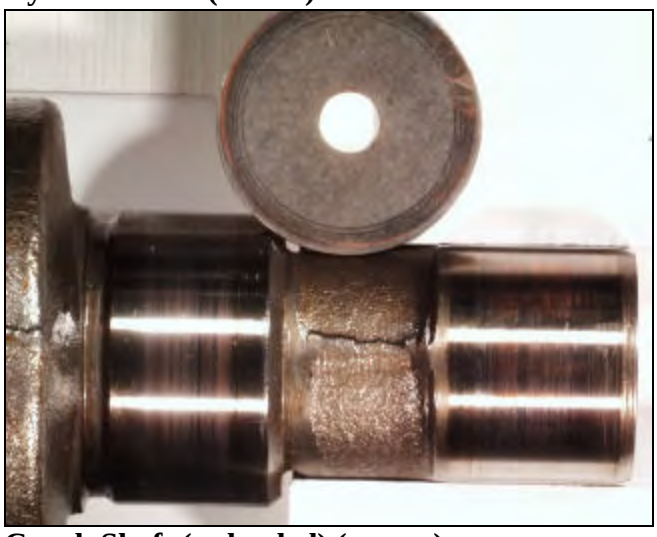
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

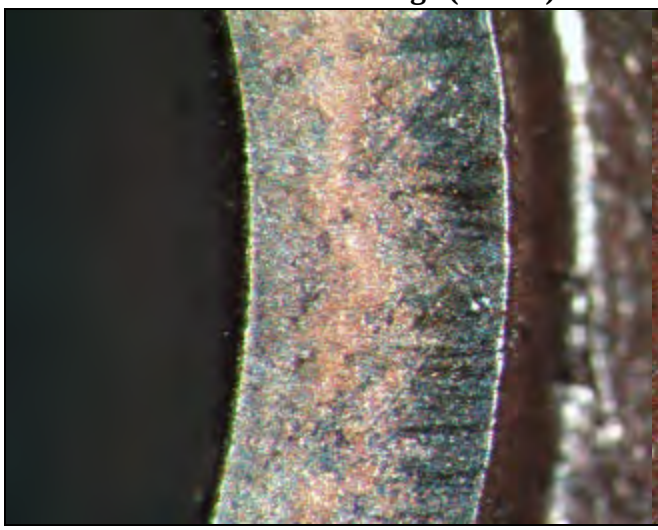


Crank Shaft (unloaded) (macro)

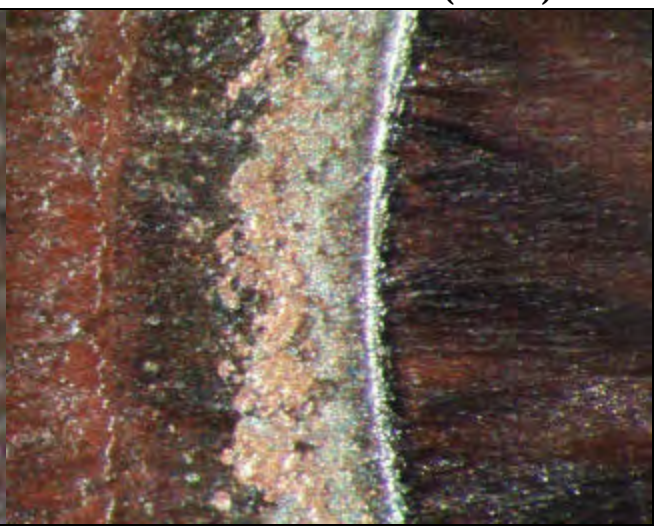
Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and Water
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

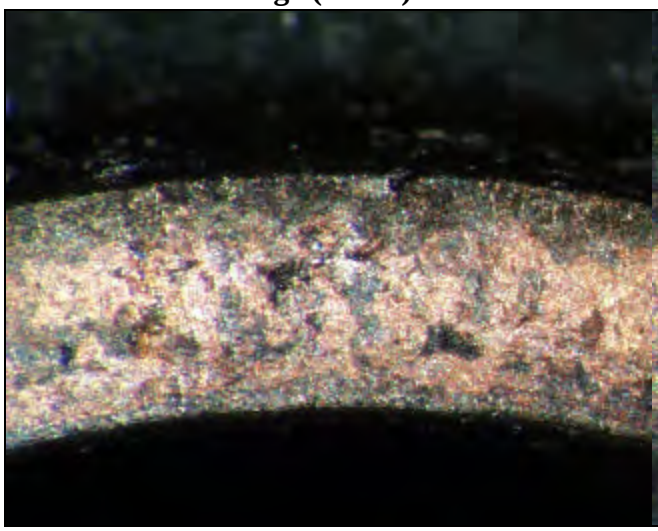
Valve Plate and Reed/Suction (macro)



Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)

Suction Reed (micro)

Report for R-507A Control Compressor

TEST HISTORY OF:

Unit Number 23

Model # RS43C1E-CAV-250 **Serial #** 96F16486
Run Time (hr.) 12026 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	355
Suction Pressure (psig)	14
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5.4 **(2)** 5.4 **(3)** 4.2 **(4)** 3.8

Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	metal chips
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 13 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 6 **(4)** 6

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/bronze plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 23
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	174
Fluoride ion (ppm)	1.8
Chloride ion (ppm)	8.8
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	2
Zinc (ppm)	0

Trash in liquid screen (g)	0.036
Number of screens	3
Debris in compressor bottom (g)	0.935

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

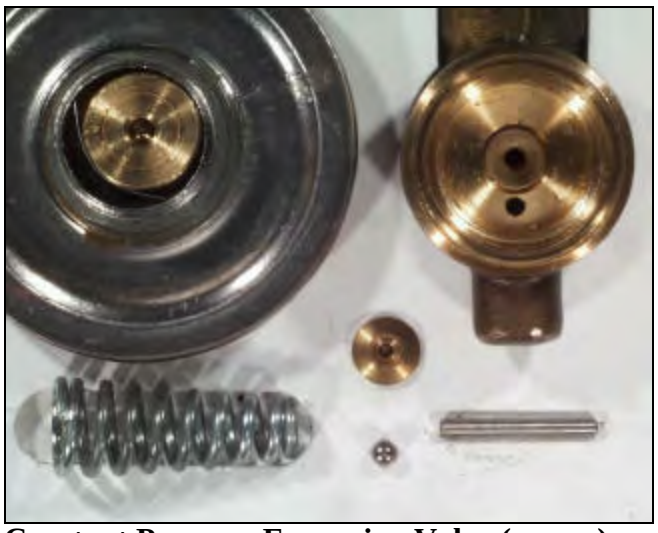
Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

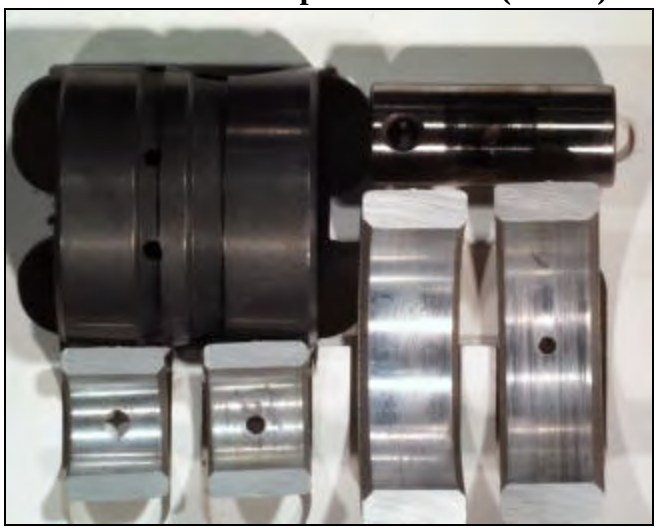
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	gray	hard
Spring	slight	gray	hard
Spring Seat	none	none	none
Ball	very slight	gray	hard
Front Side	none	none	none

Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

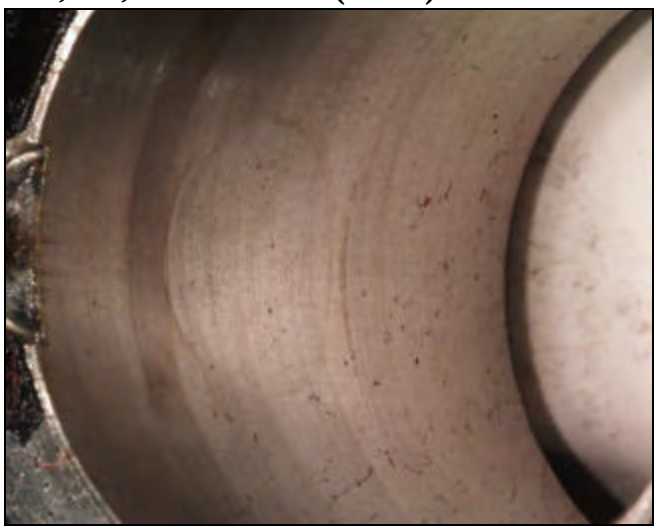


Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

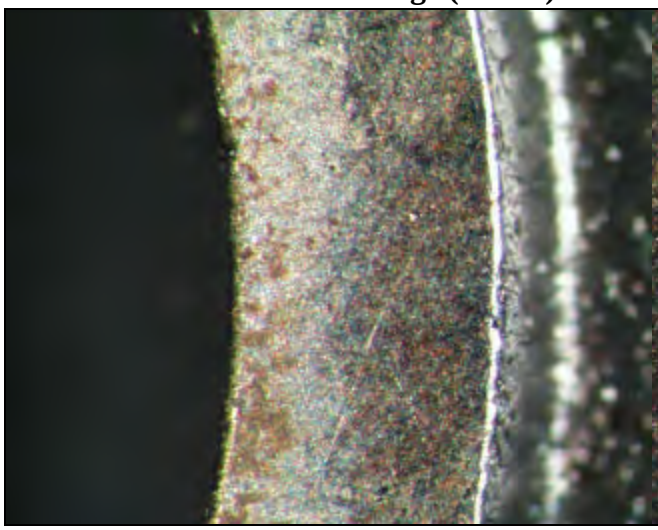
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

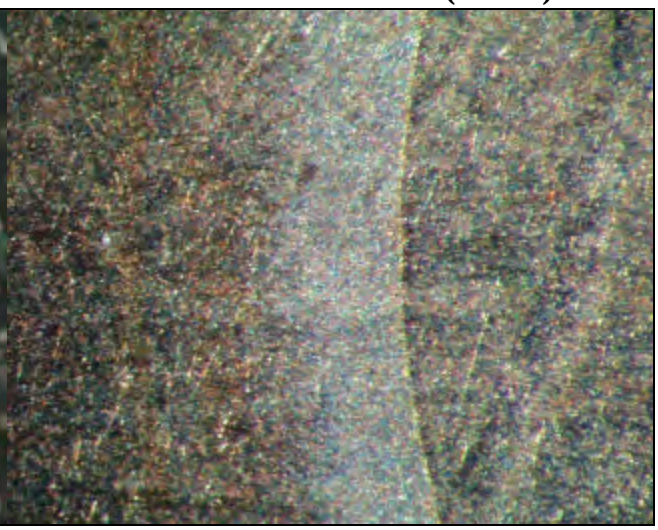
Photographic Documentation of R-507A Control Compressor
355 psig/14 psig

Valve Plate and Reed/Discharge (macro)

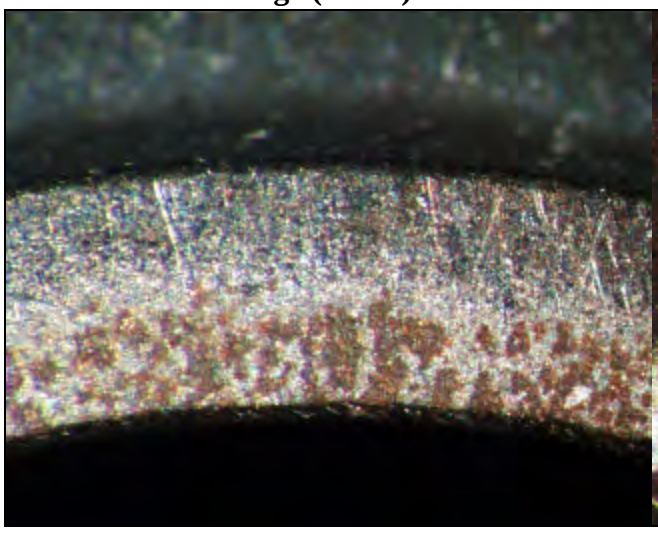
Valve Plate and Reed/Suction (macro)



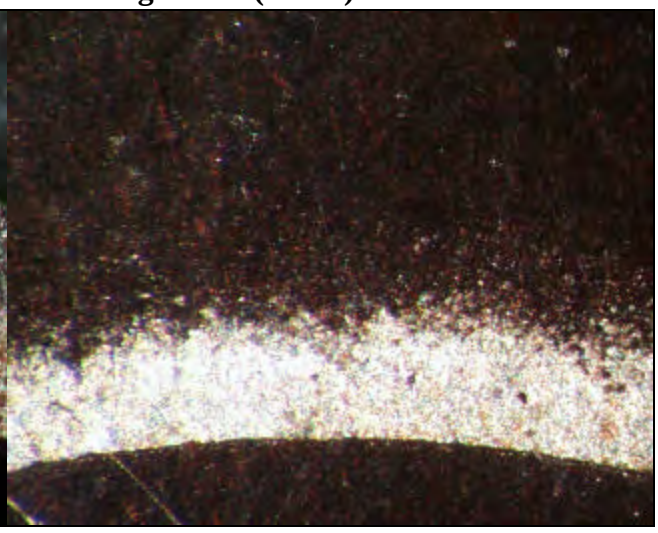
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Control Compressor

TEST HISTORY OF:

Unit Number 24
Model # RS43C1E-CAV-250 **Serial #** 96F16488
Run Time (hr.) 12011 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 3.8 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0025
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 24
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.03
Water (ppm)	172
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	8.3
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.058
Number of screens	2
Debris in compressor bottom (g)	1.192

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

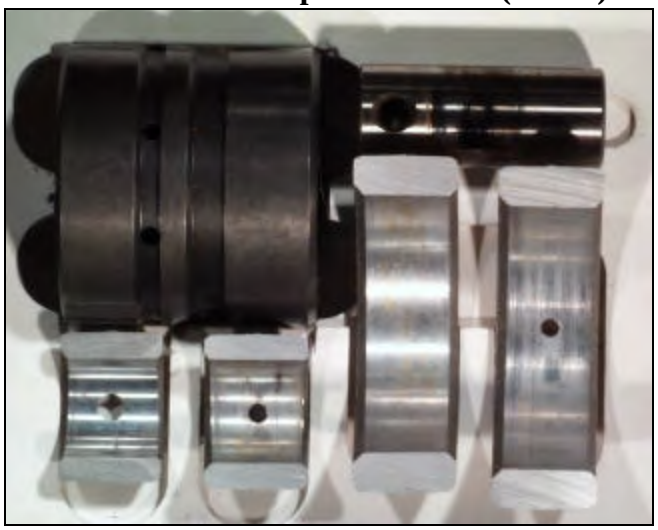
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	brown	gummy
Spring	none	none	none
Spring Seat	very slight	gray	hard
Ball	none	none	none
Front Side	none	none	none

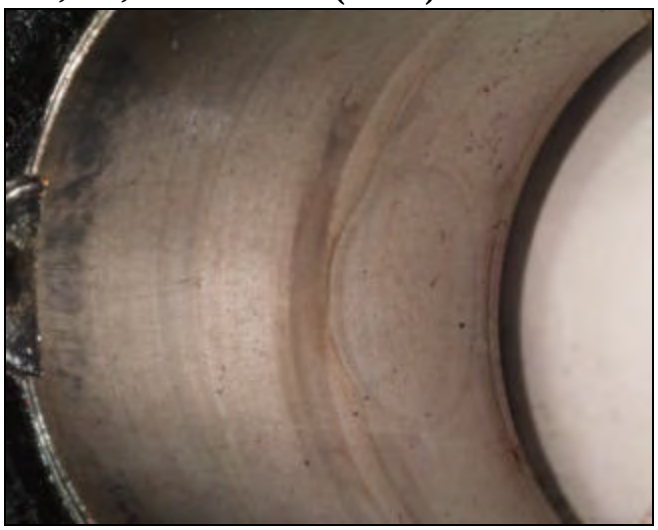
Photographic Documentation of R-507A Control Compressor
185 psig/30 psig

Constant Pressure Expansion Valve (macro)

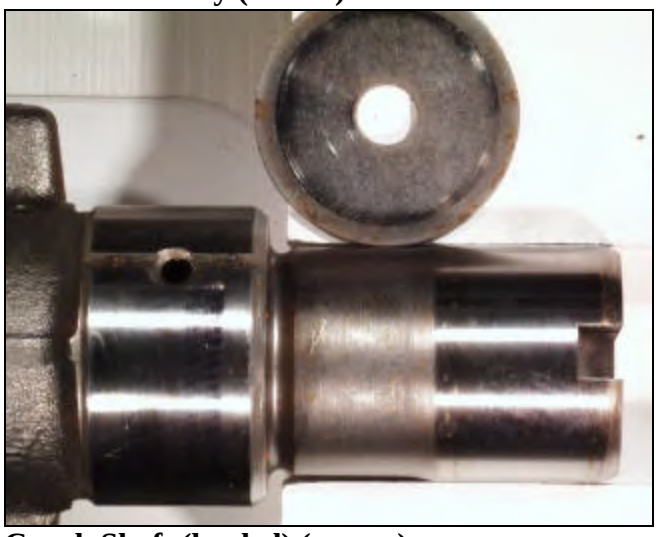
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

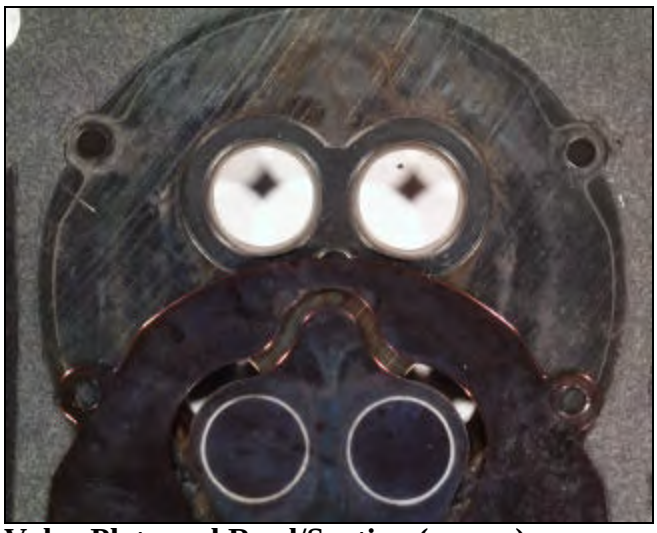


Crank Shaft (loaded) (macro)

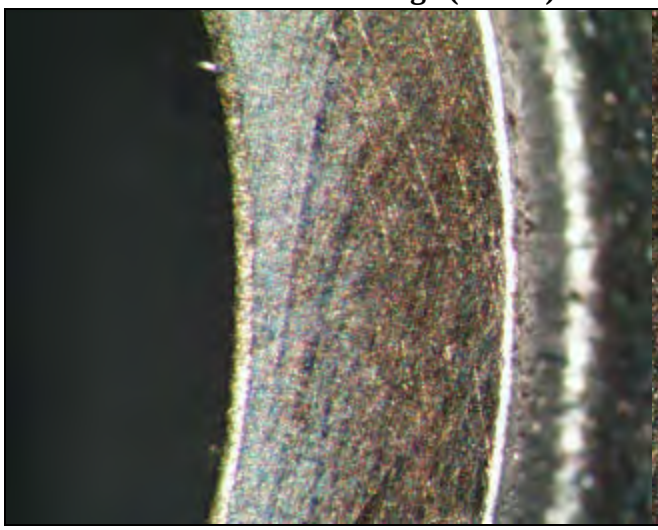
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Control Compressor
185 psig/30 psig

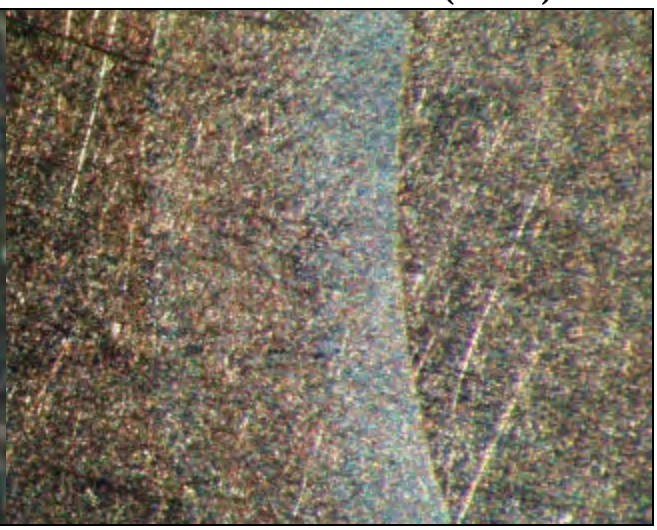
Valve Plate and Reed/Discharge (macro)



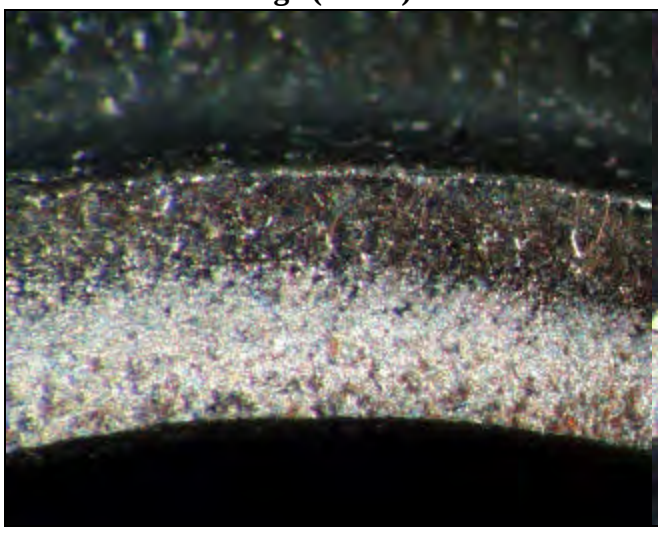
Valve Plate and Reed/Suction (macro)



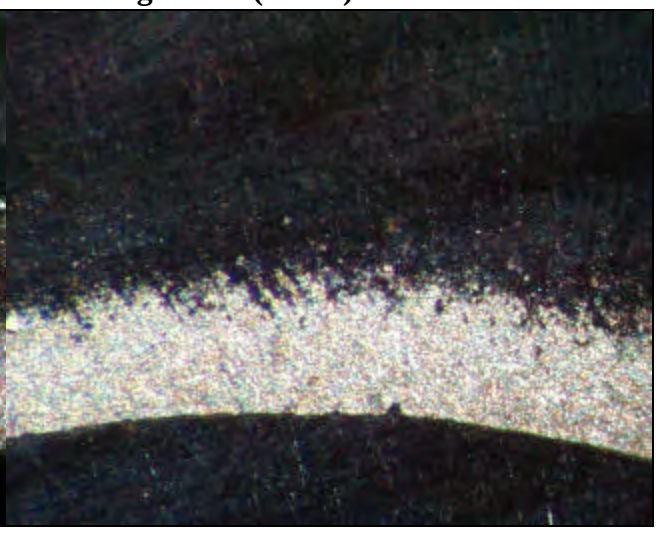
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Control Compressor

TEST HISTORY OF:

Unit Number 25
Model # RS43C1E-CAV-250 **Serial #** 96F16469
Run Time (hr.) 12118 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 3.8 **(3)** 3.8 **(4)** 3.8

Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 7.5 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 14 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 6 **(2)** 6 **(3)** 6 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 25
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	184
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	7.2
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.060
Number of screens	2
Debris in compressor bottom (g)	0.644

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

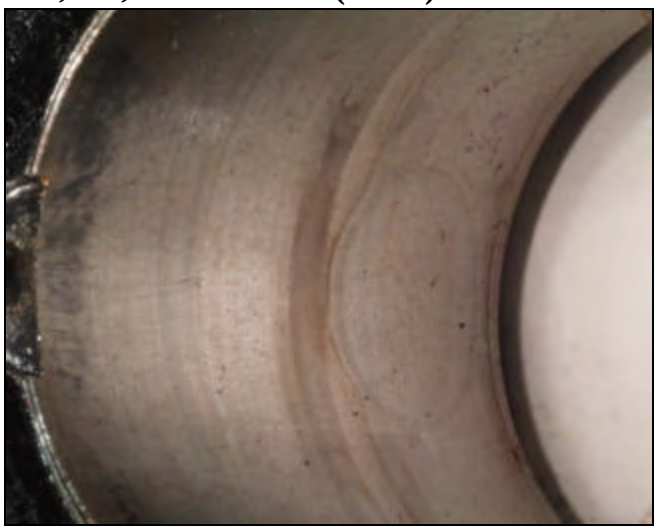
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	gray	gummy
Spring	none	none	none
Spring Seat	very slight	gray	hard
Ball	very slight	gray	hard
Front Side	none	none	none

Photographic Documentation of R-507A Control Compressor
185 psig/30 psig

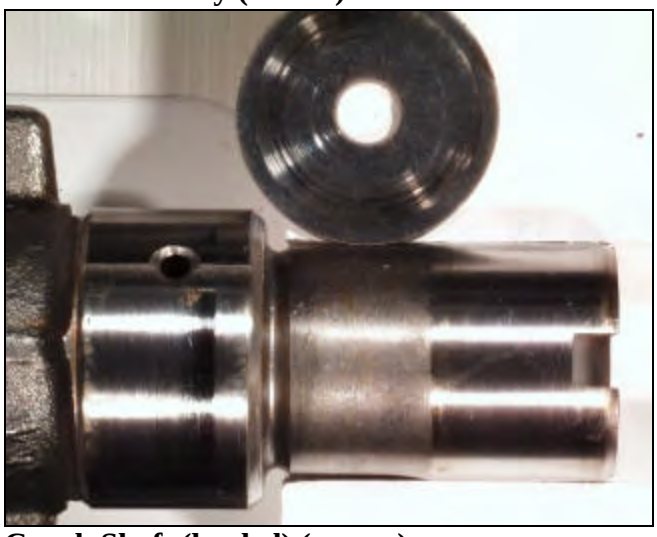
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

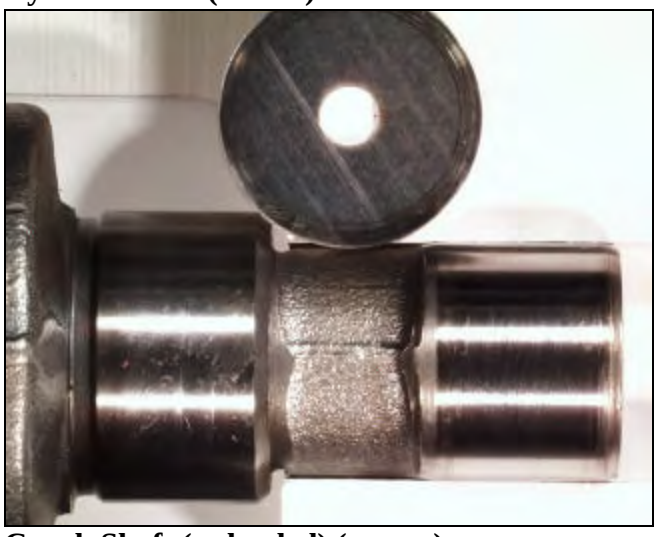
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

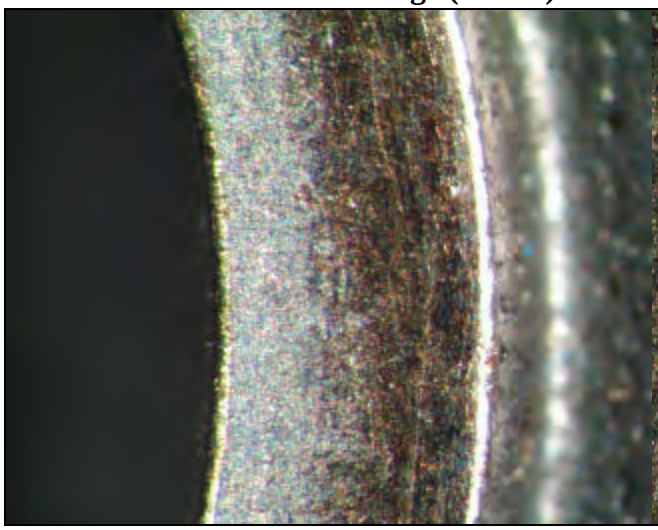


Crank Shaft (unloaded) (macro)

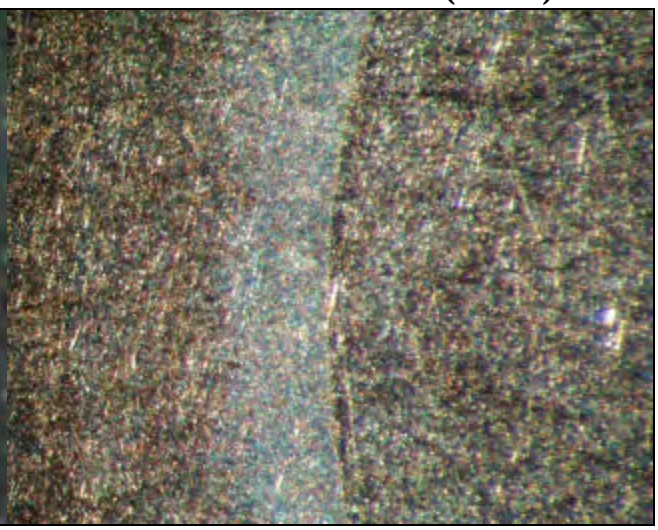
Photographic Documentation of R-507A Control Compressor
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

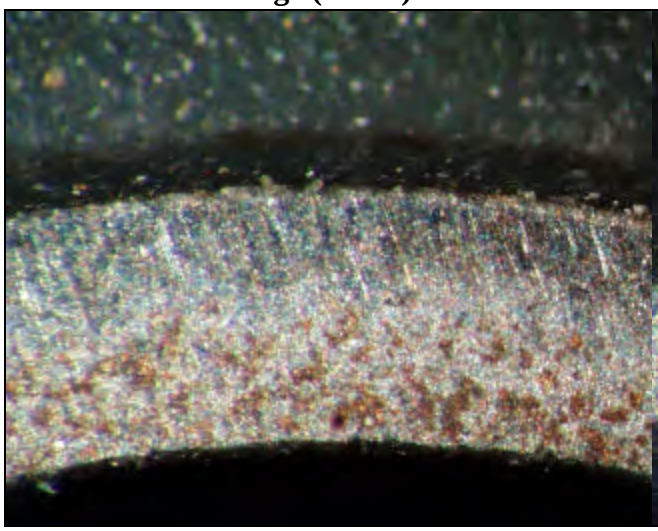
Valve Plate and Reed/Suction (macro)



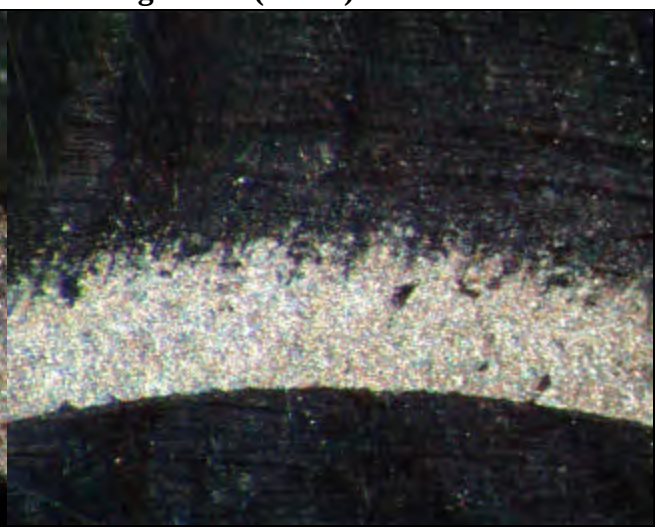
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant R-502

TEST HISTORY OF:

Unit Number 26
Model # RS43C1E-CAV-250 **Serial #** 96F16514
Run Time (hr.) 12001 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2 **(2)** 5 **(3)** 3 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 15 **(4)** 17

Head gasket brittle?	no/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 2 **(2)** 4 **(3)** 2 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2485
	Unloaded	1.2480
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0005
	Unloaded	1.0005
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	none	
Bottom washer (casting side)		
Appearance	scored/corrosion	
Wear	polish	
Lower bronze bearings		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.0015
	Unloaded	1.0015
Shaft in cage bearing		
Appearance	corrosion	
Wear	none	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2495
	Unloaded	1.2495

TEST HISTORY OF:

Unit Number 26
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.03
Water (ppm)	50
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.145
Number of screens	2
Debris in compressor bottom (g)	0.664

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

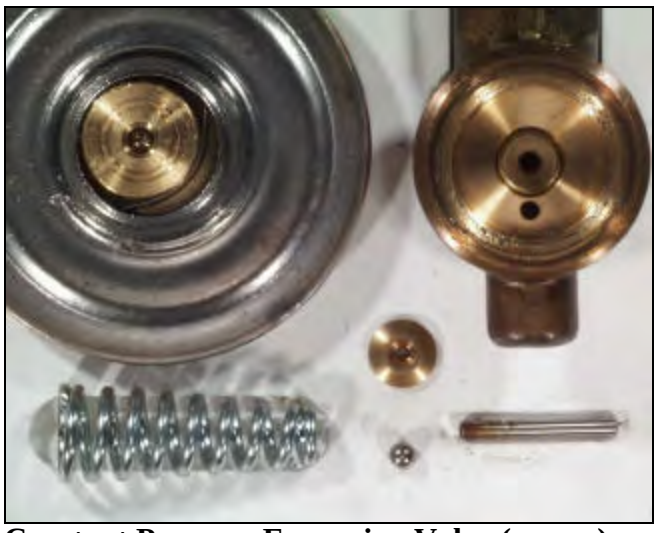
Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	gold-brown	hard
Spring	none	none	none
Spring Seat	none	none	none
Ball	none	none	none
Front Side	very slight	gray	hard

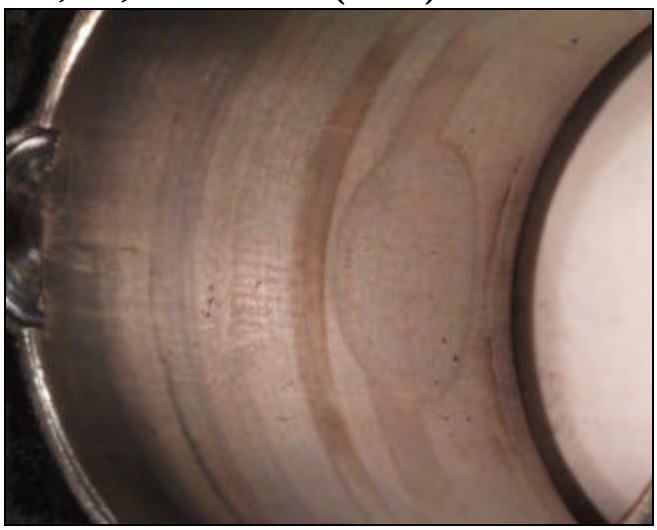
Photographic Documentation of R-507A Compressor with Contaminant R-502
185 psig/30 psig



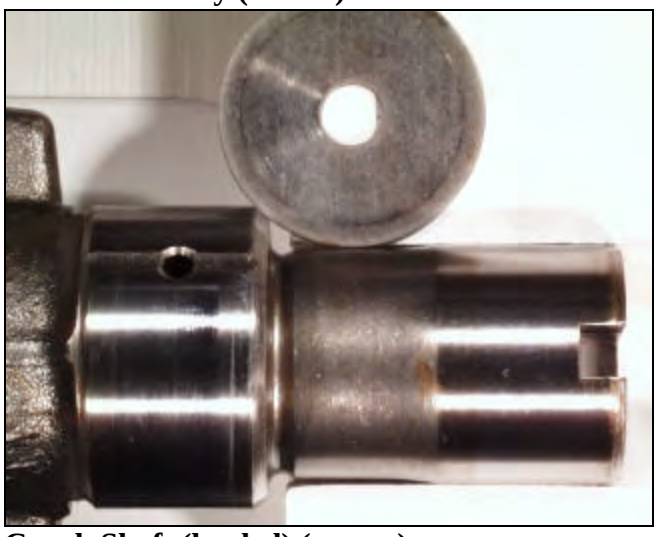
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

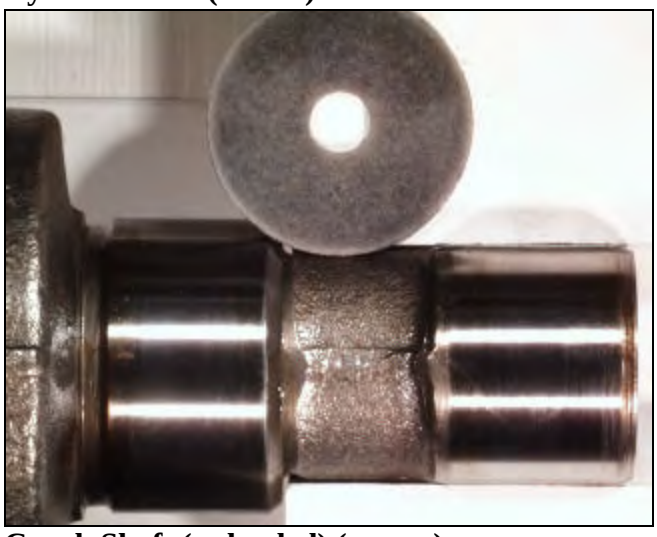
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

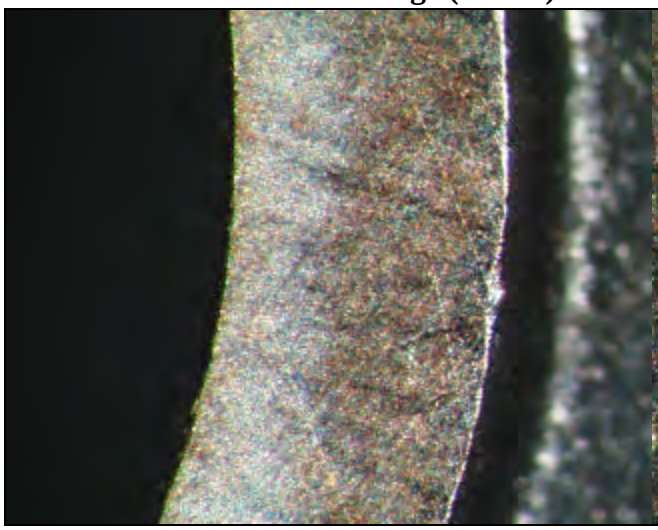


Crank Shaft (unloaded) (macro)

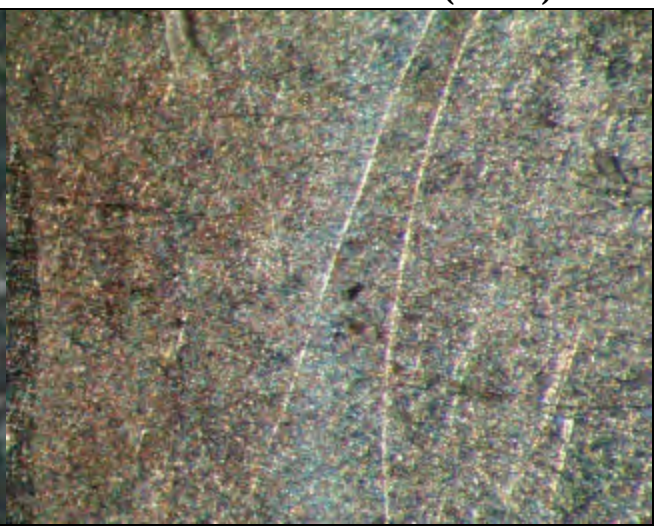
Photographic Documentation of R-507A Compressor with Contaminant R-502
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

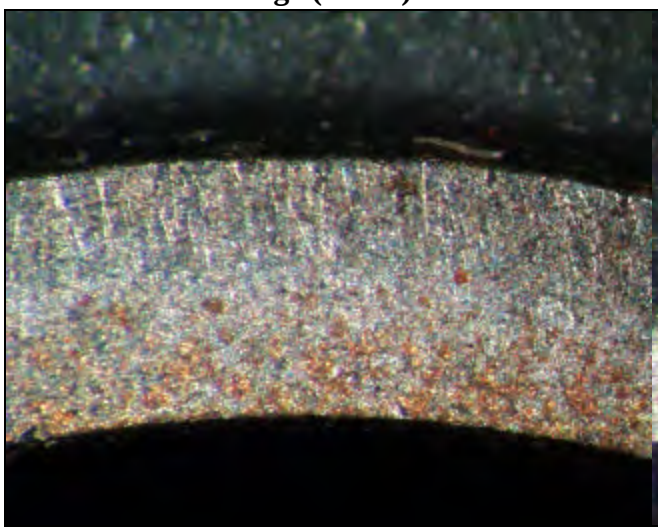
Valve Plate and Reed/Suction (macro)



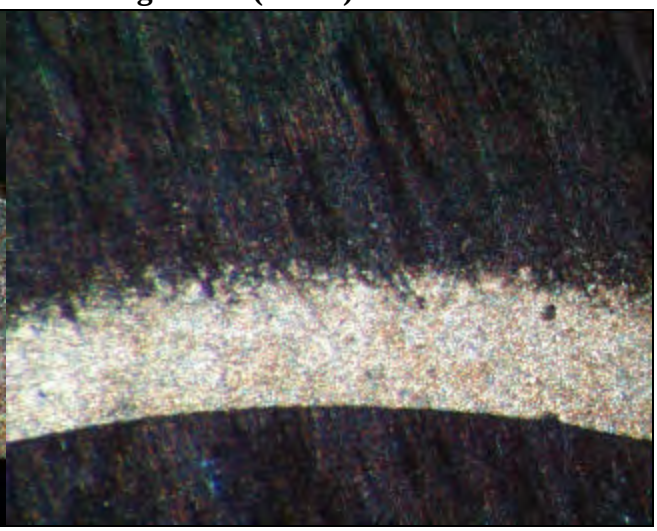
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 27
Model # RS43C1E-CAV-250 **Serial #** 96F16472
Run Time (hr.) 12041 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean/gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 7.5 **(3)** 12 **(4)** 7.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 16 **(2)** 17.5 **(3)** 17.5 **(4)** 17.5

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean/discolored

Remaining torque of cage bearing bolts
(1) 5 **(2)** 2.5 **(3)** 2.5 **(4)** 5

Crank journals
Appearance clean
Wear polish, medium
Dimensions **Loaded** 1.2460
Unloaded 1.2460

Lower crank bearing journal
Appearance clean
Wear slight
Dimensions **Loaded** 0.9980
Unloaded 0.9940

Bottom thrust washer (crank side)
Appearance scored/corrosion
Wear medium

Bottom washer (casting side)
Appearance scored
Wear heavy

Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3735
Unloaded 1.3730

Cylinder bore
Appearance low wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 27
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	261
Fluoride ion (ppm)	2.3
Chloride ion (ppm)	12
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.043
Number of screens	2
Debris in compressor bottom (g)	0.726

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

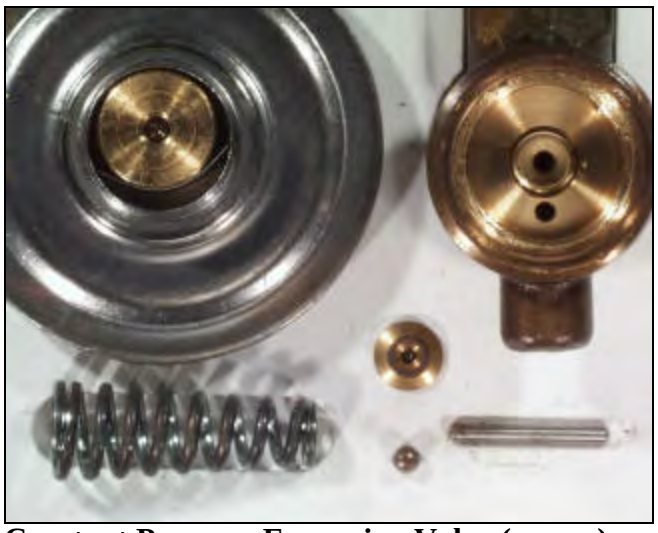
Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

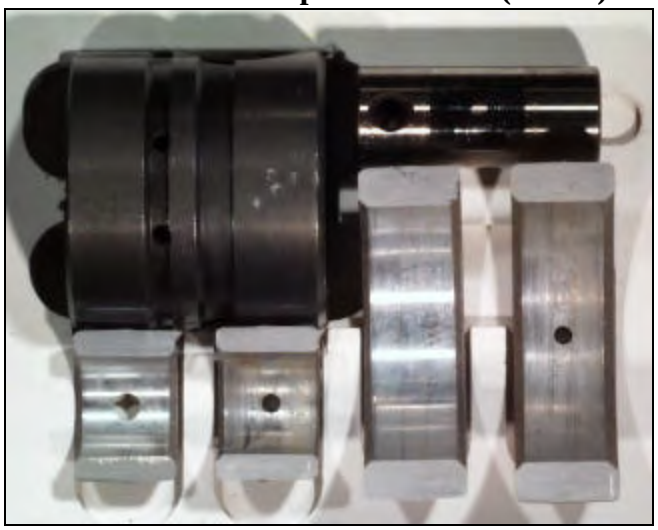
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	gray, black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	gray, brown	gummy
Spring	medium	black	gummy
Spring Seat	very slight	gray	gummy
Ball	medium	black	gummy
Front Side	slight	black	hard

Photographic Documentation of R-507A Compressor with Contaminant Acid
185 psig/30 psig



Constant Pressure Expansion Valve (macro)

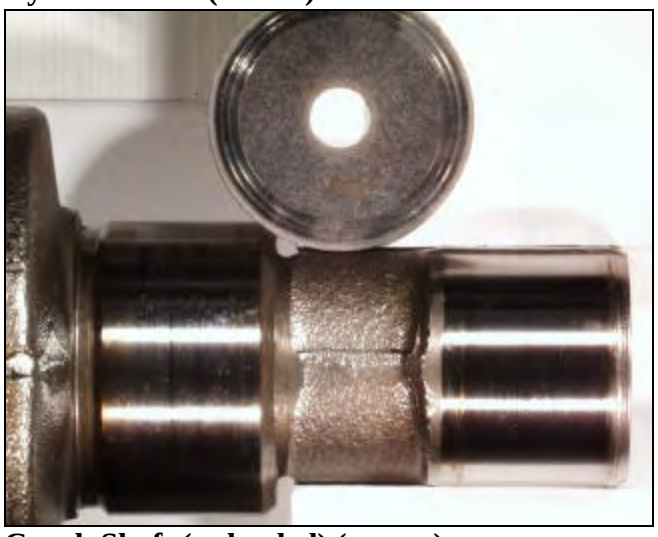
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

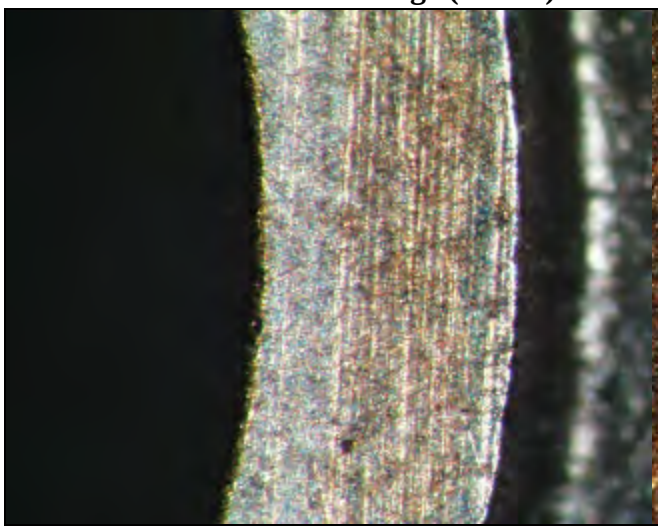


Crank Shaft (unloaded) (macro)

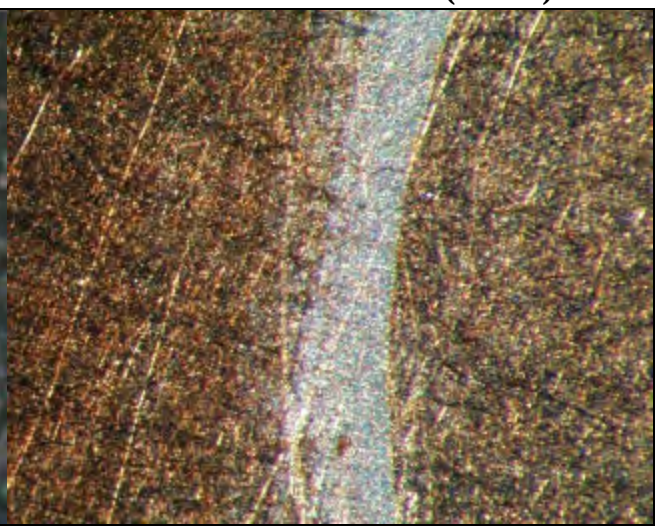
Photographic Documentation of R-507A Compressor with Contaminant Acid
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

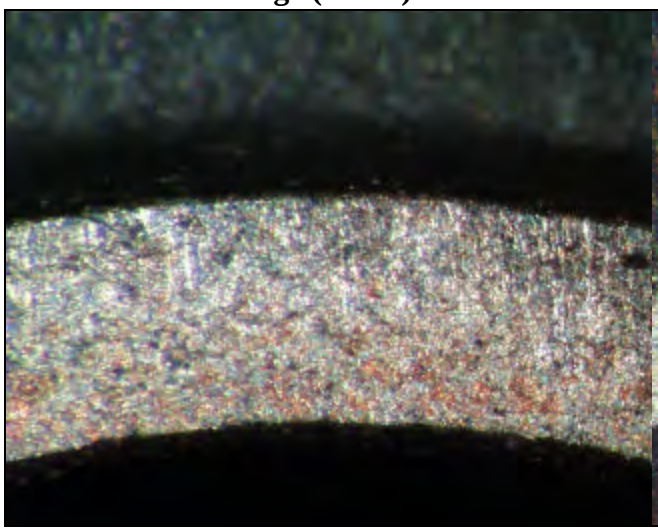
Valve Plate and Reed/Suction (macro)



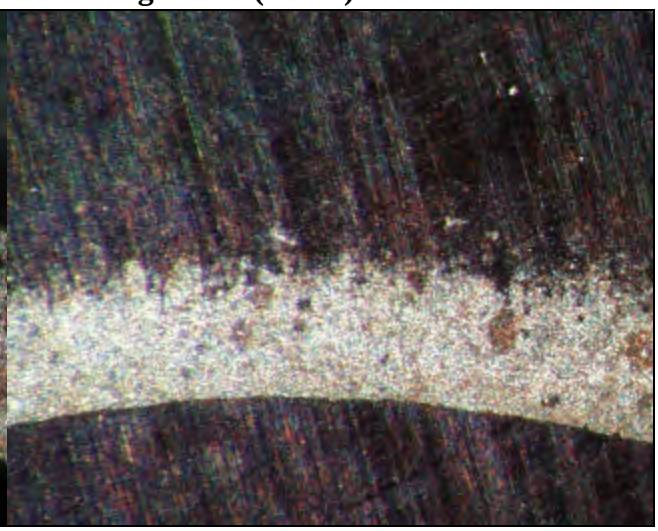
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 28
Model # RS43C1E-CAV-250 **Serial #** 96F16461
Run Time (hr.) 12005 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 5

Remaining torque of stator bolts
(1) 5 **(2)** 10 **(3)** 7.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 12.5 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 7.5

Crank journals		
Appearance	clean	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	slight	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish/slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish/slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear/Cu plating	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 28
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish, medium	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.04
Water (ppm)	96
Fluoride ion (ppm)	1.7
Chloride ion (ppm)	9.2
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.017
Number of screens	1
Debris in compressor bottom (g)	0.683

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

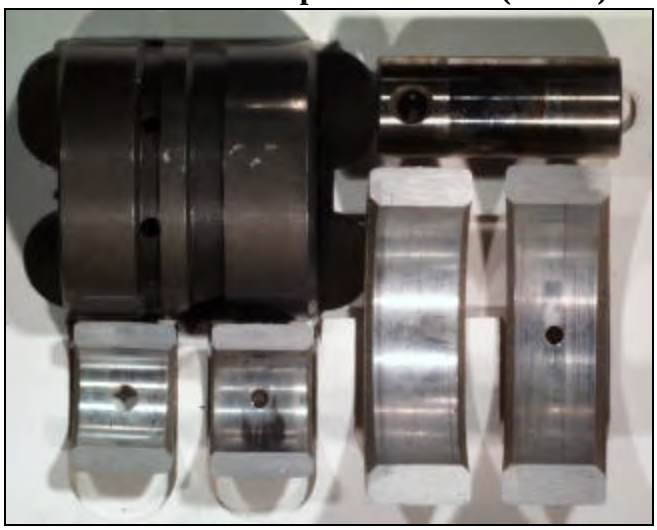
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	heavy	gray, black	hard
Spring Seat	none	none	none
Ball	medium	black	hard
Front Side	slight	black	gummy

Photographic Documentation of R-507A Compressor with Contaminant Air
185 psig/30 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

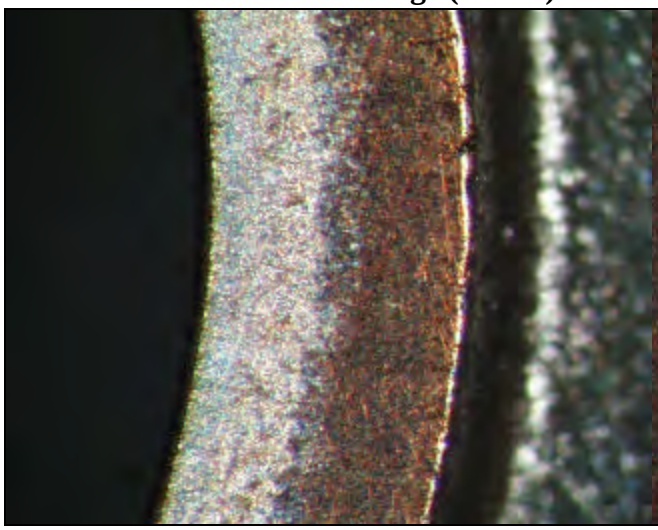
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Air
185 psig/30 psig

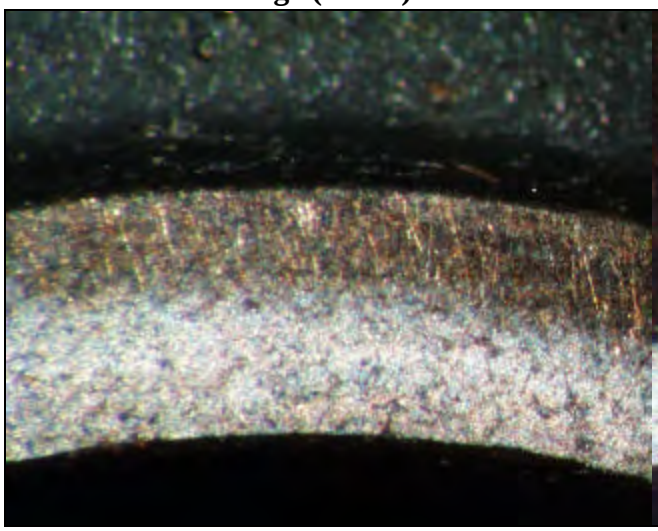
Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

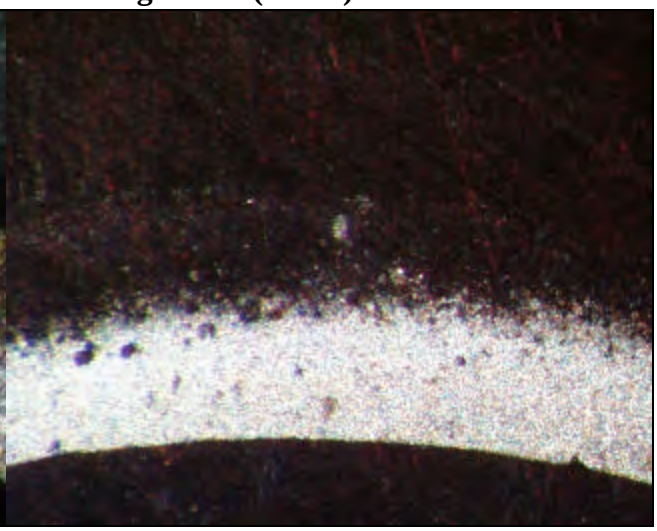


Valve Plate/Discharge (micro)

Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid and R-502

TEST HISTORY OF:

Unit Number 29
Model # RS43C1E-CAV-250 **Serial #** 96F16464
Run Time (hr.) 12037 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 3
Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 12 **(4)** 16

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean/scored	
Wear	slight	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean/scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	medium	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	none	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3755
Connecting rod (large end)		
Appearance	scored	
Wear	medium	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 29
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.15
Water (ppm)	262
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	7.5
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.075
Number of screens	1
Debris in compressor bottom (g)	0.313

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

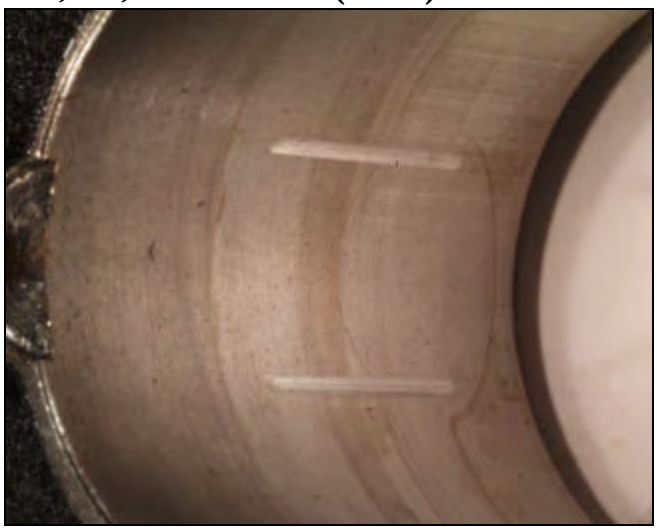
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	brown	hard
Spring	slight	gray	gummy
Spring Seat	slight	black	gummy
Ball	very slight	black	gummy
Front Side	very slight	gray	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid and R-502
185 psig/30 psig

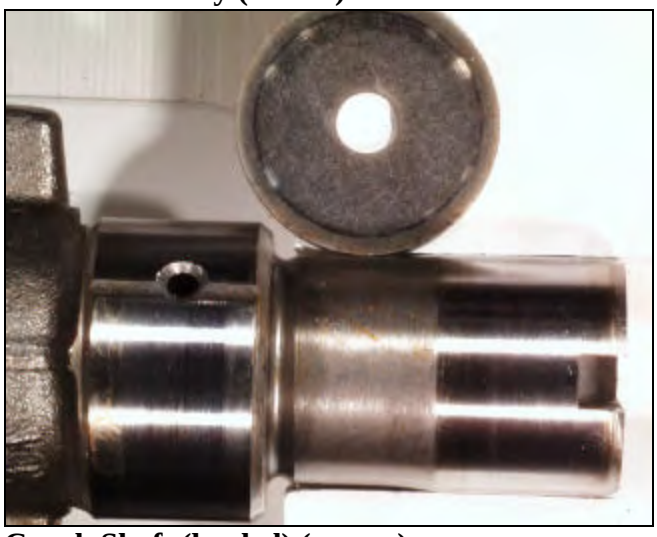
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)



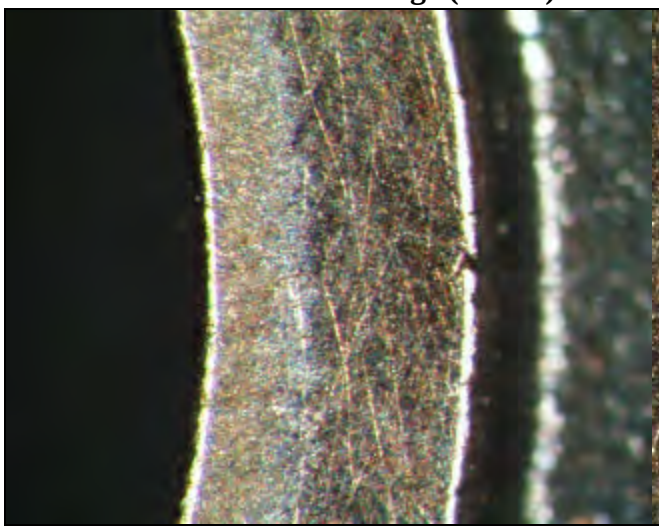
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

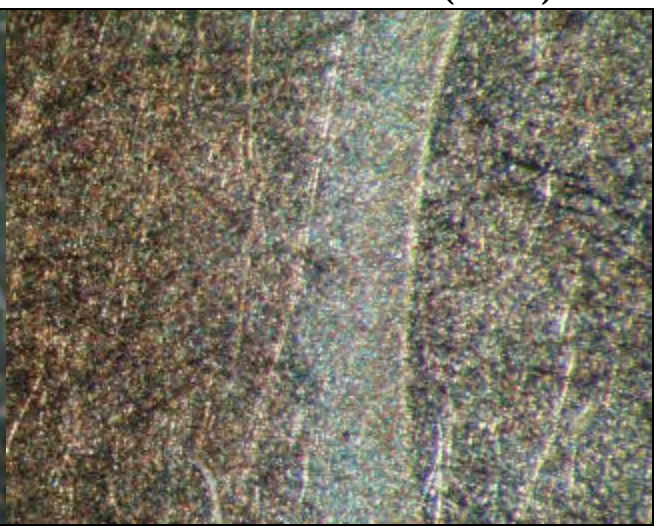
Photographic Documentation of R-507A Compressor with Contaminant Acid and R-502
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

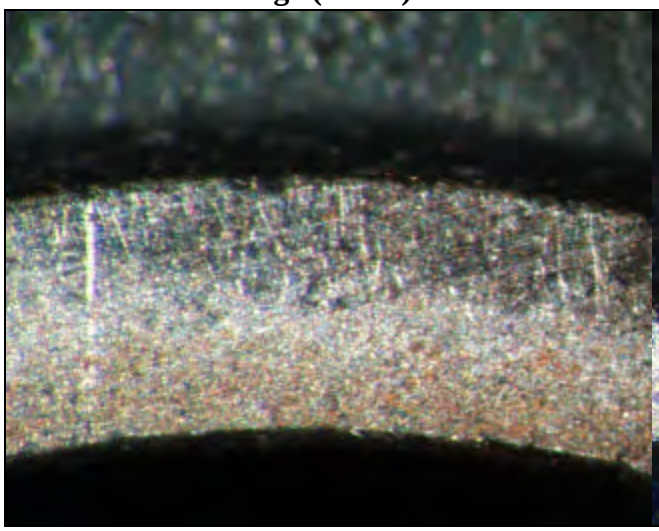
Valve Plate and Reed/Suction (macro)



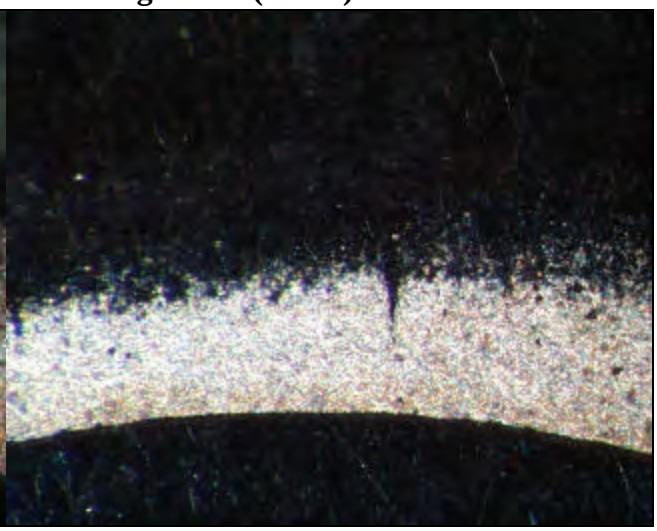
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Air, and R-502

TEST HISTORY OF:

Unit Number 30
Model # RS43C1E-CAV-250 **Serial #** 96F16463
Run Time (hr.) 12060 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig) 185
Suction Pressure (psig) 30
Discharge Temp (°F) 180
Return Gas Temp (°F) 54
SumpTemp (°F) 140

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5
Remaining torque of stator bolts
(1) 7.5 **(2)** 12.5 **(3)** 12.5 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray/Cu
Top stator windings appearance clean
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance clean/corrosion
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 20 **(2)** 20 **(3)** 20 **(4)** 20
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance dirty
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 7.5 **(3)** 5 **(4)** 7.5

Crank journals
Appearance scored
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9995
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion
Wear medium
Bottom washer (casting side)
Appearance clean/bronze plating
Wear polish
Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0040
Unloaded 1.0035
Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/bronze plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear/Cu plating
Varnish ring heavy
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2500
Unloaded 1.2500

TEST HISTORY OF:

Unit Number 30
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)
- **Appearance** contact wear/correct washer/corrosion
- **Wear** slight
- **Dimensions** **Loaded** 0.5015
  Unloaded 0.5010

Piston pin washers appearance
contact wear

Piston pin
- **Appearance** Cu plating
- **Wear** polish
- **Dimensions** **Loaded** 0.4980
  Unloaded 0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.14
Water (ppm)	47
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	7.7
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.115
Number of screens	2
Debris in compressor bottom (g)	1.302

Valve Plate Assembly Inspection

Suction side (reed backer)
- **Condition** good
- **Appearance** corrosion

Suction surface appearance
corrosion/soot

Suction reed
- **Condition** good
- **Appearance** corrosion
- **Trepan** slight
- **Varnish ring** none

Discharge side (reed backer)
- **Condition** good
- **Appearance** blued

Discharge surface appearance
corrosion

Discharge reed
- **Condition** good
- **Appearance** corrosion
- **Trepan** very slight
- **Varnish ring** very slight

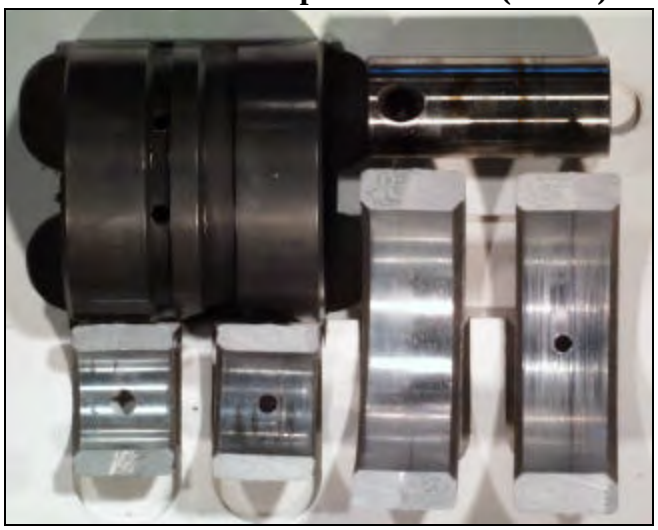
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	medium	black	gummy
Spring Seat	slight	gray	gummy
Ball	slight	black	gummy
Front Side	medium	black	hard

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and R-502
185 psig/30 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



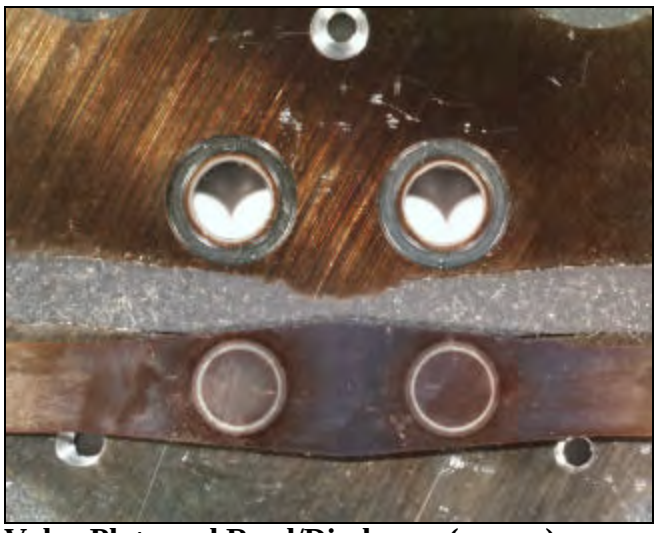
Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

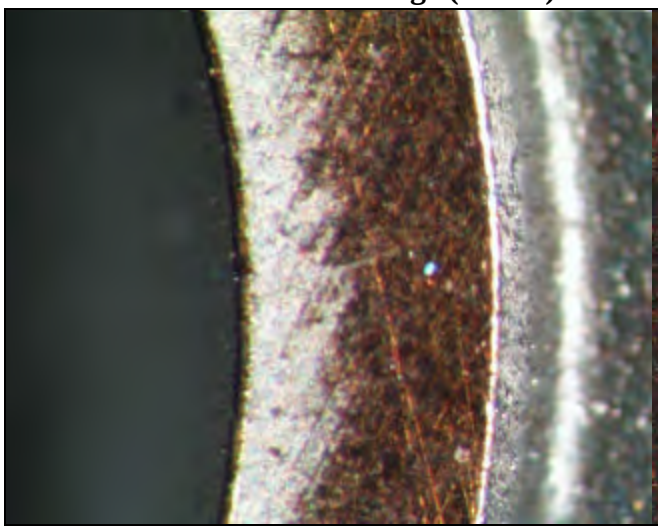
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and R-502
185 psig/30 psig

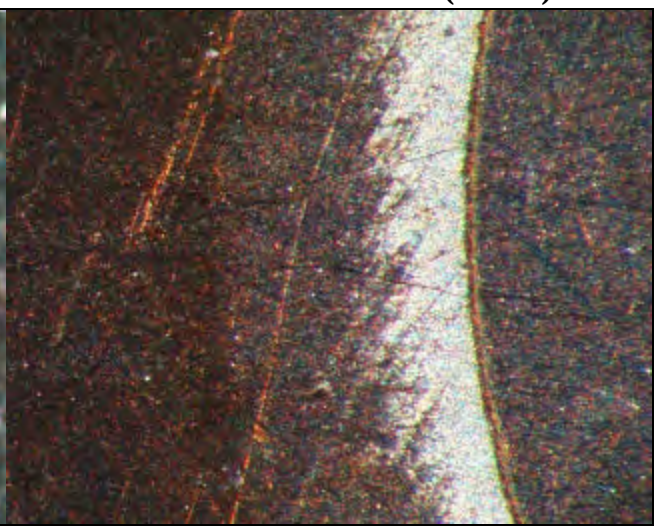


Valve Plate and Reed/Discharge (macro)

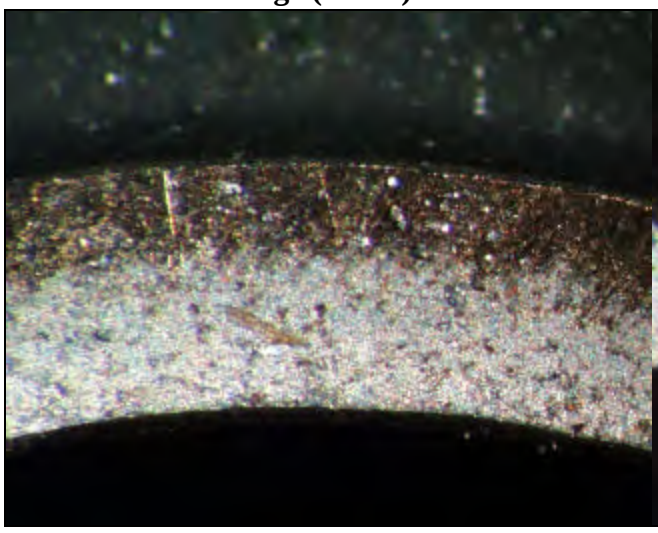
Valve Plate and Reed/Suction (macro)



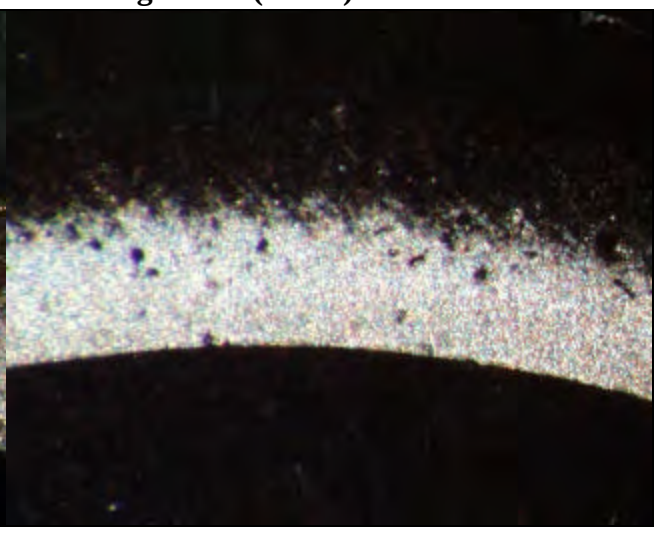
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air and R-502

TEST HISTORY OF:

Unit Number 31
Model # RS43C1E-CAV-250 **Serial #** 96F16490
Run Time (hr.) 12011 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** Yes

Discharge Pressure (psig) 185
Suction Pressure (psig) 30
Discharge Temp (°F) 180
Return Gas Temp (°F) 54
SumpTemp (°F) 140

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5
Suction muffler appearance clean
OEM flux? No
Loose restrictor? No
Discharge plate appearance gray/Cu
Top stator windings appearance clean/stator top Cu
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 15 **(2)** 12.5 **(3)** 15 **(4)** 15
Head gasket brittle? no/bonded
Head suction cavity appearance clean/slight rust
Head discharge cavity appearance dirty
Cage bearing top appearance clean/slightly discolored
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored
Wear polish
Dimensions **Loaded** 1.2460
Unloaded 1.2460
Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9985
Bottom thrust washer (crank side)
Appearance scored/bronze plating
Wear medium
Bottom washer (casting side)
Appearance scored
Wear slight
Lower bronze bearings
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.0030
Unloaded 1.0030
Shaft in cage bearing
Appearance clean
Wear polish
Piston top appearance carbon
Piston skirt
Appearance low wear/bronze plating
Dimensions **Loaded** 1.3735
Unloaded 1.3735
Cylinder bore
Appearance low wear/scored/Cu plating
Varnish ring medium
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2505
Unloaded 1.2505

TEST HISTORY OF:

Unit Number 31
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	Yes

Connecting rod (small end)
Appearance contact wear/correct washer/corrosion
Wear slight
Dimensions **Loaded** 0.5020
Unloaded 0.5010

Piston pin washers appearance
contact wear

Piston pin
Appearance corrosion
Wear medium
Dimensions **Loaded** 0.4990
Unloaded 0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	54
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	5
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.146
Number of screens	1
Debris in compressor bottom (g)	1.314

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion
Suction reed
Condition good
Appearance corrosion
Trepan slight
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance blued
Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion/blued
Trepan very slight
Varnish ring very slight

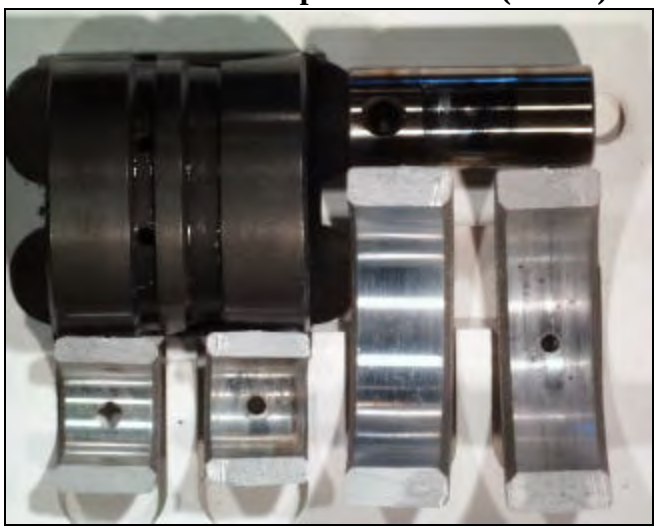
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	black, brown	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	hard
Spring	medium	black	hard
Spring Seat	very slight	gray	gummy
Ball	very slight	gray	gummy
Front Side	slight	black	hard

Photographic Documentation of R-507A Compressor with Contaminant Air and R-502
185 psig/30 psig

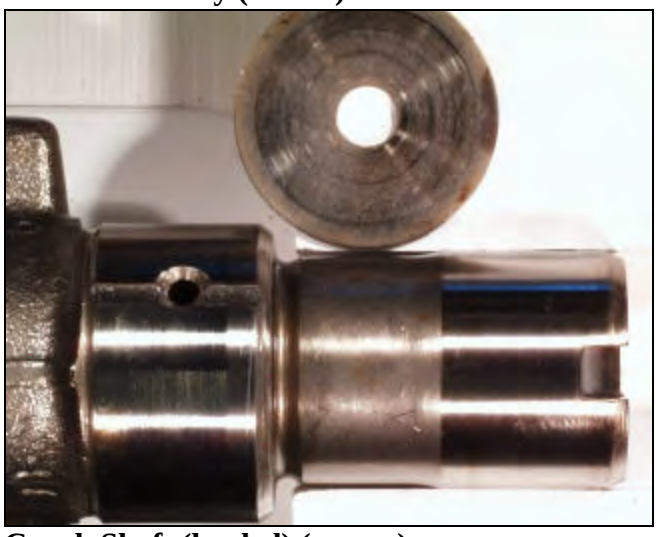
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

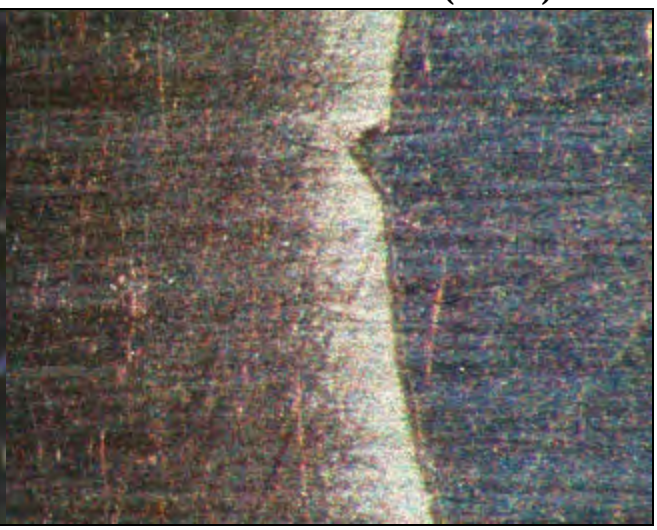
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Air and R-502
185 psig/30 psig

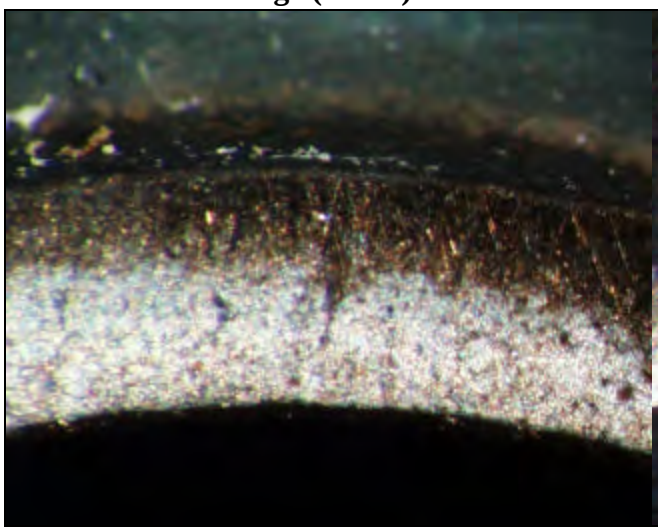
Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

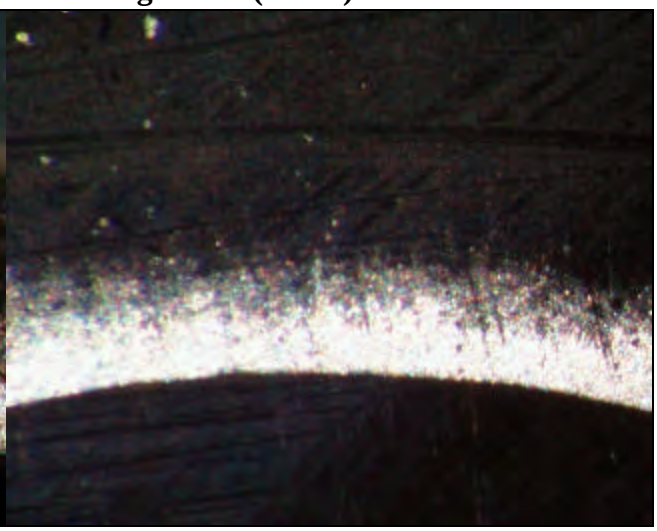
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 32
Model # RS43C1E-CAV-250 **Serial #** 96F16465
Run Time (hr.) 12103 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 3 **(2)** 3 **(3)** 3 **(4)** 4

Remaining torque of stator bolts
(1) 9 **(2)** 10 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/soot
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 9 **(2)** 10 **(3)** 9 **(4)** 9

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2475
	Unloaded	1.2475
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0000
	Unloaded	1.0000
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	scored	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	none	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear/scored	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 32
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	correct washer (only 1)	
Wear	polish, slight	
Dimensions	**Loaded**	0.5000
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.15
Water (ppm)	41
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	8.0
Aluminum (ppm)	1
Copper (ppm)	1
Iron (ppm)	1
Lead (ppm)	2
Silicon (ppm)	5
Tin (ppm)	2
Zinc (ppm)	3

Trash in liquid screen (g)	0.051
Number of screens	1
Debris in compressor bottom (g)	1.357

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/soot

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion/soot

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	none

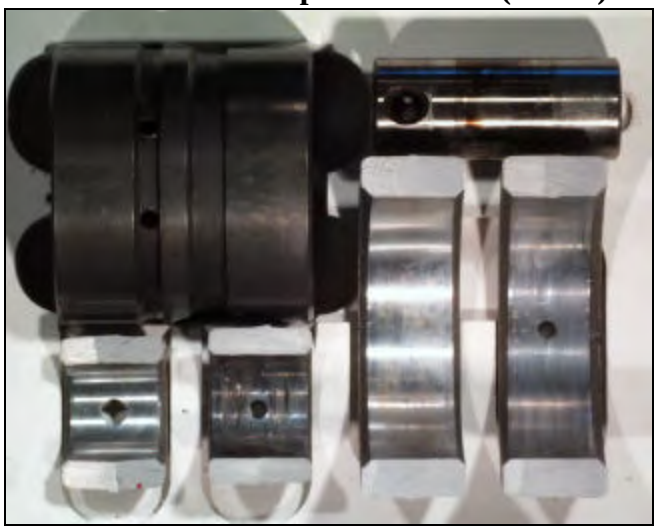
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	gummy
Rear Pin	none	none	none
Equalizer Hole	slight	black	gummy
Tip of Pin	heavy	black, brown	gummy
Spring	medium	gray	gummy
Spring Seat	medium	gray	gummy
Ball	medium	gray	gummy
Front Side	medium	gray	gummy

Photographic Documentation of R-507A Compressor with Contaminant Acid and Air
185 psig/30 psig

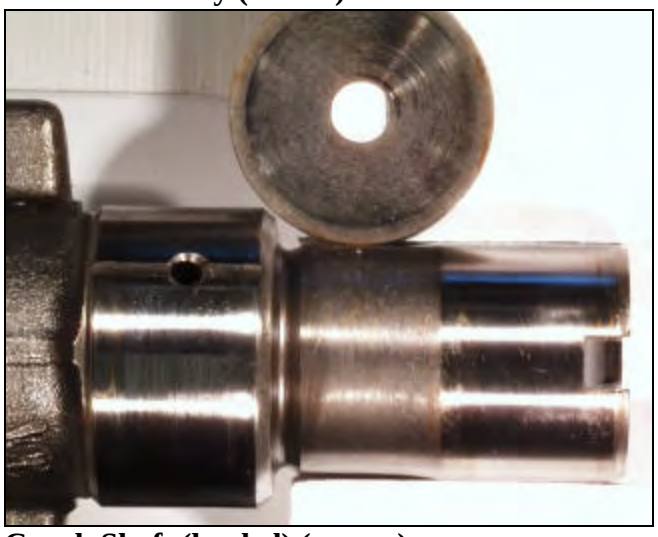
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

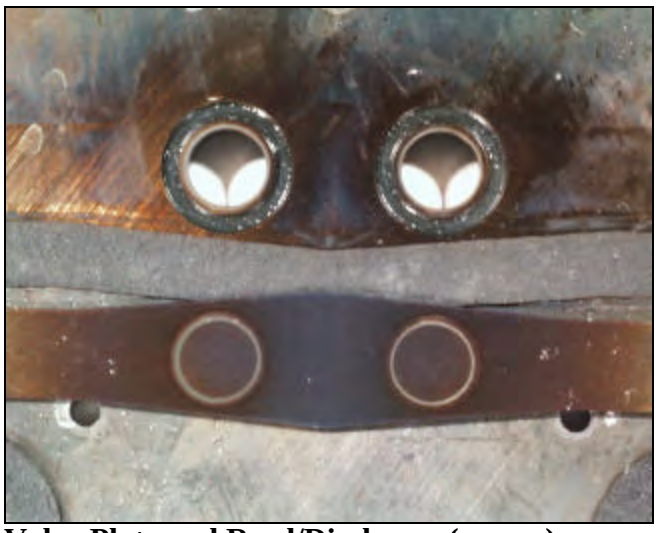
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

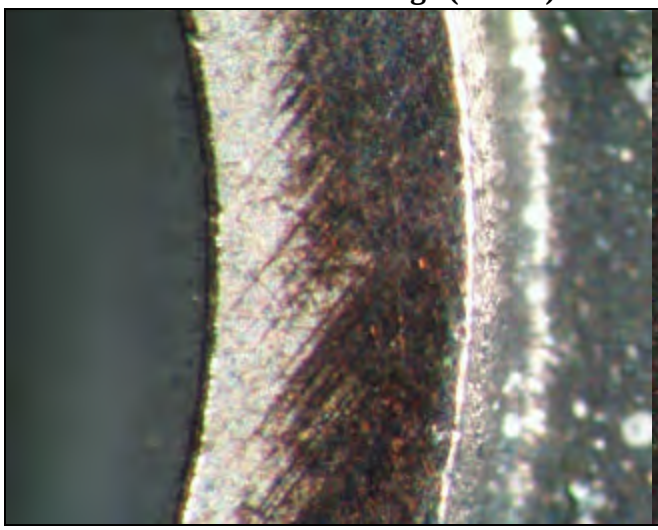
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid and Air
185 psig/30 psig

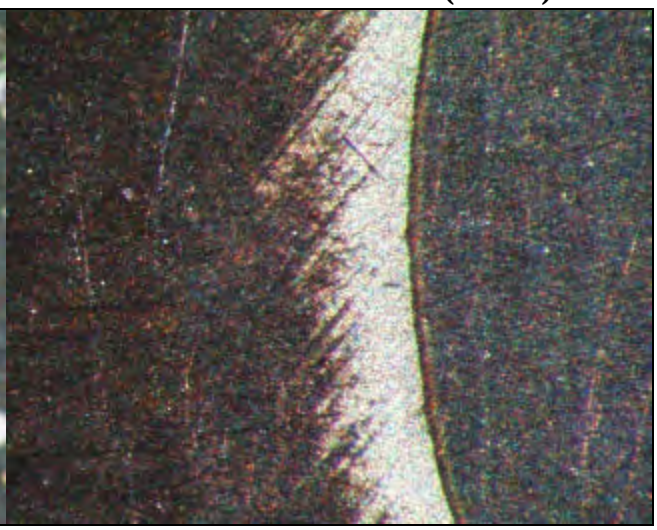


Valve Plate and Reed/Discharge (macro)

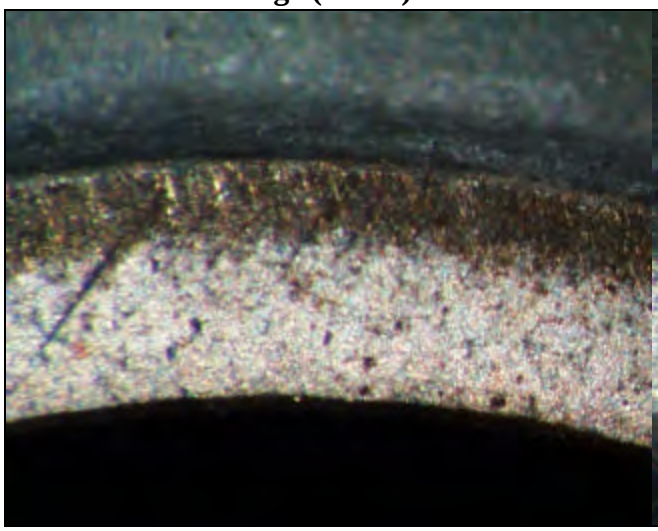
Valve Plate and Reed/Suction (macro)



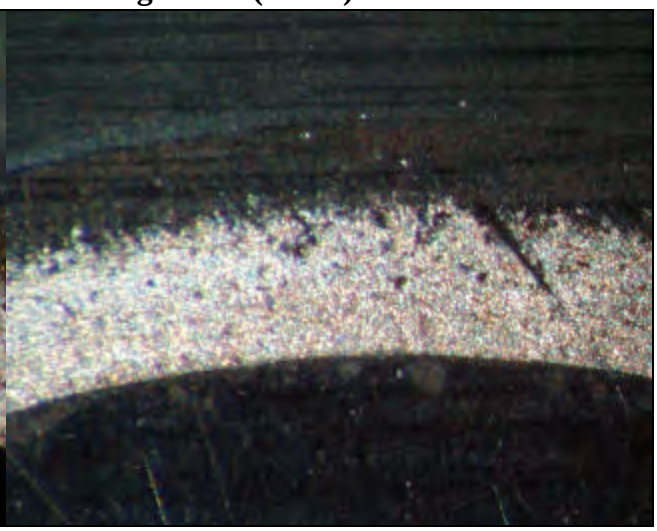
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Water and R-502

TEST HISTORY OF:

Unit Number 33
Model # RS43C1E-CAV-250 **Serial #** 96F16468
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 2.5 **(2)** 2.5 **(3)** 3 **(4)** 3

Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 10 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 7

Crank journals		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3660
	Unloaded	1.3660
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 33
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)

Appearance	correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5000
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	65
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	8.9
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.259
Number of screens	2
Debris in compressor bottom (g)	1.507

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	medium
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

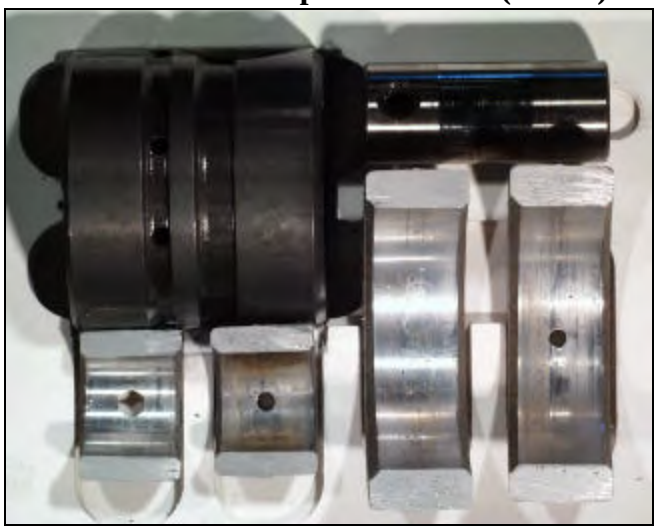
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	brown	hard
Spring	slight	gray	gummy
Spring Seat	very slight	gray	hard
Ball	very slight	gray	gummy
Front Side	slight	gray	hard

Photographic Documentation of R-507A Compressor with Contaminant Water and R-502
185 psig/30 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

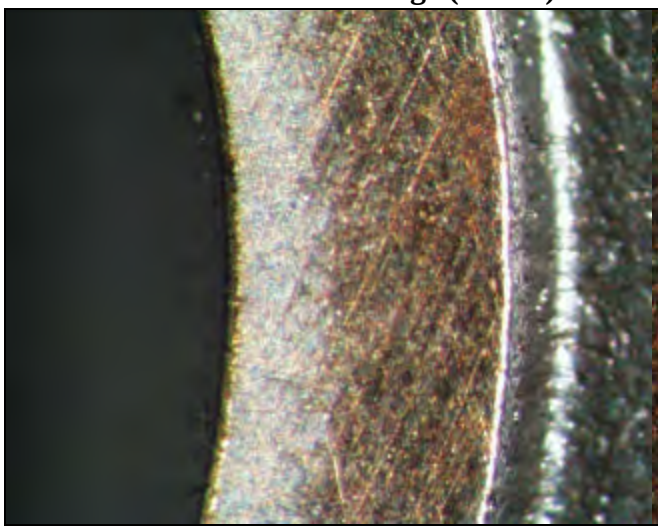
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

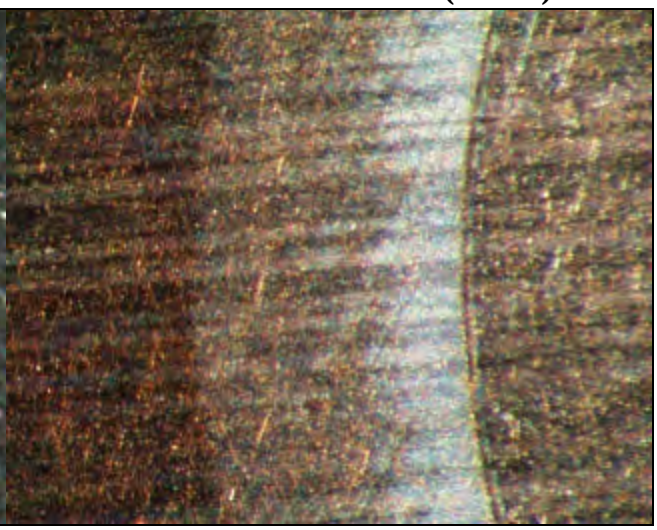
Photographic Documentation of R-507A Compressor with Contaminant Water and R-502
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

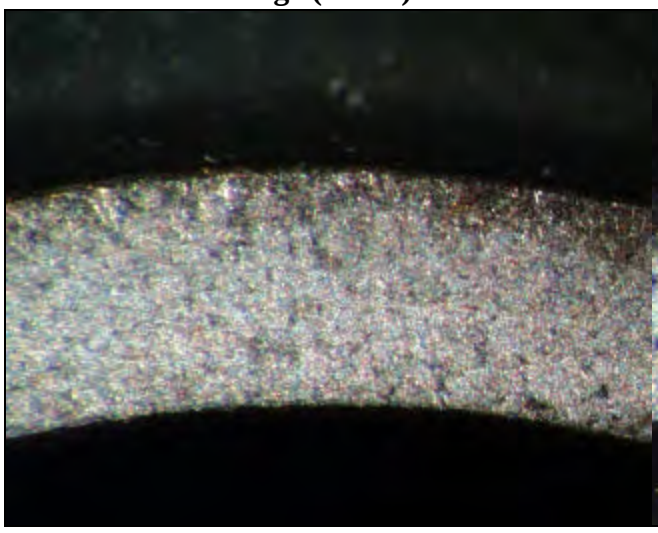
Valve Plate and Reed/Suction (macro)



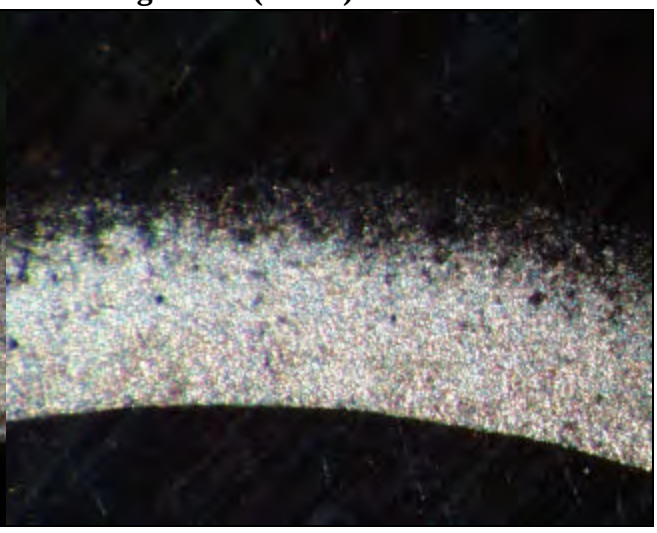
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 34
Model # RS43C1E-CAV-250 **Serial #** 96F16471
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 3 **(4)** 4
Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 10 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/Cu
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 14 **(3)** 14 **(4)** 14

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9940
	Unloaded	0.9940
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	none	
Lower bronze bearings		
Appearance	clean	
Wear	none	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, very slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3670
	Unloaded	1.3670
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 34
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	0.4940
	Unloaded	0.4940

Final Lubricant Values

Total Acid Number (TAN)	0.14
Water (ppm)	125
Fluoride ion (ppm)	2.4
Chloride ion (ppm)	9.6
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	6
Tin (ppm)	1
Zinc (ppm)	2

Trash in liquid screen (g)	0.126
Number of screens	2
Debris in compressor bottom (g)	0.649

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	medium

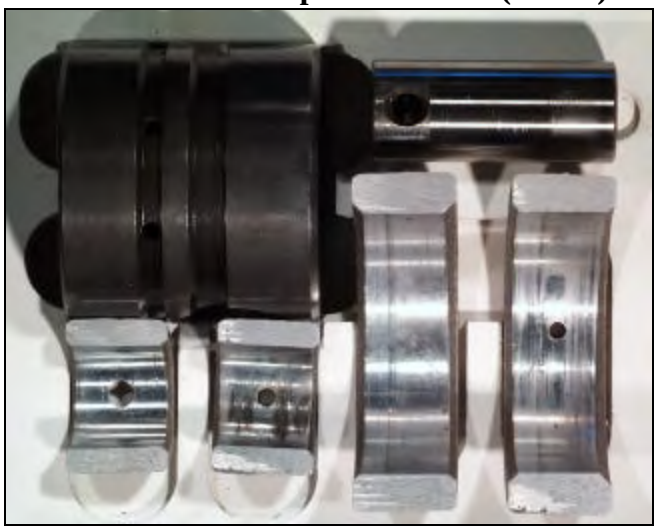
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	brown	hard
Spring	slight	gray	gummy
Spring Seat	none	none	none
Ball	very slight	black	gummy
Front Side	very slight	black	gummy

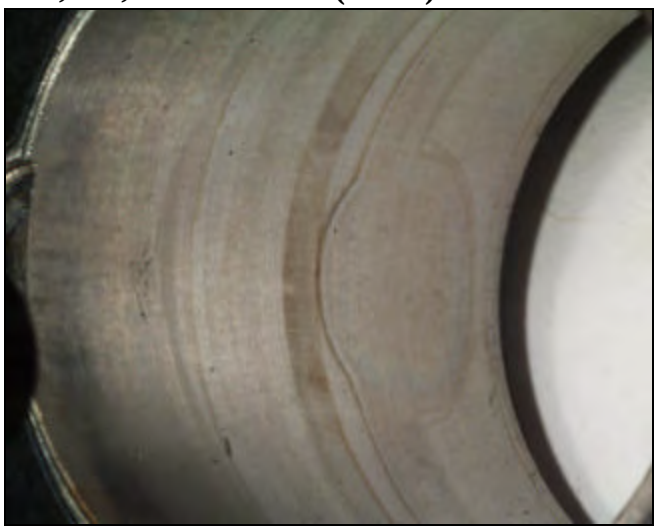
Photographic Documentation of R-507A Compressor with Contaminant Acid and Water
185 psig/30 psig

Constant Pressure Expansion Valve (macro)

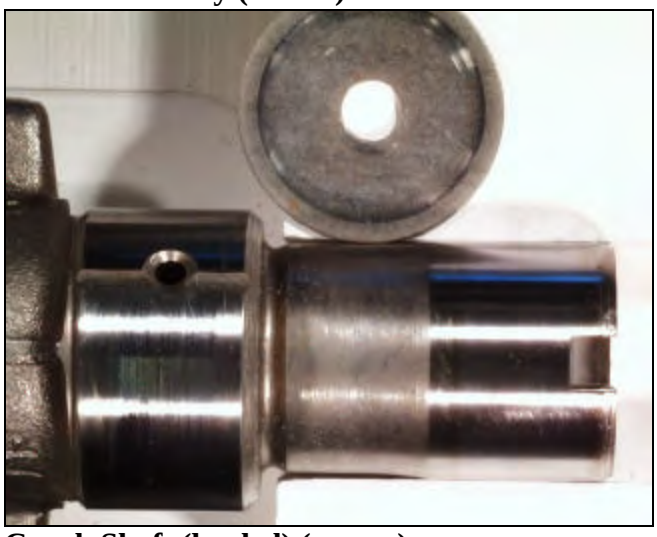
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



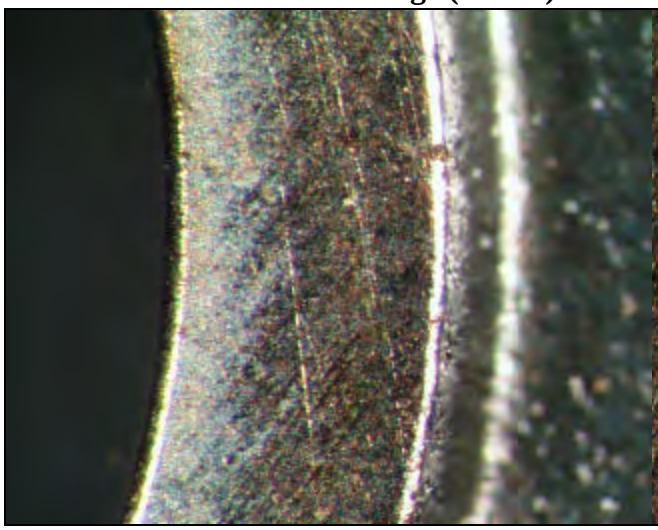
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

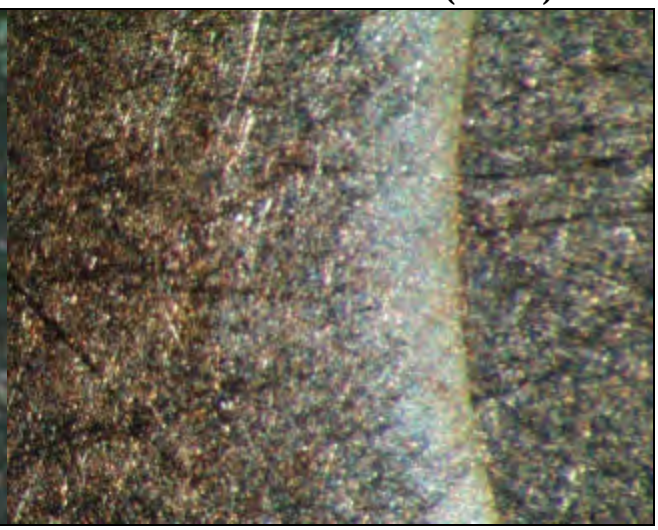
Photographic Documentation of R-507A Compressor with Contaminant Acid and Water
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

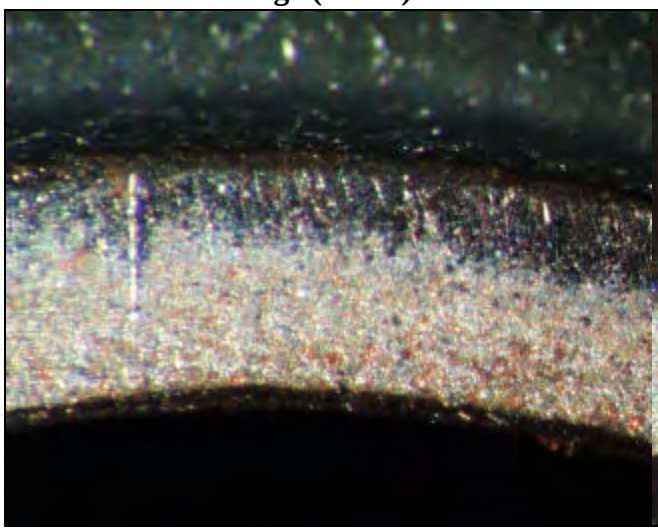
Valve Plate and Reed/Suction (macro)



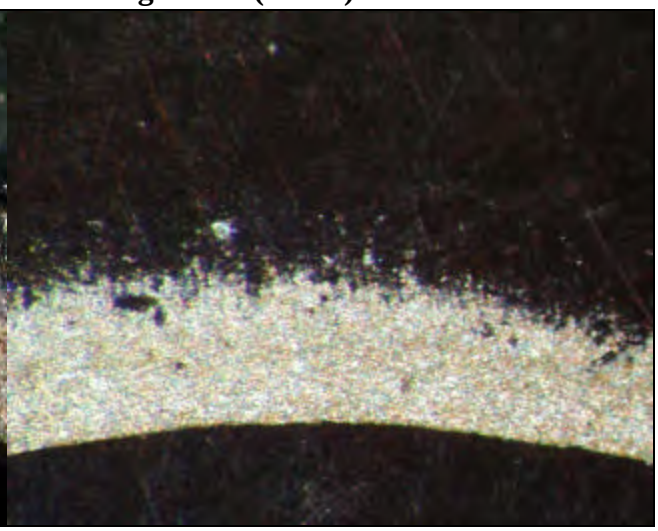
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 35
Model # RS43C1E-CAV-250 **Serial #** 96F16513
Run Time (hr.) 3555 **Failed?** Yes
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) ND **(2)** ND **(3)** ND **(4)** ND
Remaining torque of stator bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean/scored	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	damaged	
Piston skirt		
Appearance	wear/scored	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	medium	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 35
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5025
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	none	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.20
Water (ppm)	100
Fluoride ion (ppm)	2.0
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.064
Number of screens	1
Debris in compressor bottom (g)	0.946

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	broken
Appearance	corrosion

Suction surface appearance
damaged

Suction reed

Condition	broken
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

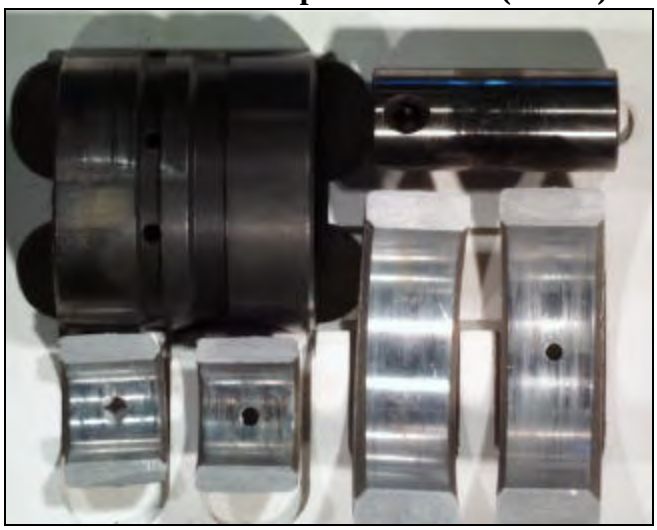
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	brown	gummy
Spring	medium	gray	hard
Spring Seat	medium	black	hard
Ball	very slight	gray	hard
Front Side	none	none	none

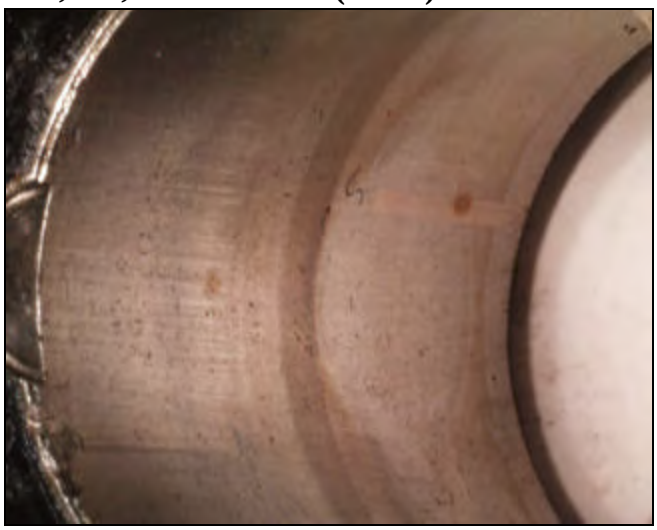
Photographic Documentation of R-507A Compressor with Contaminant Air and Water
185 psig/30 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

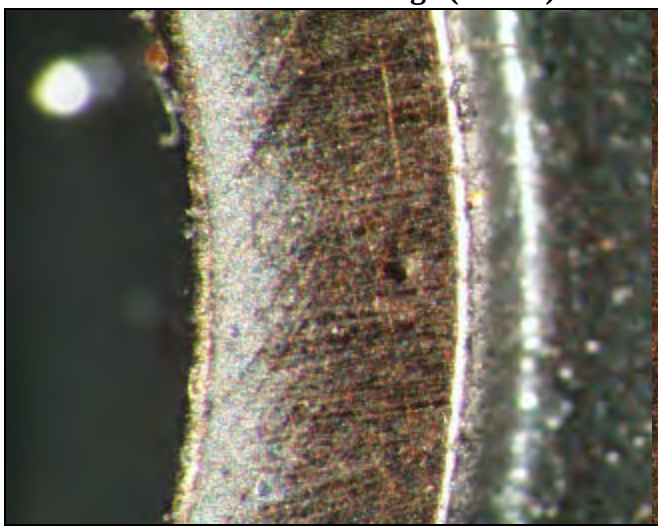
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

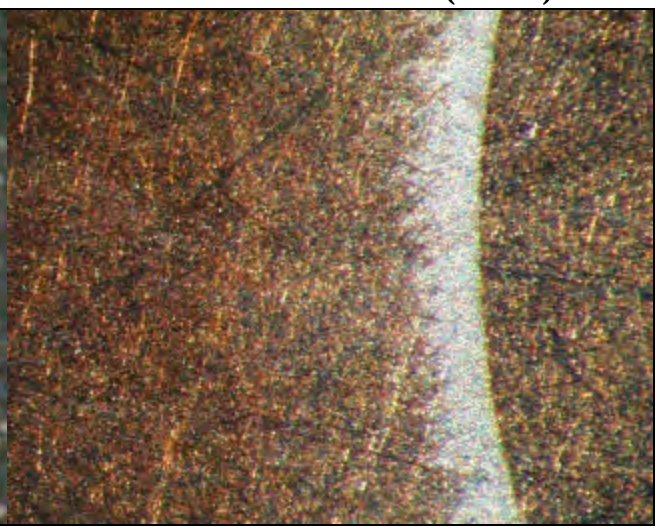
Photographic Documentation of R-507A Compressor with Contaminant Air and Water
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

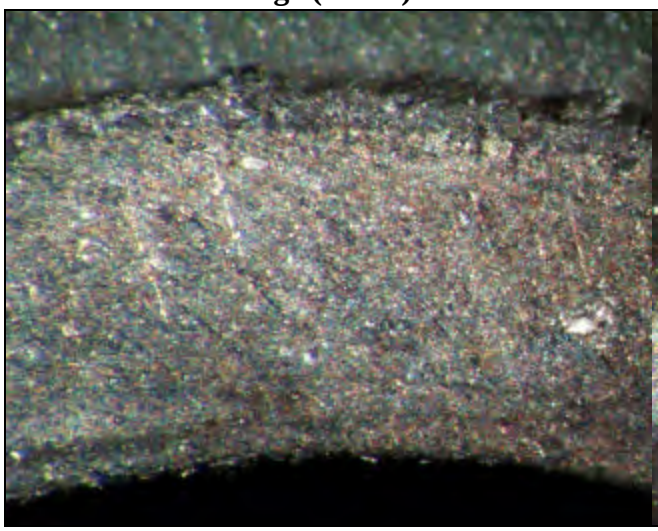
Valve Plate and Reed/Suction (macro)



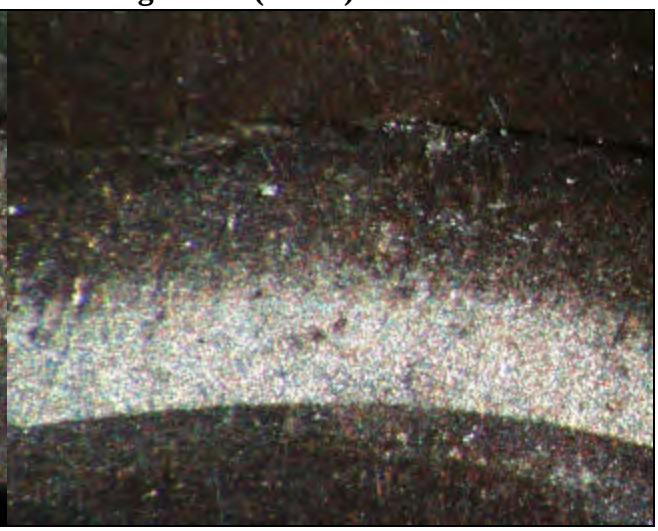
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 36
Model # RS43C1E-CAV-250 **Serial #** 96F16497
Run Time (hr.) 12018 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	none	
Lower bronze bearings		
Appearance	scored	
Wear	none	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	none	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3670
	Unloaded	1.3670
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Connecting rod (large end)		
Appearance	none	
Wear	polish	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2490

TEST HISTORY OF:

Unit Number 36
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	59
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	8.7
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.069
Number of screens	1
Debris in compressor bottom (g)	0.944

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/soot

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion/soot
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued/soot

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/soot
Trepan	very slight
Varnish ring	very slight

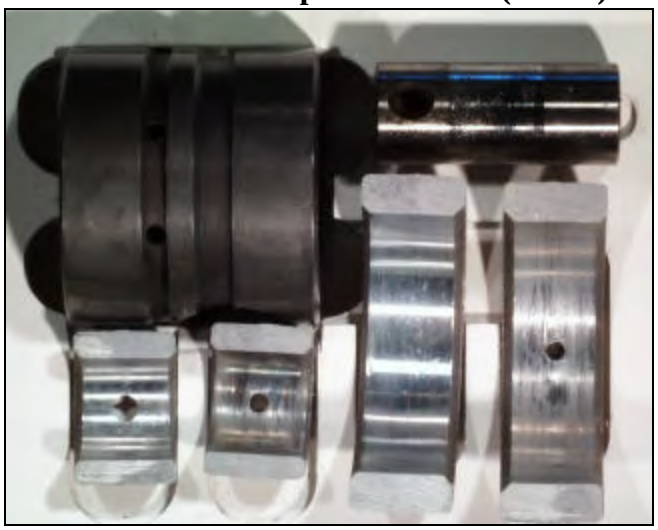
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	gray	gummy
Spring	medium	gray	gummy
Spring Seat	none	none	none
Ball	very slight	gray	gummy
Front Side	very slight	gray	gummy

Photographic Documentation of R-507A Compressor with Contaminant Water
185 psig/30 psig

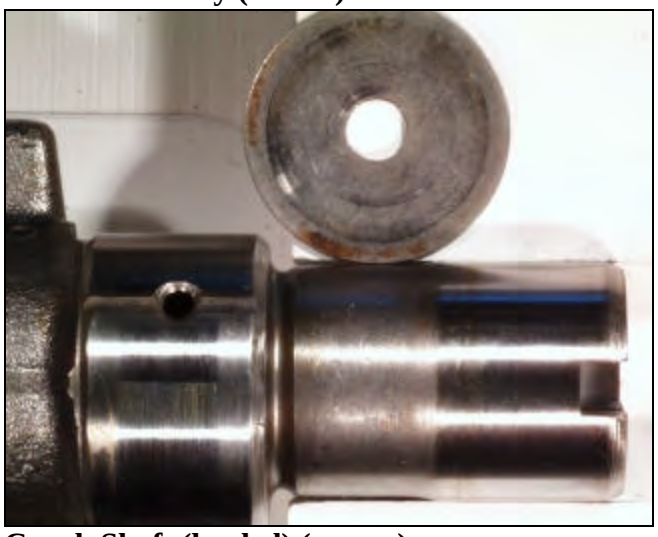
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

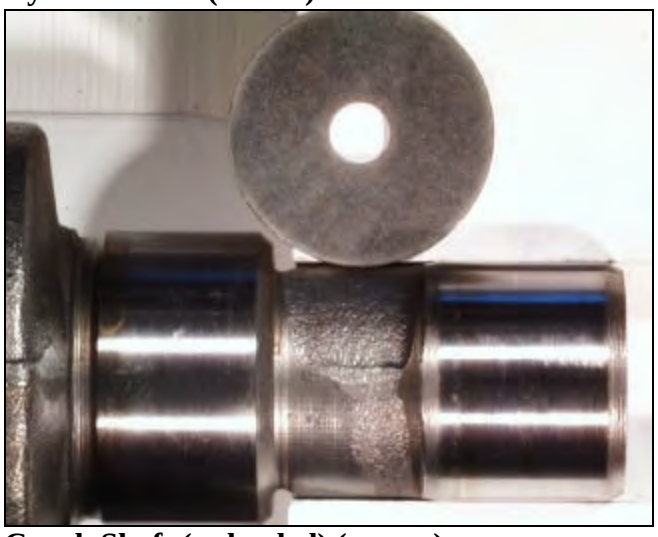


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

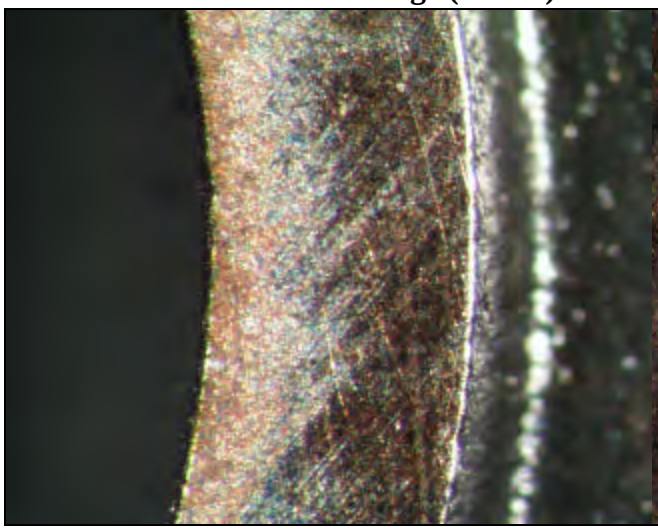


Crank Shaft (unloaded) (macro)

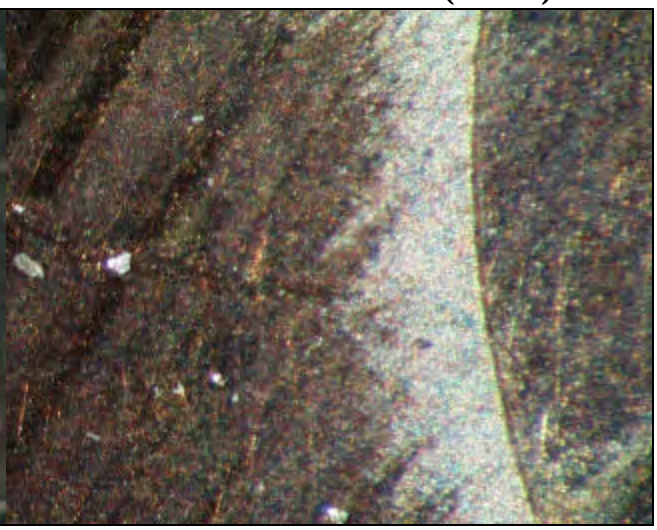
Photographic Documentation of R-507A Compressor with Contaminant Water
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

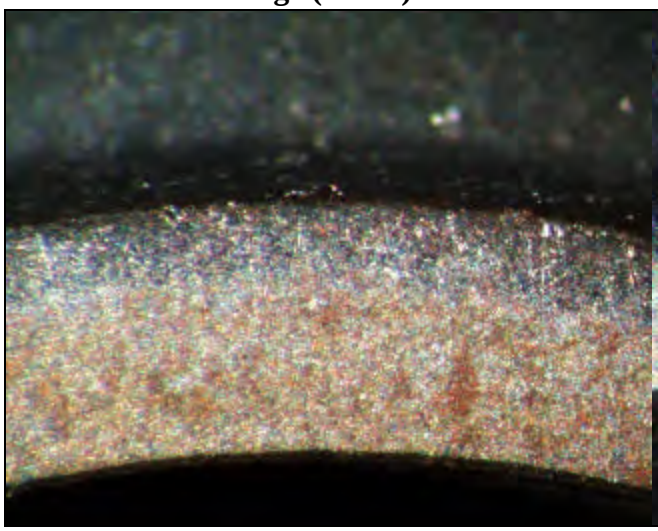
Valve Plate and Reed/Suction (macro)



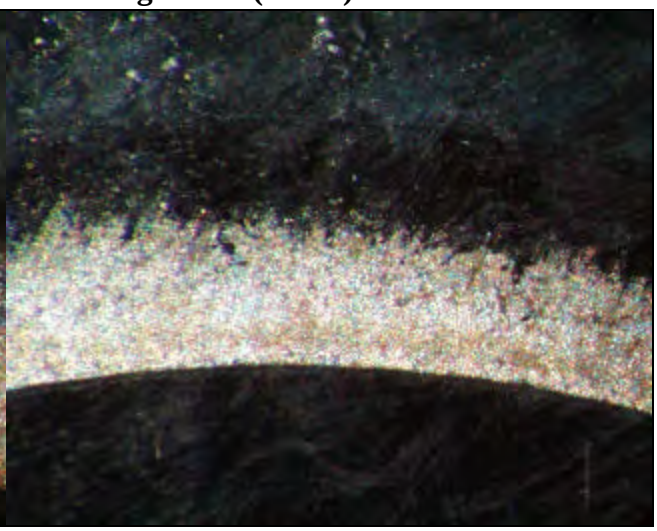
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Water, and R-502

TEST HISTORY OF:

Unit Number 37
Model # RS43C1E-CAV-250 **Serial #** 96F16508
Run Time (hr.) 12007 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5

Remaining torque of stator bolts
(1) 7.5 **(2)** 15 **(3)** 15 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/Cu
Top stator windings appearance	gray/stator top Cu
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 20 **(2)** 17.5 **(3)** 15 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 2.5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/bronze plating	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	wear/Cu plating	
Varnish ring	slight	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3765
Connecting rod (large end)		
Appearance	scored	
Wear	medium	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 37
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5020
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.29
Water (ppm)	139
Fluoride ion (ppm)	2.2
Chloride ion (ppm)	9.0
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.024
Number of screens	1
Debris in compressor bottom (g)	1.318

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

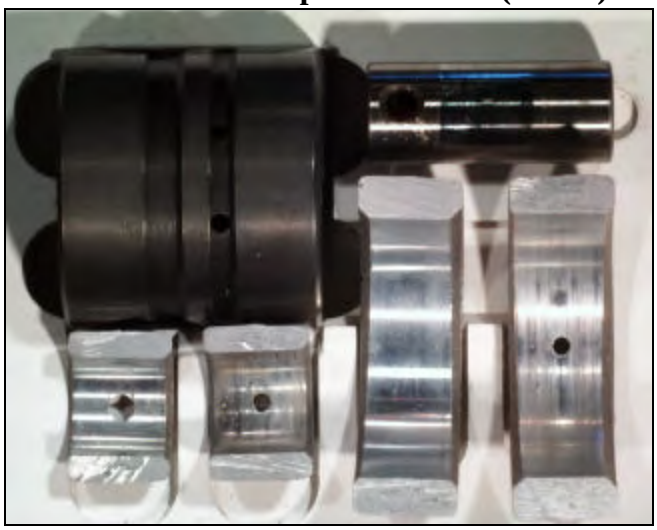
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	purple, brown	gummy
Spring	medium	black	gummy
Spring Seat	very slight	tarnished	hard
Ball	slight	black	hard
Front Side	very slight	tarnished	hard

Photographic Documentation of R-507A Compressor with Contaminant Acid, Water, and R-502 185 psig/30 psig

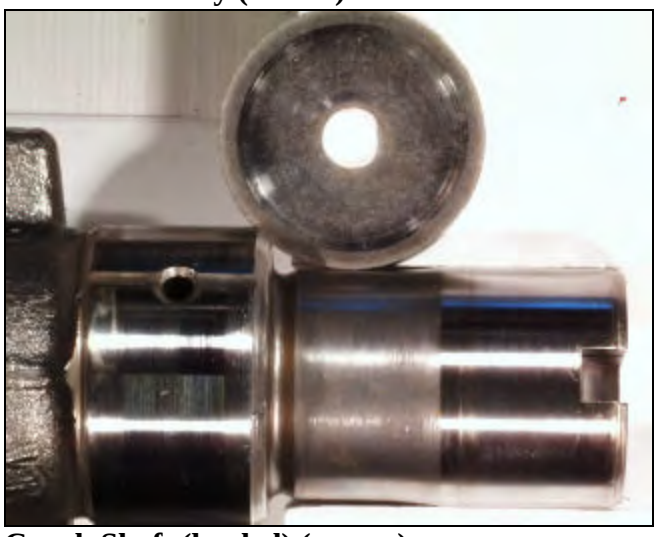
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

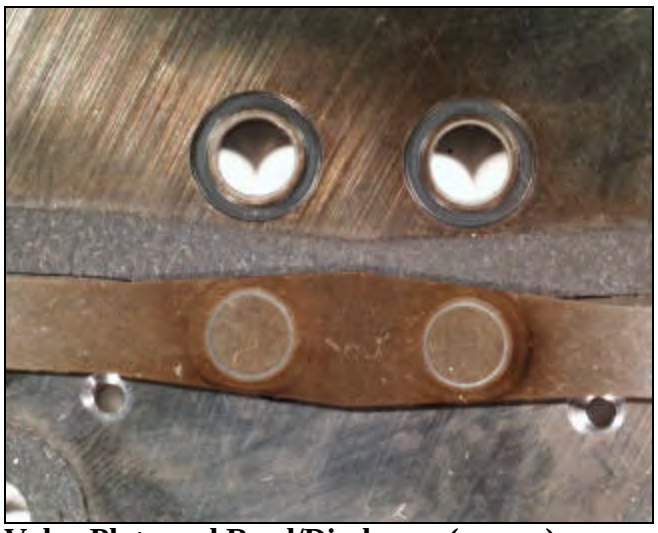
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

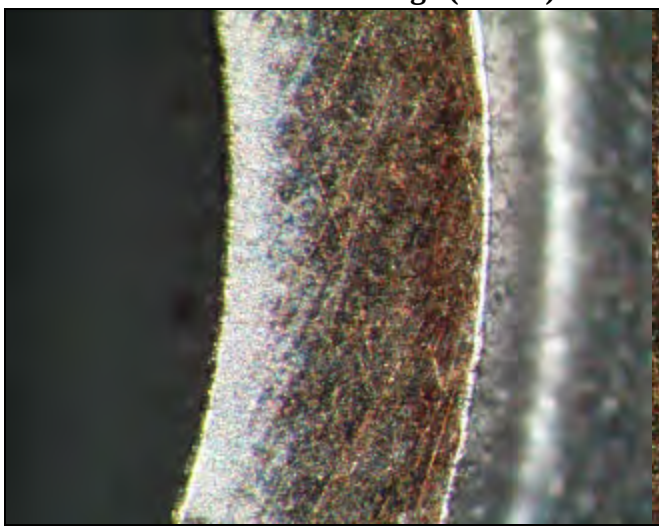
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid, Water, and R-502
185 psig/30 psig

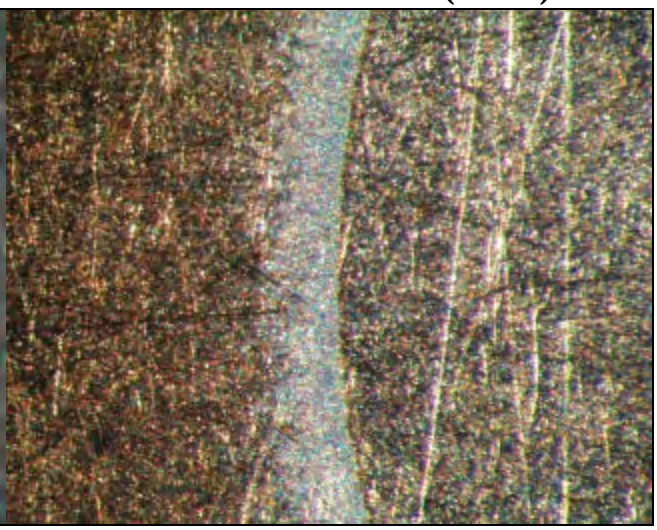


Valve Plate and Reed/Discharge (macro)

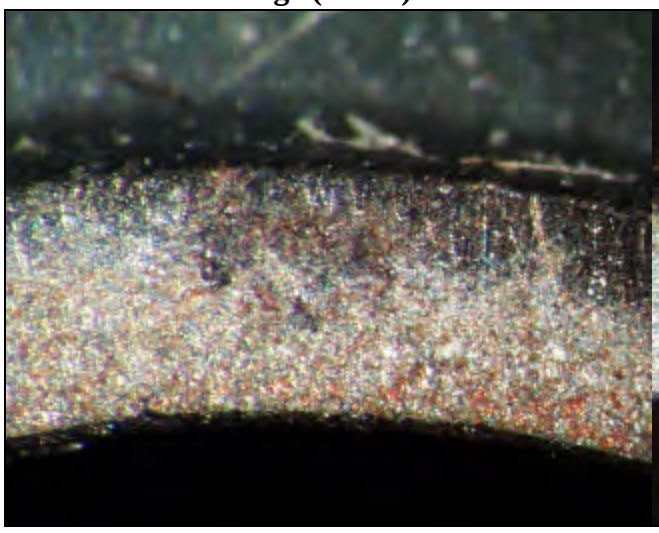
Valve Plate and Reed/Suction (macro)



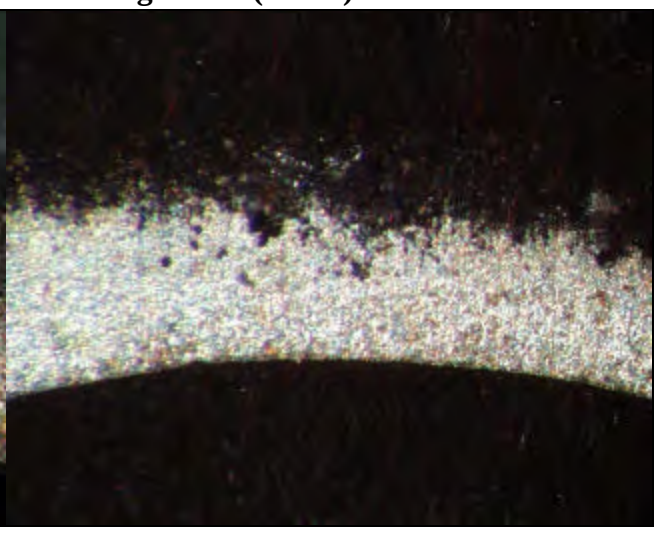
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Air, Water, and R-502

TEST HISTORY OF:

Unit Number 38
Model # RS43C1E-CAV-250 **Serial #** 96F16527
Run Time (hr.) 12016 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 3 **(4)** 3
Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean/scored	
Wear	polish	
Lower bronze bearings		
Appearance	clean/scored	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, very slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3755
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 38
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)

Appearance	correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.23
Water (ppm)	58
Fluoride ion (ppm)	1.7
Chloride ion (ppm)	8.6
Aluminum (ppm)	0
Copper (ppm)	3
Iron (ppm)	0
Lead (ppm)	4
Silicon (ppm)	7
Tin (ppm)	1
Zinc (ppm)	20

Trash in liquid screen (g)	0.039
Number of screens	1
Debris in compressor bottom (g)	1.038

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

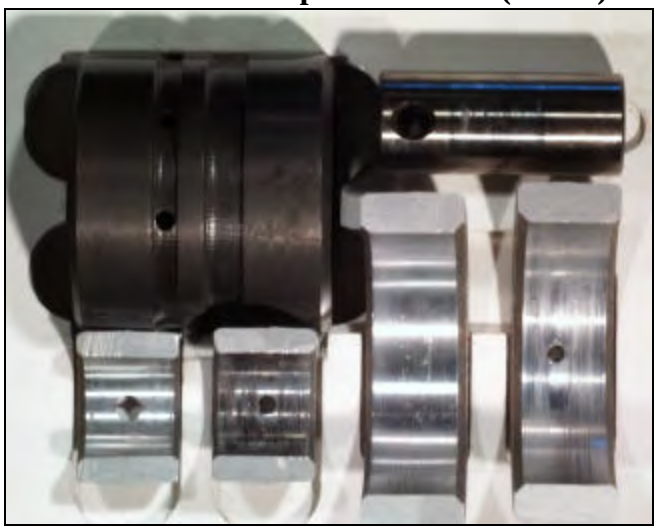
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	gray	hard
Spring	very slight	gray	gummy
Spring Seat	very slight	gray	hard
Ball	very slight	gray	gummy
Front Side	very slight	gray	gummy

Photographic Documentation of R-507A Compressor with Contaminant
Acid, Air, Water, and R-502
185 psig/30 psig

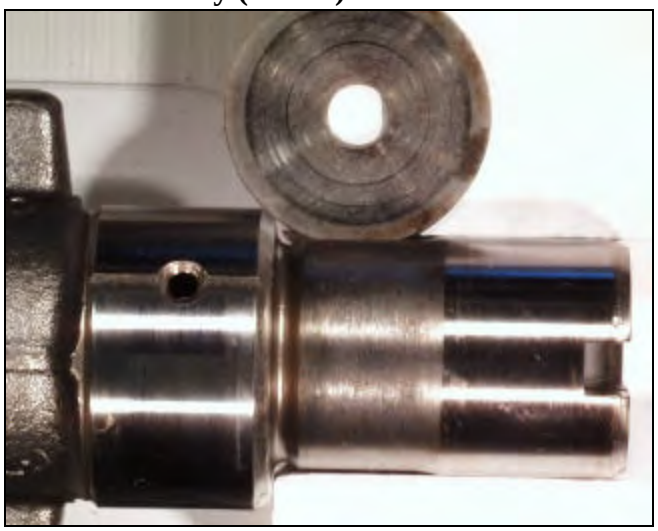
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



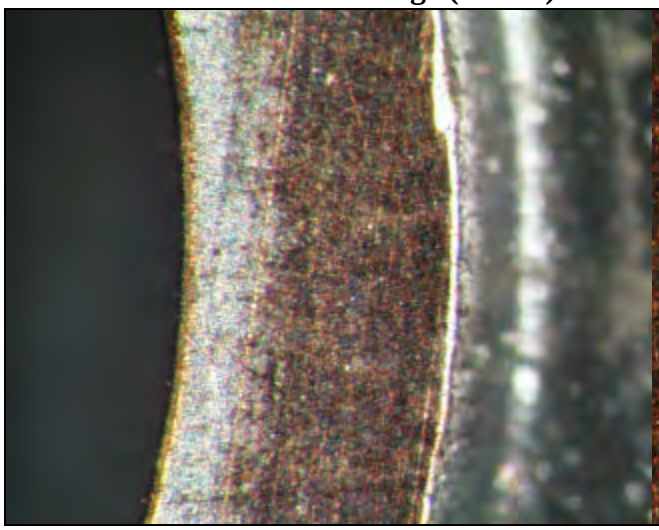
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

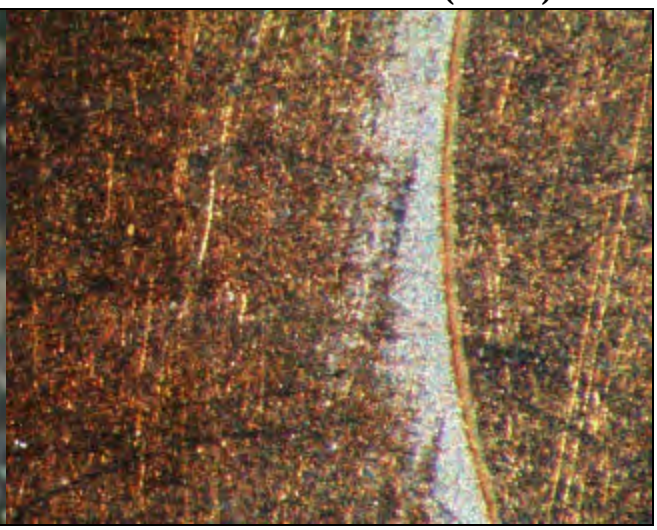
Photographic Documentation of R-507A Compressor with Contaminant
Acid, Air, Water, and R-502
185 psig/30 psig

Valve Plate and Reed/Discharge (macro)

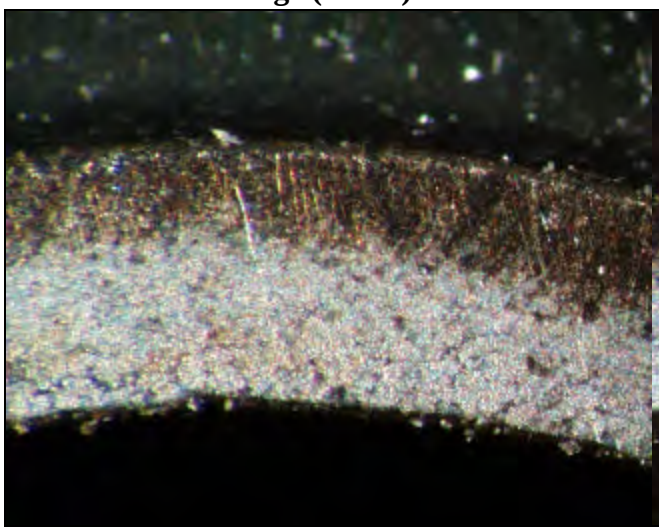
Valve Plate and Reed/Suction (macro)



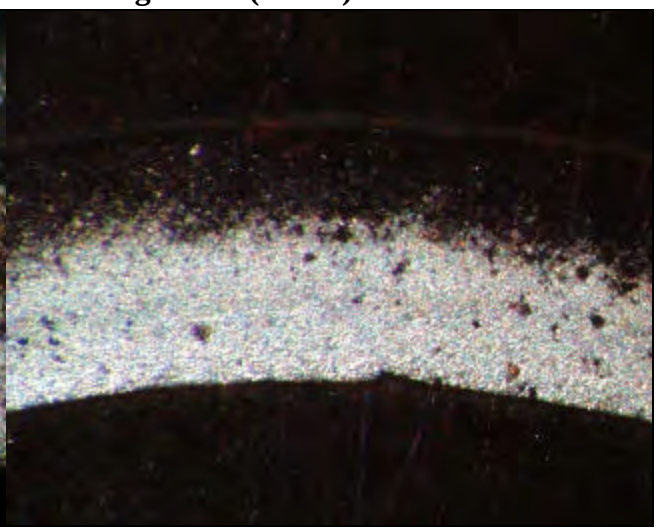
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Air, Water, and R-502

TEST HISTORY OF:

Unit Number 39
Model # RS43C1E-CAV-250 **Serial #** 96F16496
Run Time (hr.) 12029 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** Yes

Discharge Pressure (psig)	185
Suction Pressure (psig)	30
Discharge Temp (°F)	180
Return Gas Temp (°F)	54
SumpTemp (°F)	140
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 16 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	none	
Lower bronze bearings		
Appearance	clean/scored	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, very slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	no wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 39
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	Yes

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	97
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	8.3
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.108
Number of screens	2
Debris in compressor bottom (g)	0.644

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	blued
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

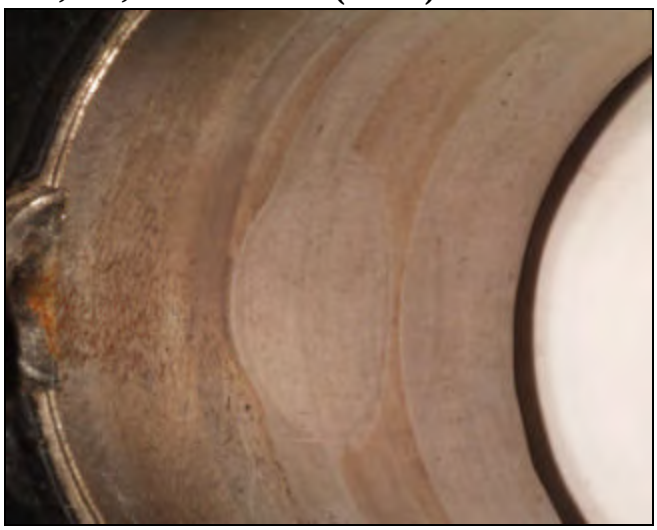
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	none	none	none
Spring	slight	gray	hard
Spring Seat	very slight	gray	hard
Ball	none	none	none
Front Side	very slight	gray	hard

Photographic Documentation of R-507A Compressor with Contaminant Air, Water, and R-502
185 psig/30 psig

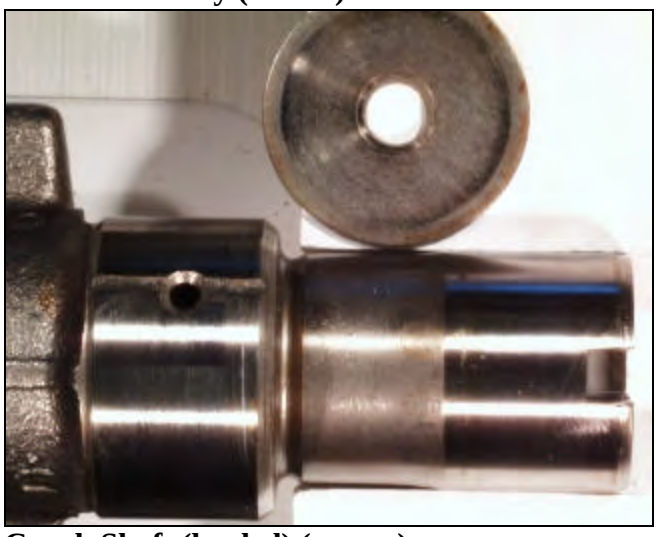
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

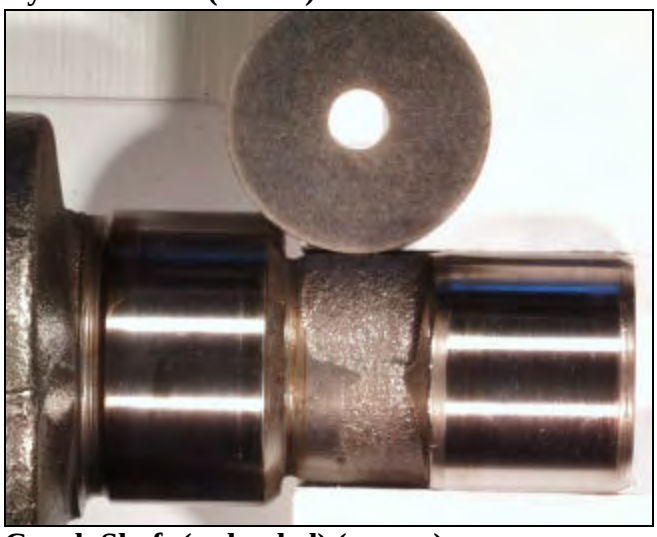
Piston Assembly (macro)



Cylinder Bore (macro)



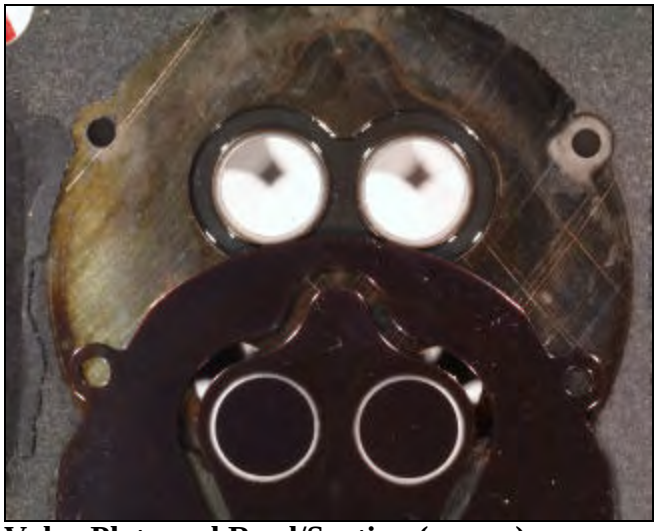
Crank Shaft (loaded) (macro)



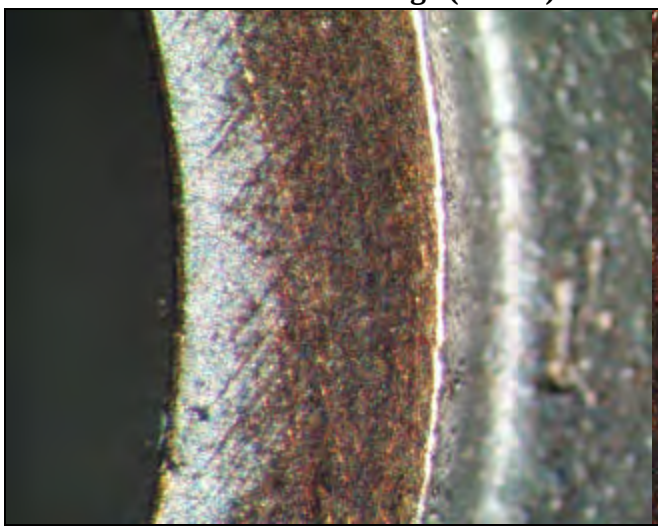
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Air, Water, and R-502
185 psig/30 psig

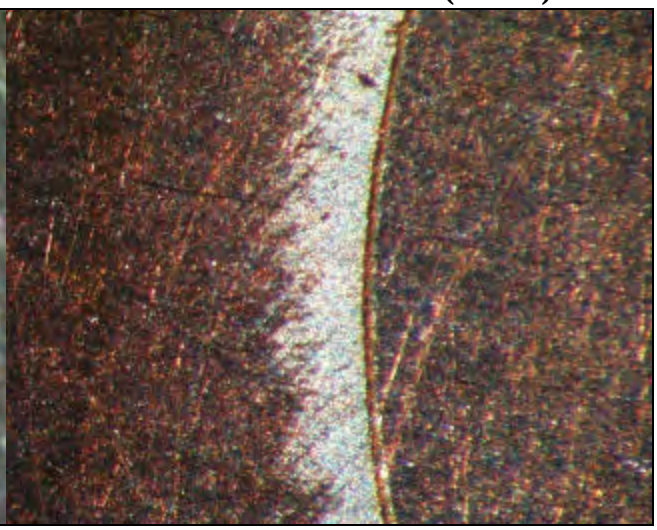
Valve Plate and Reed/Discharge (macro)



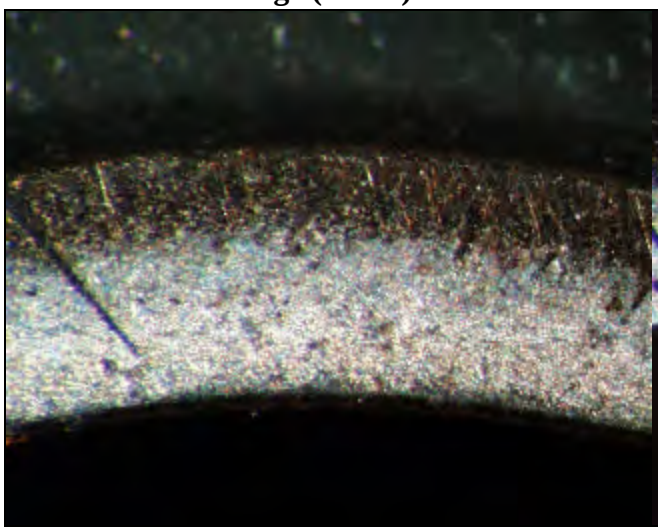
Valve Plate and Reed/Suction (macro)



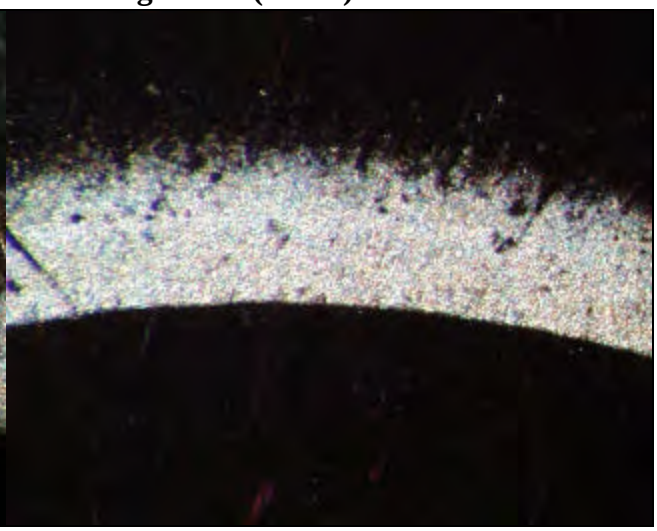
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-507A Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 40
Model # RS43C1E-CAV-250 **Serial #** 96F16499
Run Time (hr.) 12037 **Failed?** No
Refrigerant R-507A
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 185
Suction Pressure (psig) 30
Discharge Temp (°F) 180
Return Gas Temp (°F) 54
SumpTemp (°F) 140

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance black
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 10.4 **(2)** 10.4 **(3)** 10.4 **(4)** 10.4
Suction muffler appearance gray
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance Cu
Top stator windings appearance Cu trace
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 14.6
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance Cu plate
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5

Crank journals
Appearance scored
Wear slight
Dimensions **Loaded** 1.2480
Unloaded 1.2480
Lower crank bearing journal
Appearance scored
Wear slight
Dimensions **Loaded** 1.0025
Unloaded 1.0025
Bottom thrust washer (crank side)
Appearance scored
Wear slight
Bottom washer (casting side)
Appearance clean
Wear polish
Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030
Shaft in cage bearing
Appearance Cu plating
Wear slight
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3725
Unloaded 1.3725
Cylinder bore
Appearance low wear/Cu plating
Varnish ring medium
Dimensions **Loaded** 1.3710
Unloaded 1.3710
Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2485
Unloaded 1.2485

TEST HISTORY OF:

Unit Number 40
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating	
Wear	medium	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.18
Water (ppm)	68
Fluoride ion (ppm)	1.2
Chloride ion (ppm)	8.8
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	5
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.145
Number of screens	1
Debris in compressor bottom (g)	1.110

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	very slight

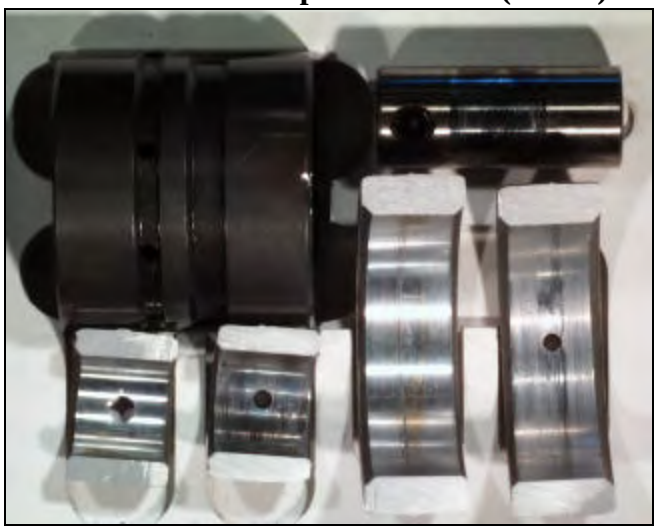
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	none	none	none
Spring	slight	gray	hard
Spring Seat	slight	gray	hard
Ball	none	none	none
Front Side	slight	gray	hard

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and Water
185 psig/30 psig

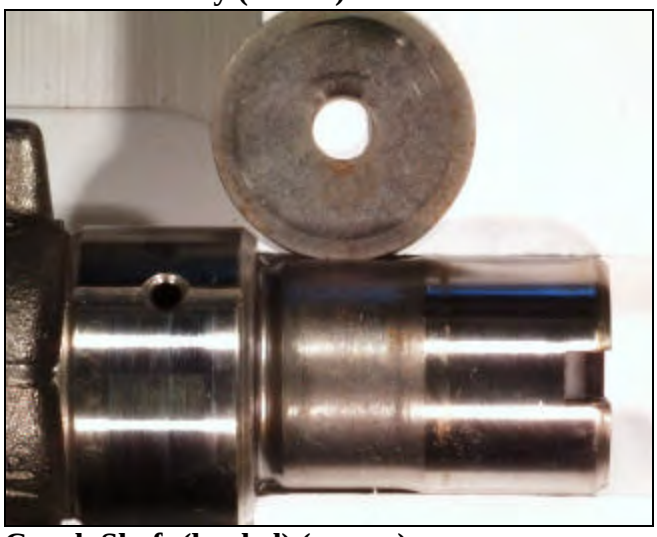
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

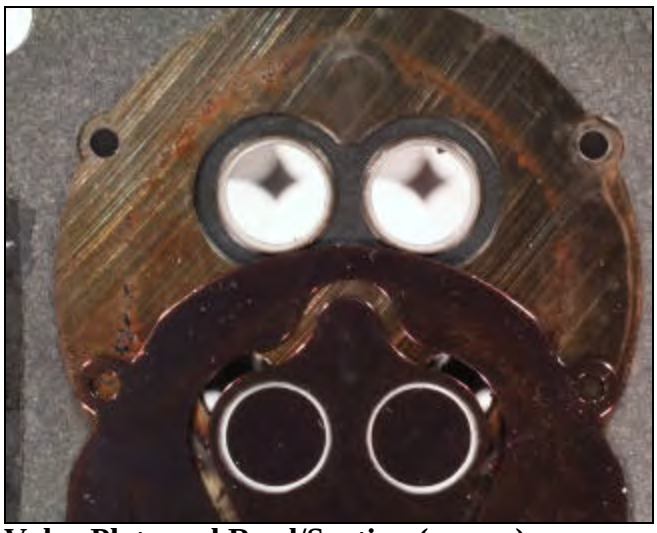


Crank Shaft (loaded) (macro)

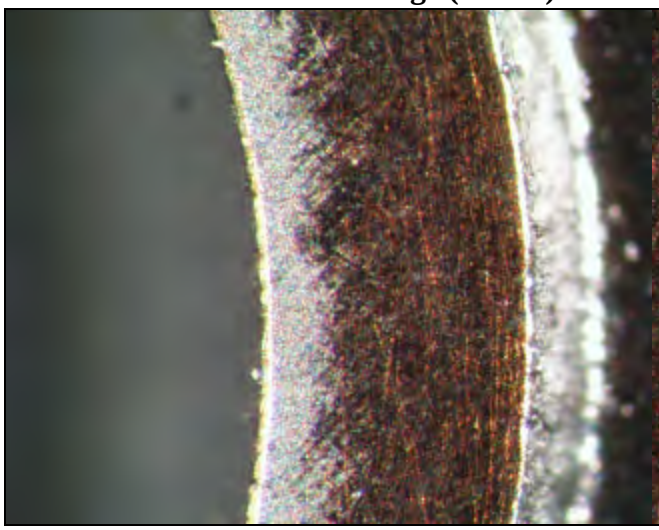
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-507A Compressor with Contaminant Acid, Air, and Water
185 psig/30 psig

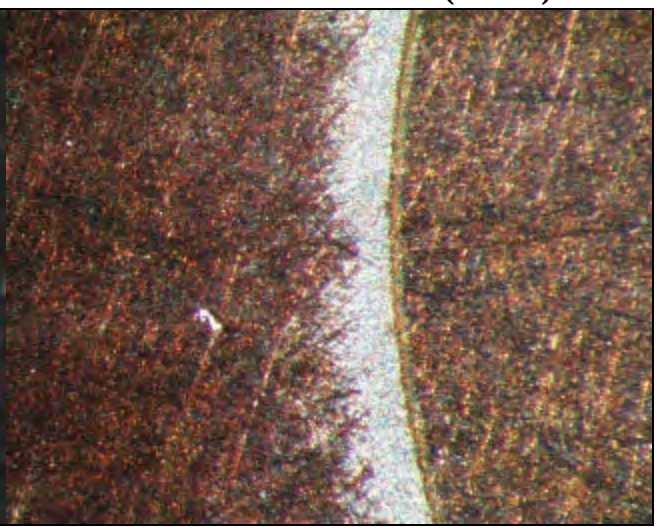
Valve Plate and Reed/Discharge (macro)



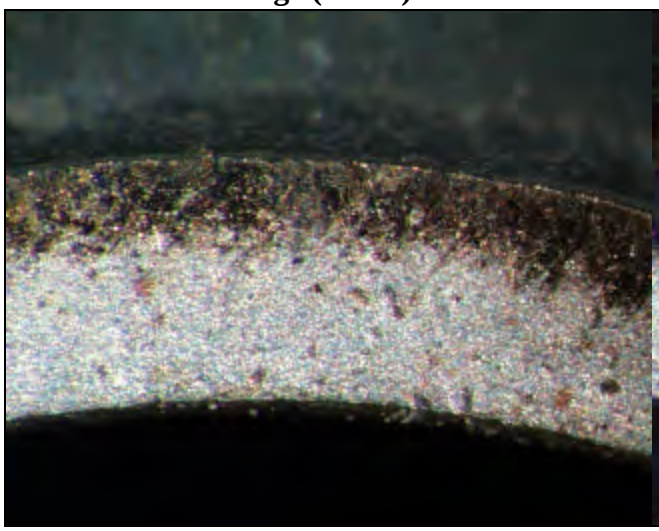
Valve Plate and Reed/Suction (macro)



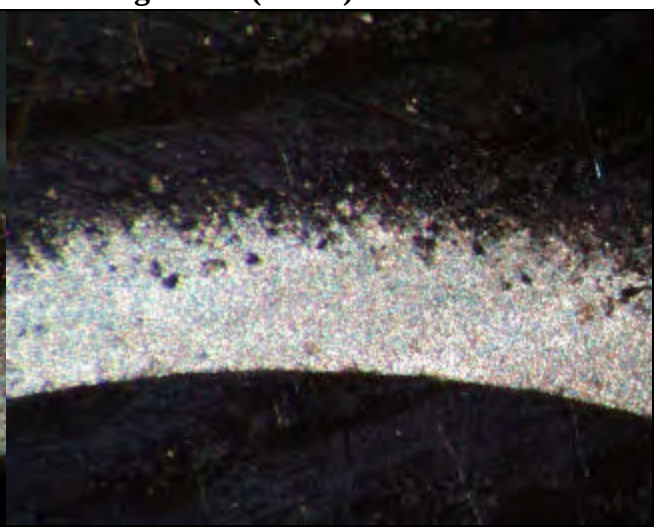
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Control Compressor

TEST HISTORY OF:

Unit Number 41
Model # RS43C1E-CAV-250 **Serial #** 96F16519
Run Time (hr.) 12005 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	70
Discharge Temp (°F)	153
Return Gas Temp (°F)	58
SumpTemp (°F)	96
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4.2 **(2)** 5.8 **(3)** 3.8 **(4)** 3.8

Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 7.5 **(4)** 7.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	wear metals

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	none	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 41
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	none	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.03
Water (ppm)	174
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	8.8
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.034
Number of screens	1
Debris in compressor bottom (g)	0.270

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	brown	gummy
Spring	very slight	gray	hard
Spring Seat	slight	brown	hard
Ball	medium	brown	gummy
Front Side	none	none	none

Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)

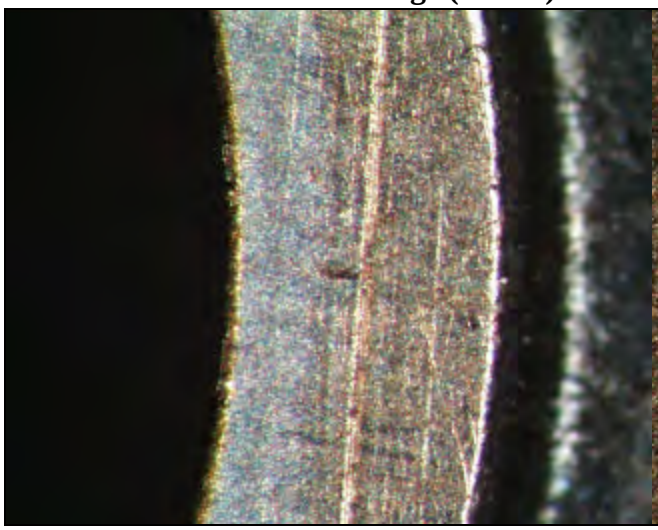
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

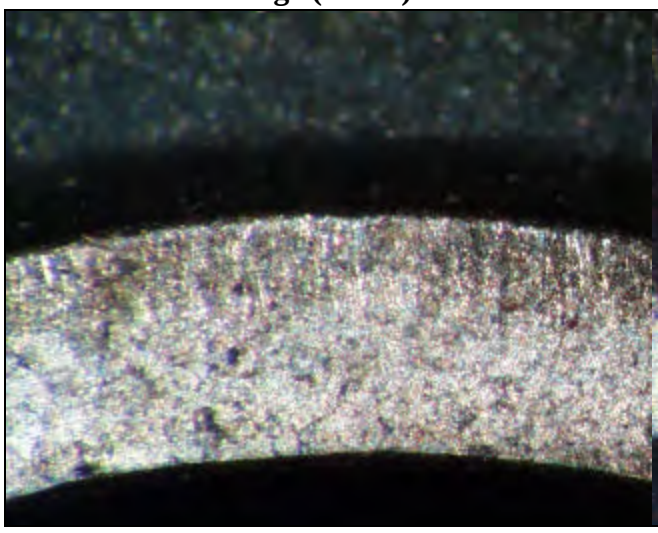
Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

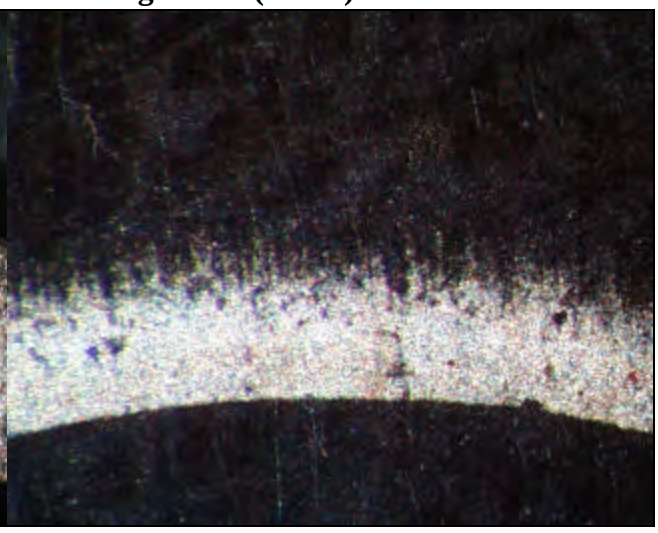


Valve Plate/Discharge (micro)

Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Control Compressor

TEST HISTORY OF:

Unit Number 42

Model # RS43C1E-CAV-250 **Serial #** 96F16509
Run Time (hr.) 12013 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	70
Discharge Temp (°F)	153
Return Gas Temp (°F)	58
SumpTemp (°F)	96
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 3.3 **(2)** 3.3 **(3)** 3.3 **(4)** 3.3
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 11 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	soot
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 16 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 6 **(4)** 6

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 42
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	112
Fluoride ion (ppm)	0.99
Chloride ion (ppm)	8.3
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.500

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	very slight	brown	gummy
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	very slight	gray	hard
Spring Seat	very slight	brown	gummy
Ball	very slight	brown	gummy
Front Side	none	none	none

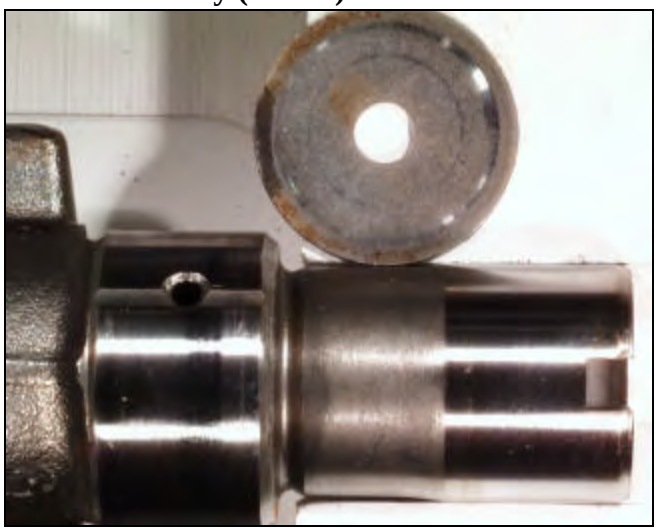
Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



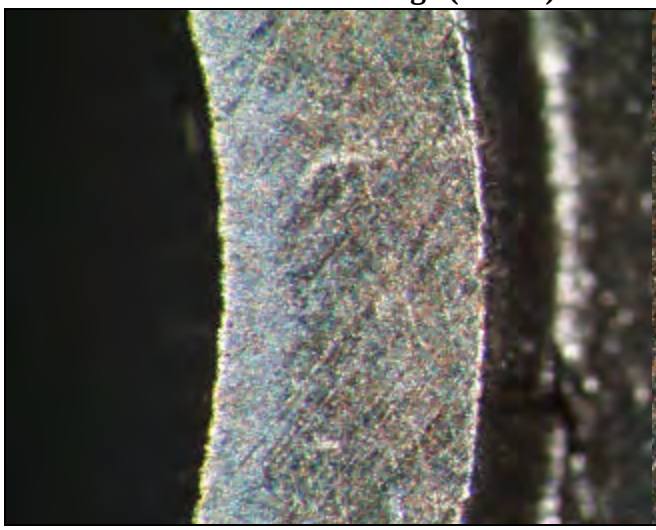
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

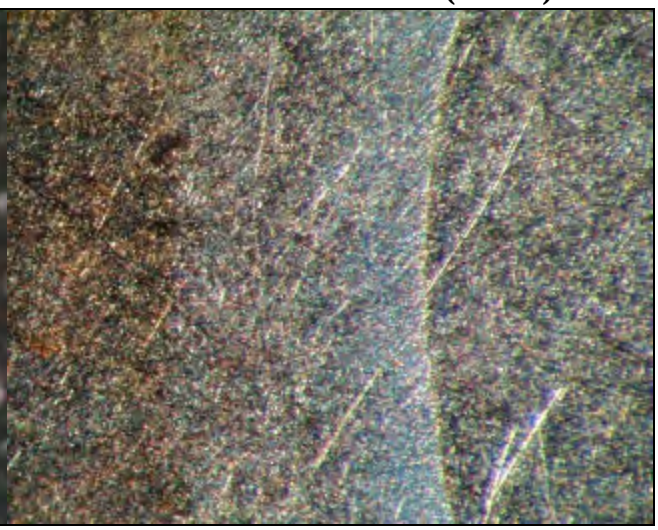
Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Valve Plate and Reed/Discharge (macro)

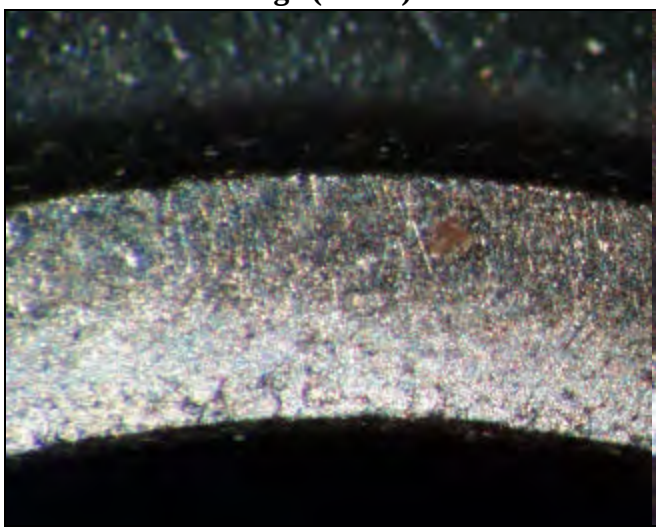
Valve Plate and Reed/Suction (macro)



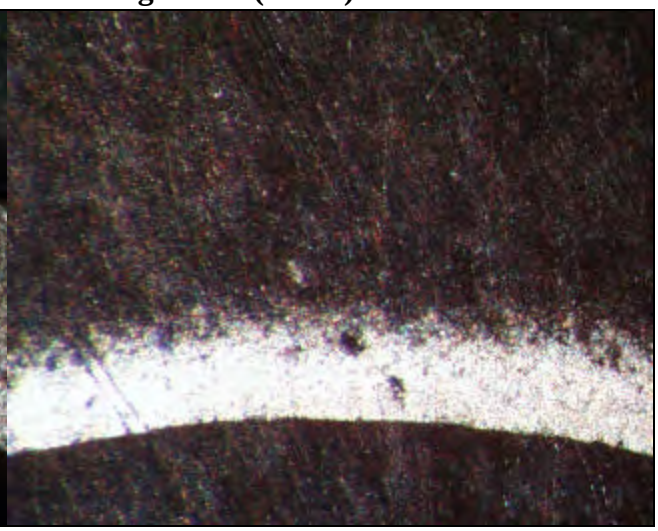
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Control Compressor

TEST HISTORY OF:

Unit Number 43
Model # RS43C1E-CAV-250 **Serial #** 96F16510
Run Time (hr.) 12033 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	70
Discharge Temp (°F)	153
Return Gas Temp (°F)	58
SumpTemp (°F)	96
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 3 **(2)** 3 **(3)** 4 **(4)** 3

Remaining torque of stator bolts
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	Cu
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 17.5 **(3)** 15 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean/Cu plate
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 7.5 **(2)** 7.5 **(3)** 7.5 **(4)** 7.5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	Cu plating	
Wear	polish	
Lower bronze bearings		
Appearance	clean/scored	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear/Cu plating	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 43
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	211
Fluoride ion (ppm)	1.2
Chloride ion (ppm)	9.1
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.041
Number of screens	1
Debris in compressor bottom (g)	0.227

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

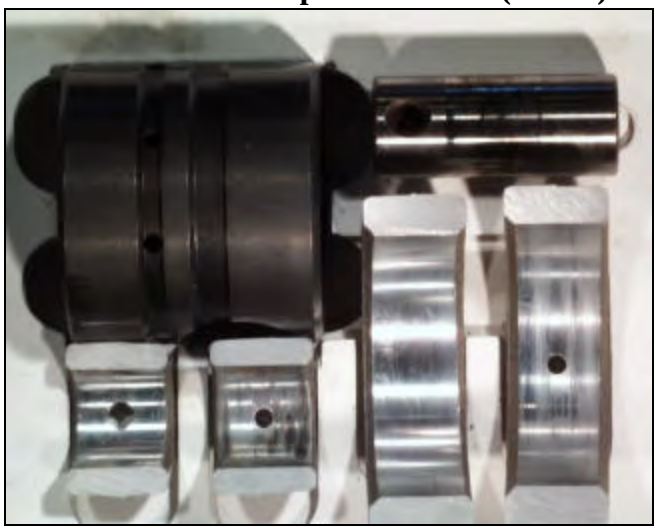
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	none	none	none
Spring Seat	medium	brown	gummy
Ball	medium	brown	gummy
Front Side	none	none	none

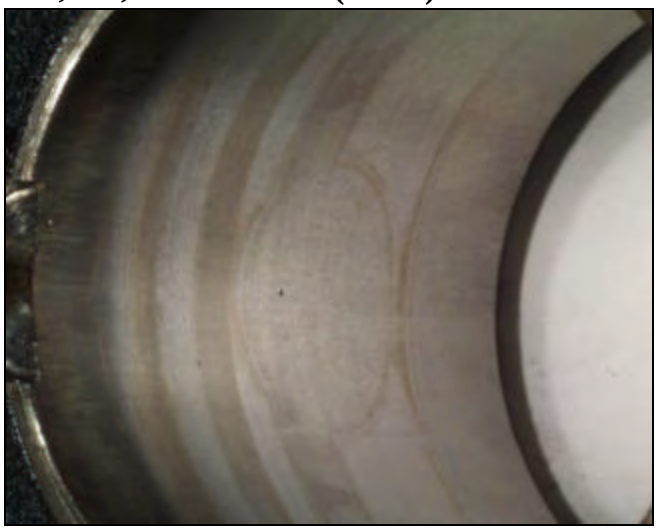
Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

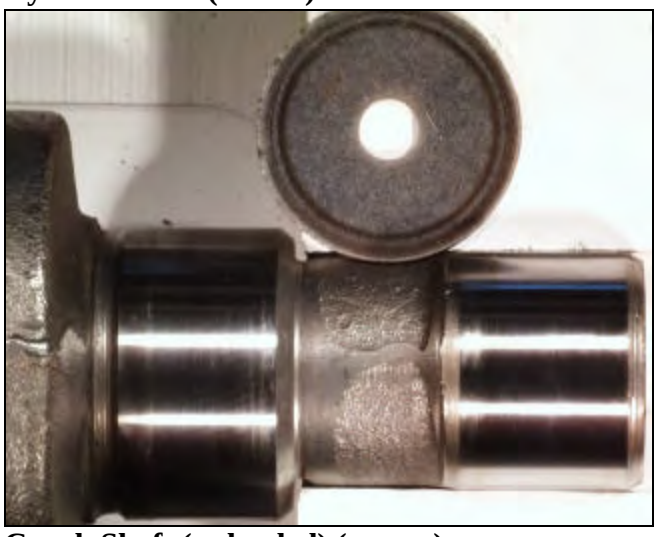


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

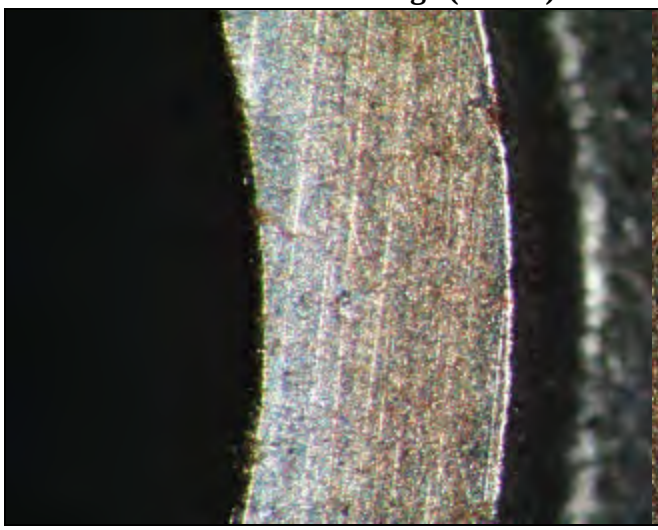


Crank Shaft (unloaded) (macro)

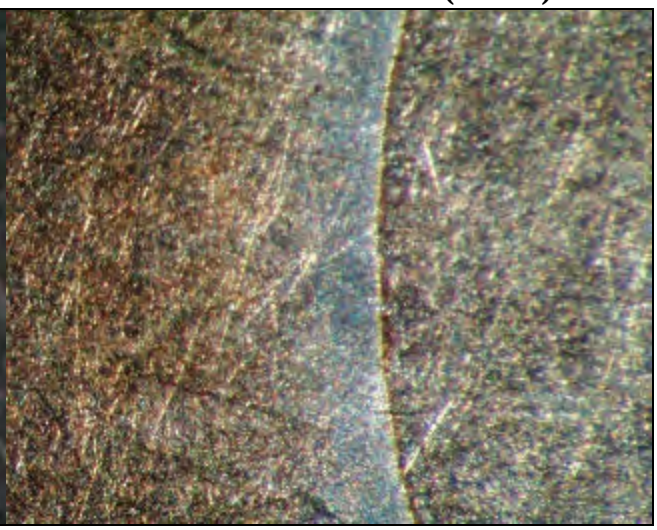
Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Valve Plate and Reed/Discharge (macro)

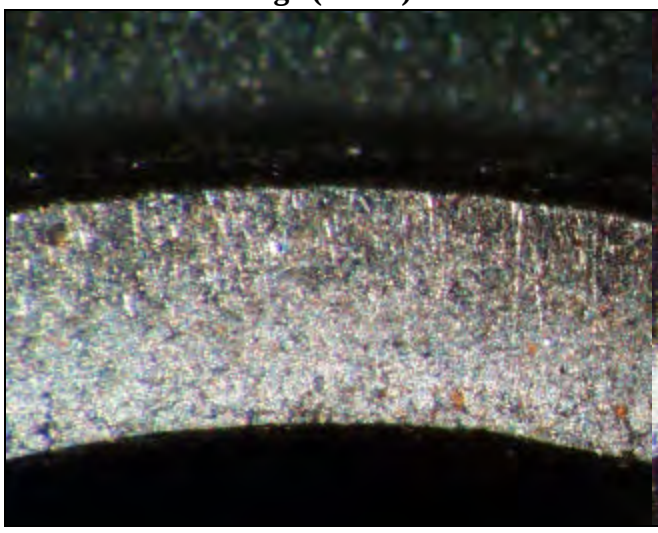
Valve Plate and Reed/Suction (macro)



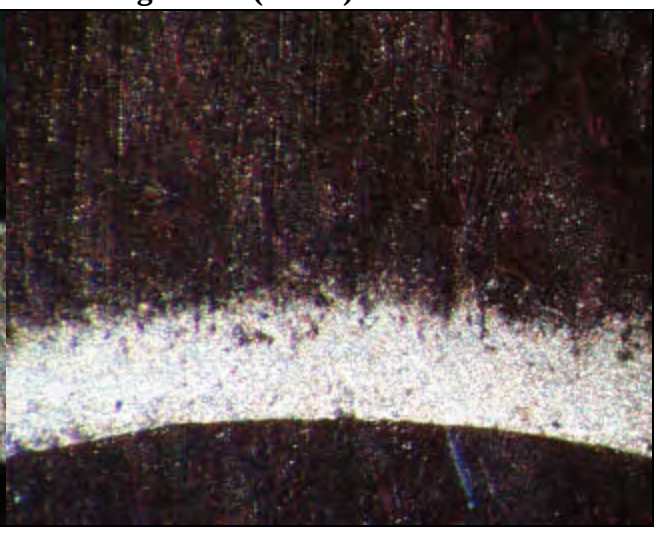
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant R-22

TEST HISTORY OF:

Unit Number 44
Model # RS43C1E-CAV-250 **Serial #** 96F16511
Run Time (hr.) 12007 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 5 **(2)** 4 **(3)** 4 **(4)** 4

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0010
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3715
	Unloaded	1.3715
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3725
	Unloaded	1.3725
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2490

TEST HISTORY OF:

Unit Number 44
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	85
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	9.2
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.022
Number of screens	1
Debris in compressor bottom (g)	0.511

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

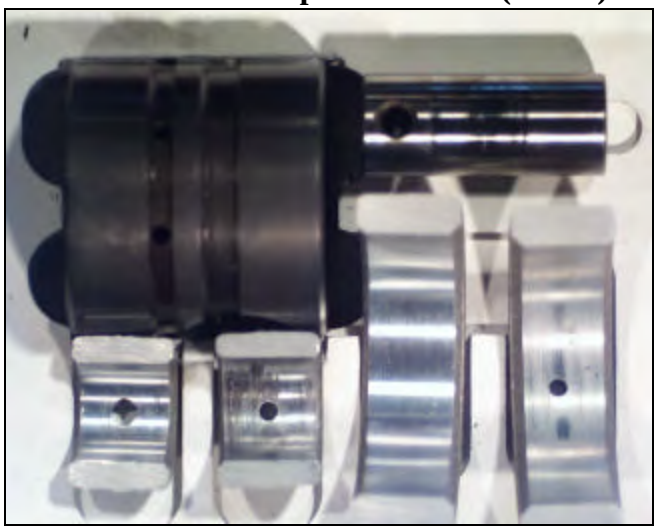
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black, brown	gummy
Spring	very slight	gray	gummy
Spring Seat	very slight	gray	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

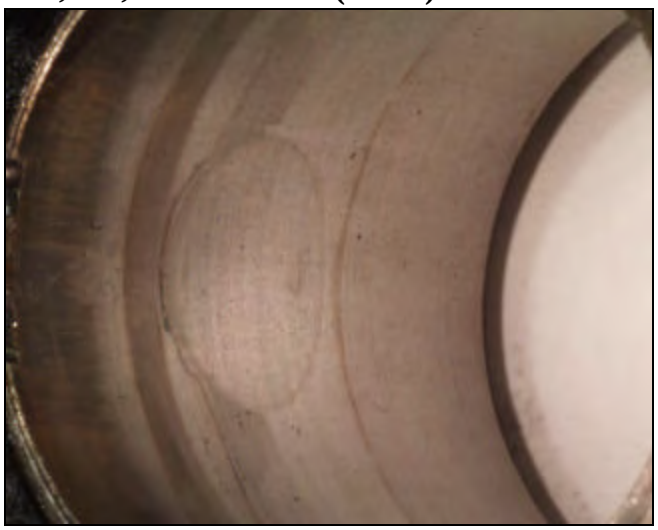
Photographic Documentation of R-407C Compressor with Contaminant R-22
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

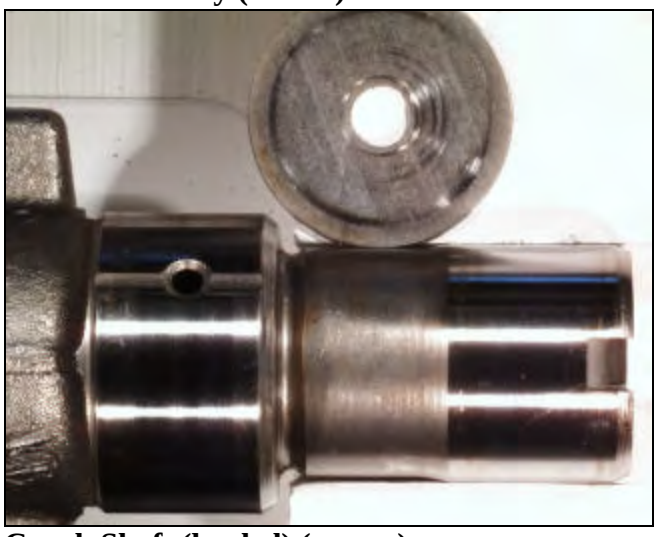
Ball, Pin, Seat of CPEV (micro)



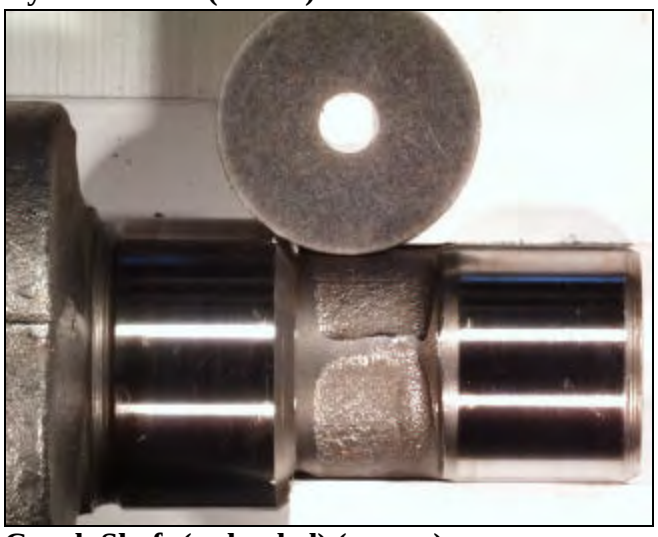
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

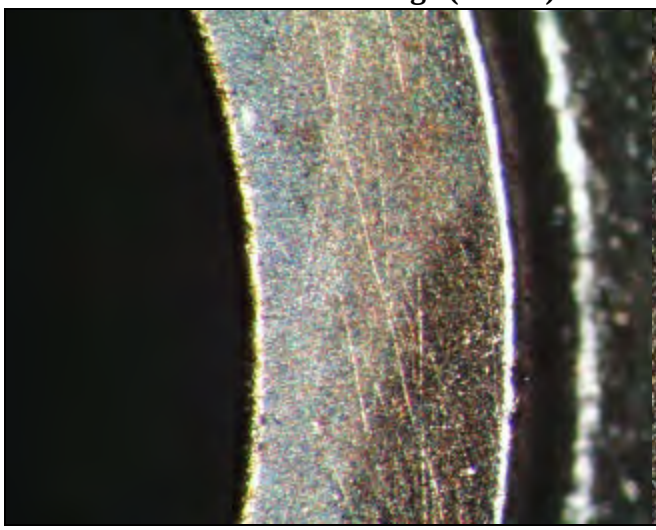


Crank Shaft (unloaded) (macro)

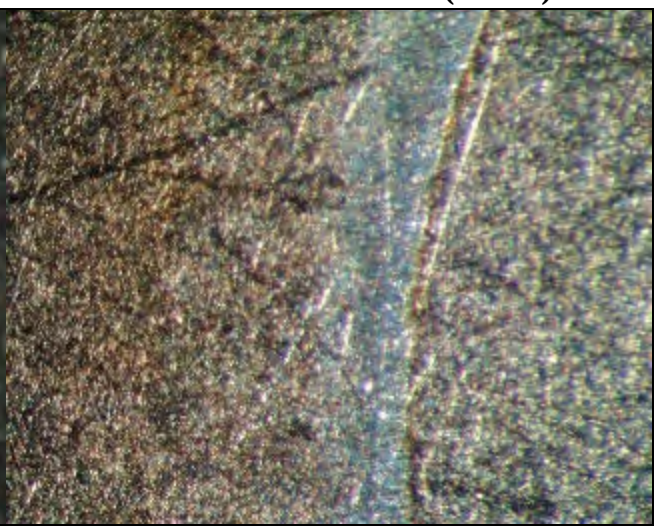
Photographic Documentation of R-407C Compressor with Contaminant R-22
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

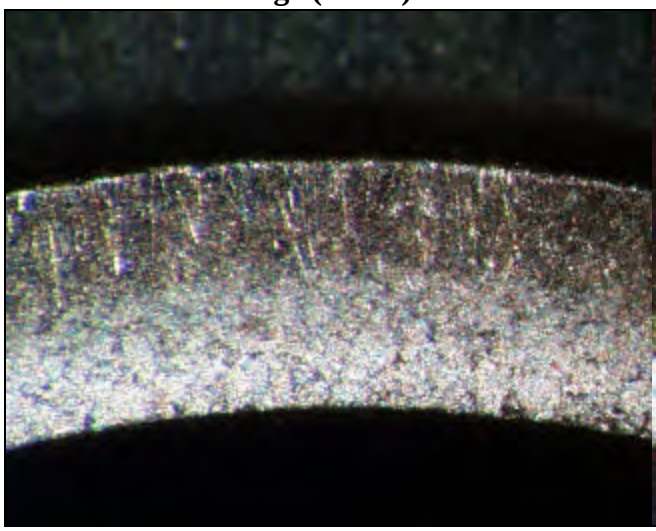
Valve Plate and Reed/Suction (macro)



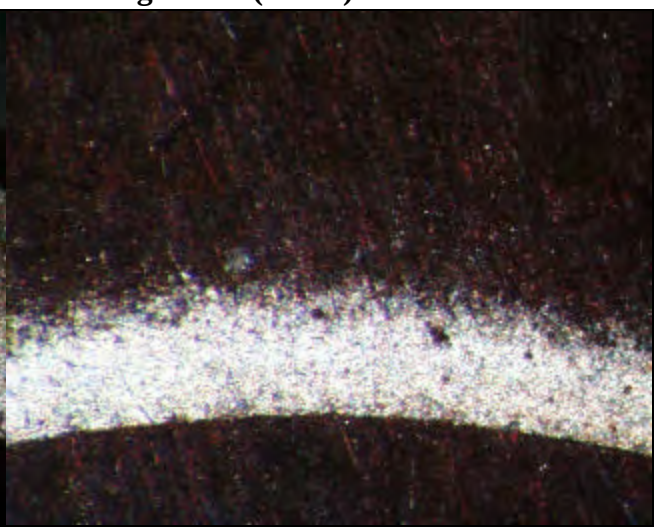
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 45
Model # RS43C1E-CAV-250 **Serial #** 96F16512
Run Time (hr.) 12071 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 11 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 6 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0025
	Unloaded	1.0025
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	carbon	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 45
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.10
Water (ppm)	65
Fluoride ion (ppm)	2.1
Chloride ion (ppm)	19
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.057
Number of screens	2
Debris in compressor bottom (g)	0.554

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

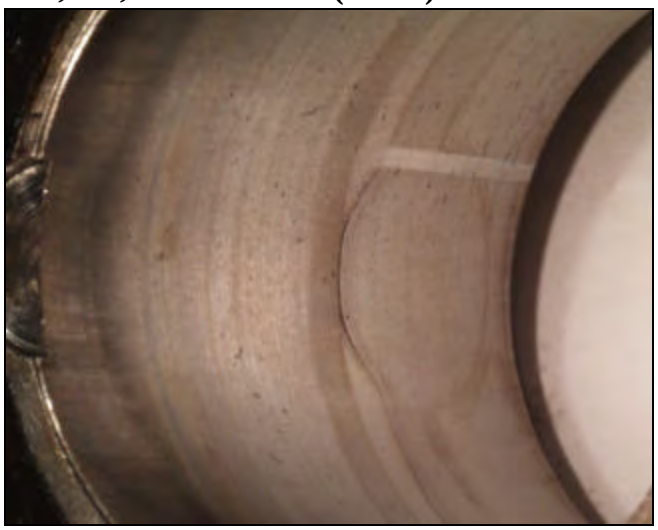
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	very slight	brown	gummy
Equalizer Hole	very slight	black	gummy
Tip of Pin	slight	brown	gummy
Spring	none	none	none
Spring Seat	none	none	none
Ball	slight	brown	gummy
Front Side	slight	brown	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

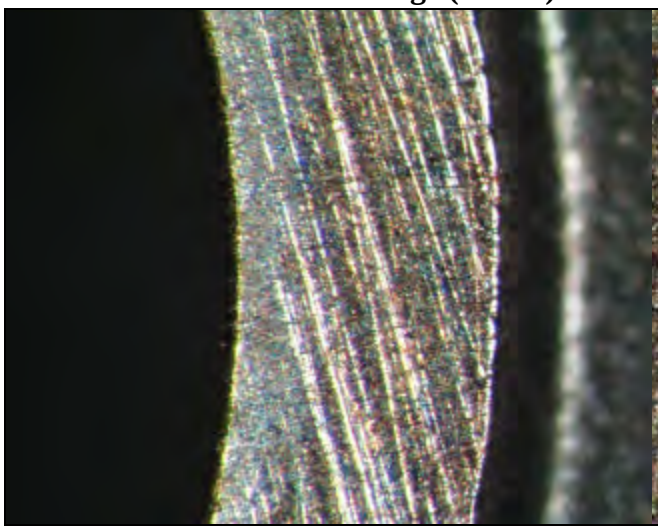
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

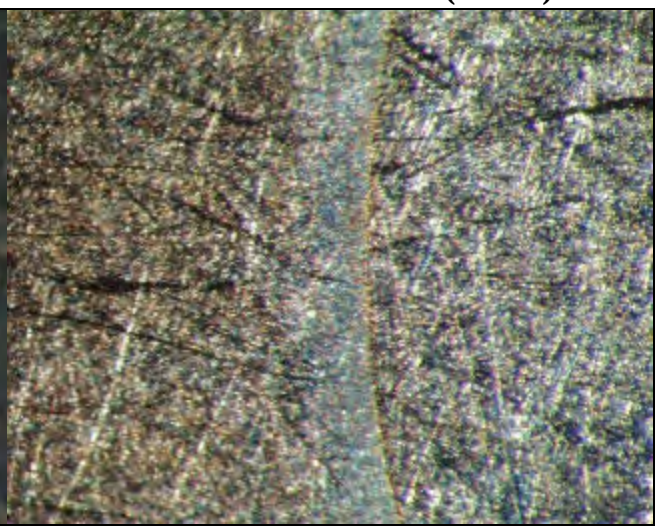
Photographic Documentation of R-407C Compressor with Contaminant Acid
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

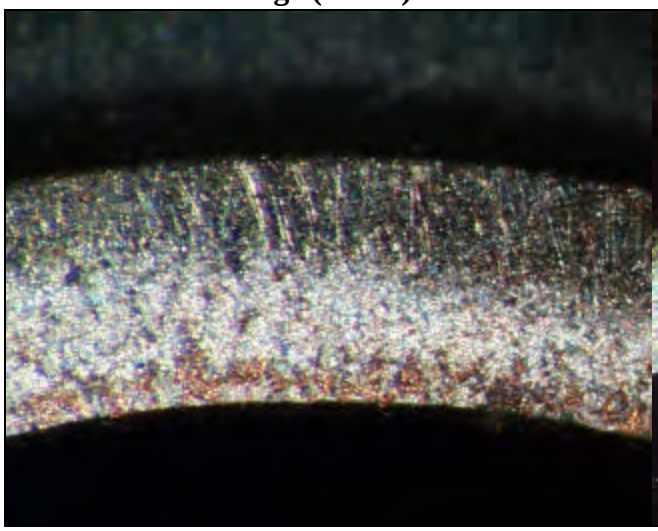
Valve Plate and Reed/Suction (macro)



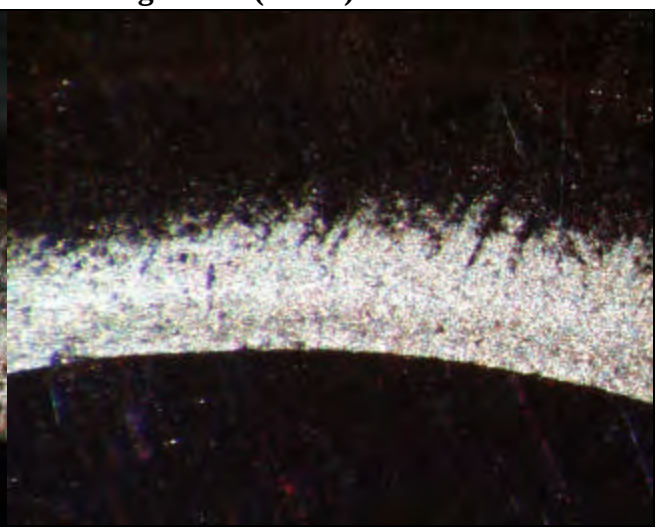
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 46
Model # RS43C1E-CAV-250 **Serial #** 96F16507
Run Time (hr.) 12024 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 3 **(3)** 4 **(4)** 3

Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 9 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 16 **(3)** 16 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 6 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	carbon	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 46
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, medium	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	34
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	12
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	7
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.437

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

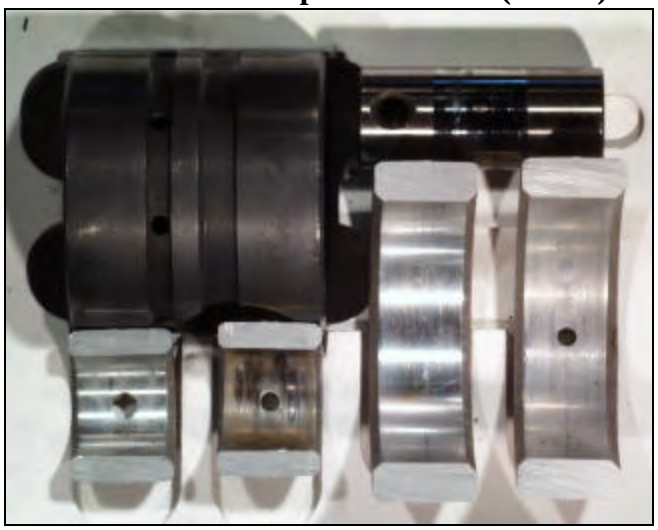
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	brown	gummy
Spring	medium	brown	gummy
Spring Seat	medium	brown	gummy
Ball	medium	brown	gummy
Front Side	heavy	brown	gummy

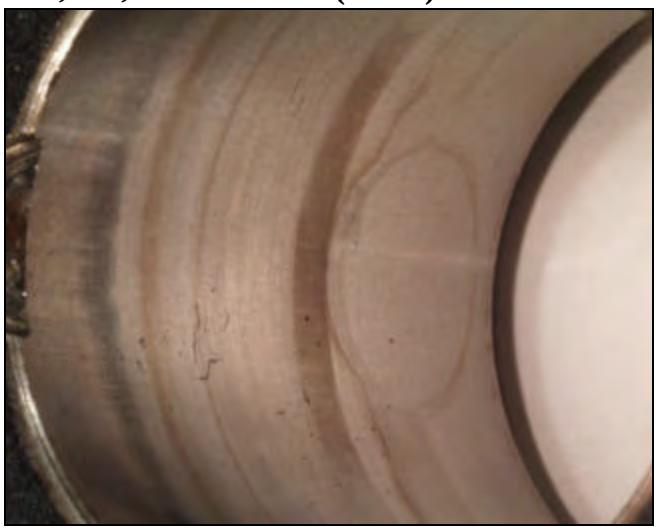
Photographic Documentation of R-407C Compressor with Contaminant Air
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

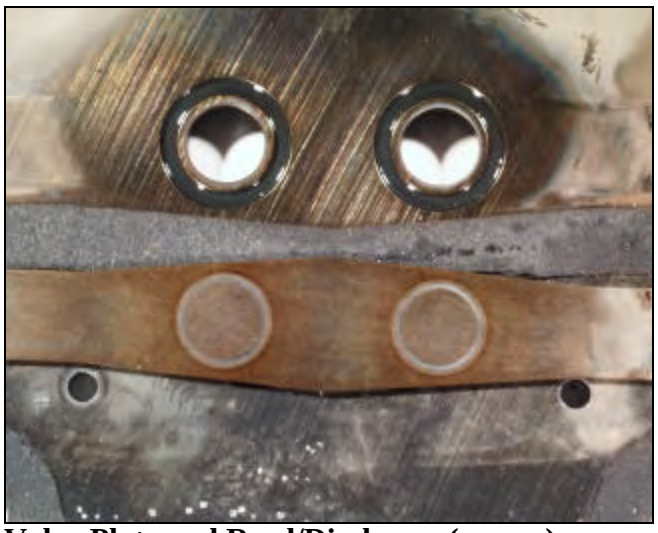


Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

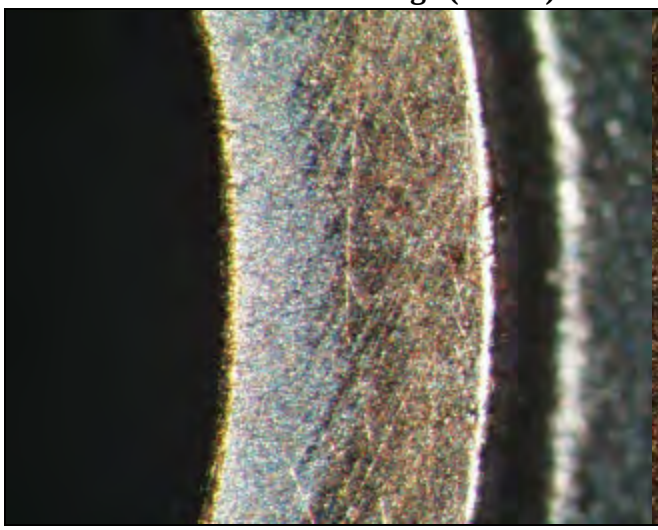
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Compressor with Contaminant Air
325 psig/75 psig

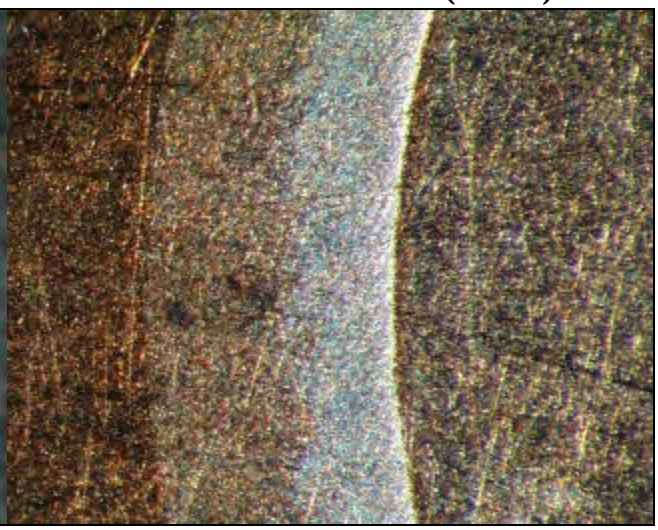


Valve Plate and Reed/Discharge (macro)

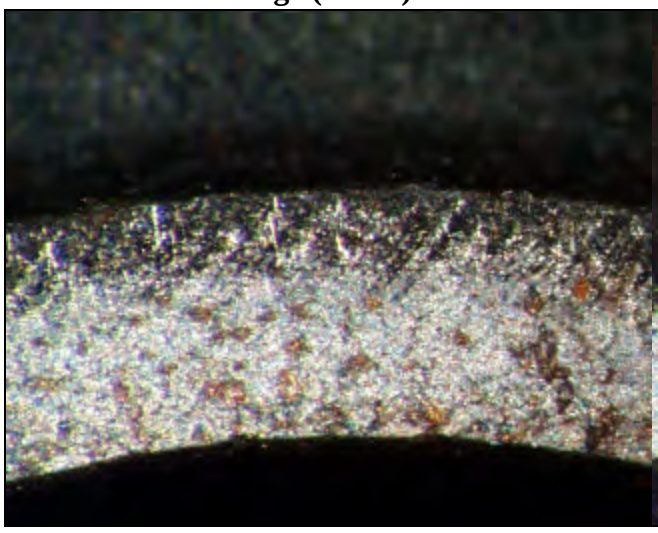
Valve Plate and Reed/Suction (macro)



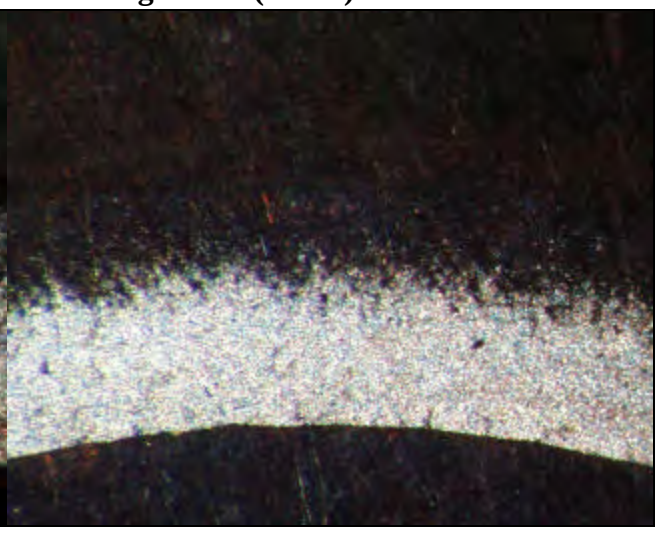
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid and R-22

TEST HISTORY OF:

Unit Number 47
Model # RS43C1E-CAV-250 **Serial #** 96F16467
Run Time (hr.) 12004 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	58
Return Gas Temp (°F)	65
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 5 **(4)** 2.5
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 7.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/soot
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 12.5 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	scored	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 47
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	63
Fluoride ion (ppm)	0.83
Chloride ion (ppm)	12
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	5
Tin (ppm)	1
Zinc (ppm)	1

Trash in liquid screen (g)	0.005
Number of screens	1
Debris in compressor bottom (g)	1.102

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

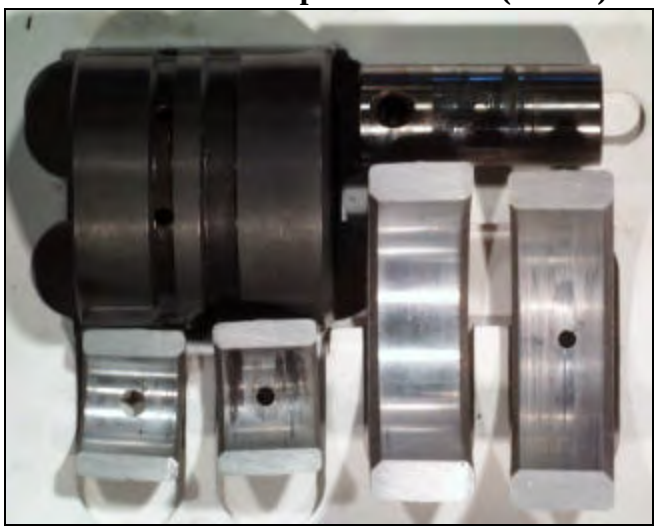
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	none	none	none
Ball	medium	gray	gummy
Front Side	slight	brown	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid and R-22
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

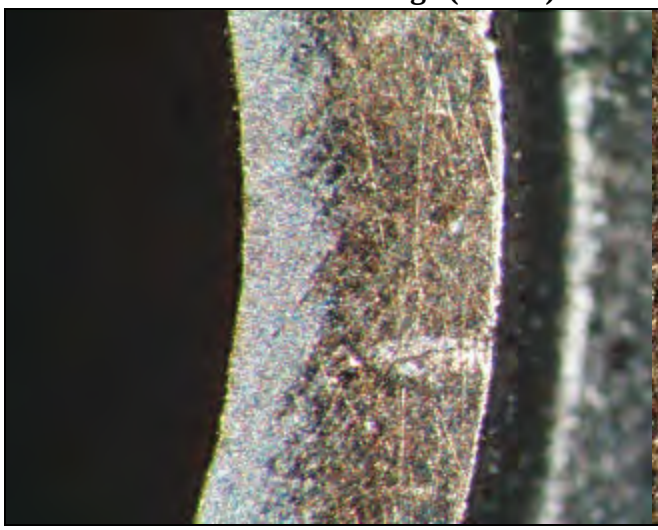
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

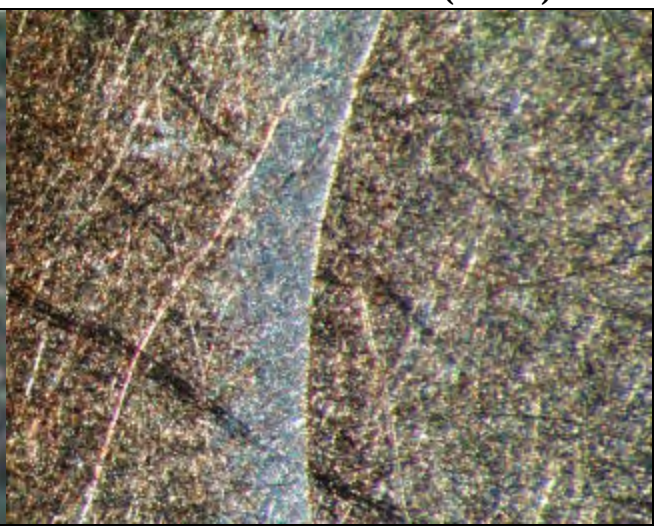
Photographic Documentation of R-407C Compressor with Contaminant Acid and R-22
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

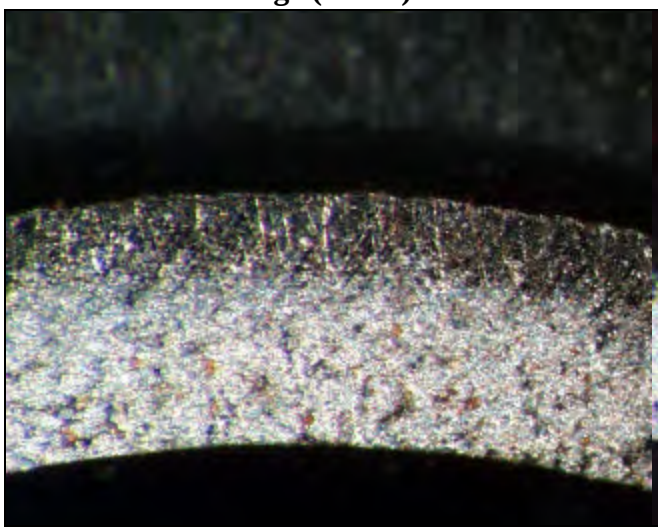
Valve Plate and Reed/Suction (macro)



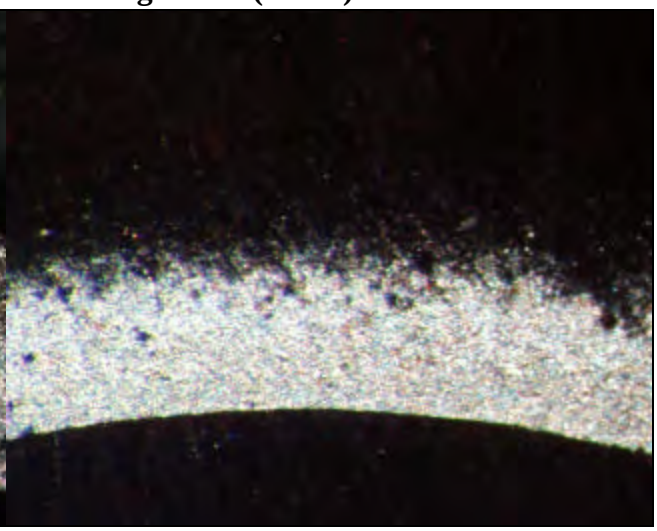
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Air, and R-22

TEST HISTORY OF:

Unit Number 48
Model # RS43C1E-CAV-250 **Serial #** 96F16539
Run Time (hr.) 12002 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig) 325
Suction Pressure (psig) 75
Discharge Temp (°F) 141
Return Gas Temp (°F) 65
SumpTemp (°F) 81

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 15 **(2)** 17 **(3)** 15 **(4)** 12.5
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance gray/stator top green
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 17 **(4)** 17
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance dirty
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 7.5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9985
Unloaded 0.9985
Bottom thrust washer (crank side)
Appearance scored/corrosion
Wear polish
Bottom washer (casting side)
Appearance clean
Wear polish
Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance corrosion
Wear polish
Dimensions **Loaded** 1.2515
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 48
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.12
Water (ppm)	92
Fluoride ion (ppm)	0.66
Chloride ion (ppm)	12
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	1
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	3

Trash in liquid screen (g)	0.065
Number of screens	2
Debris in compressor bottom (g)	1.310

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	tan, black	gummy
Spring	slight	gray, black	gummy
Spring Seat	very slight	brown	gummy
Ball	slight	gray	gummy
Front Side	slight	brown	gummy

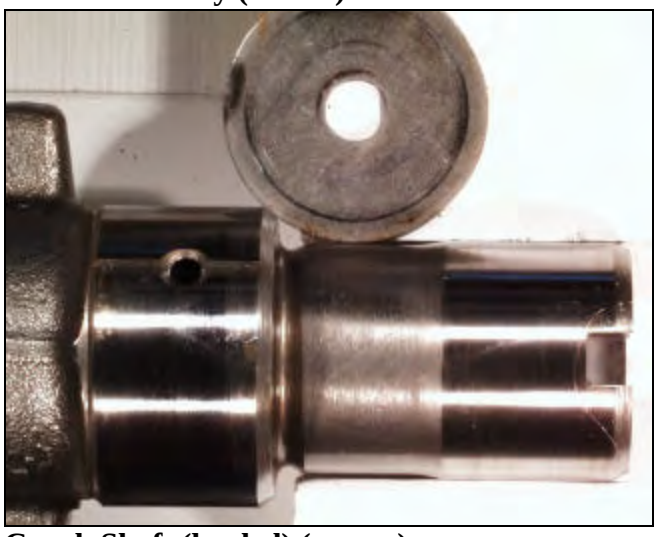
Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and R-22
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

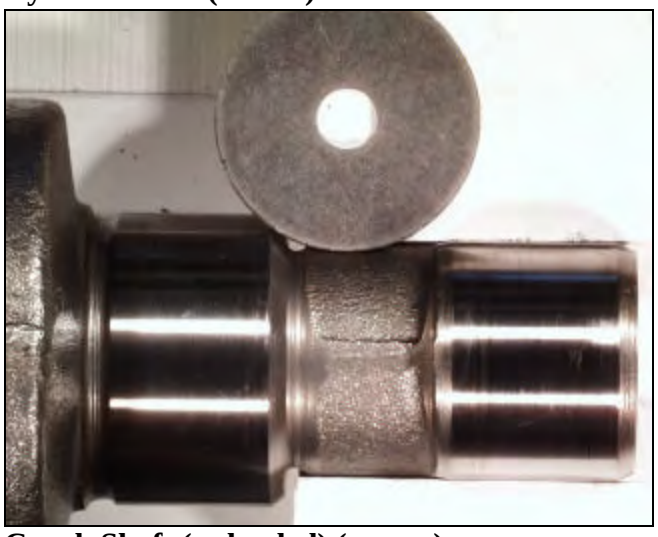
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

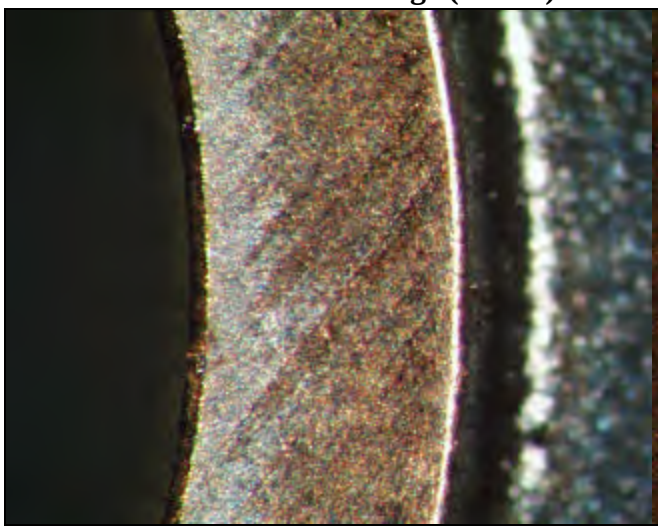


Crank Shaft (unloaded) (macro)

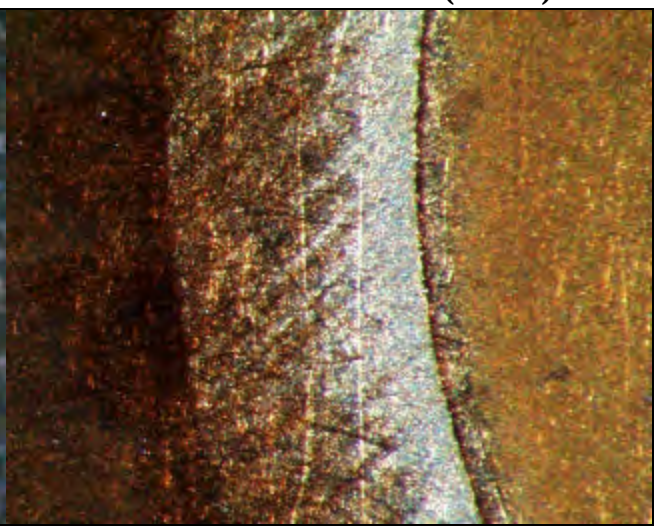
Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and R-22
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

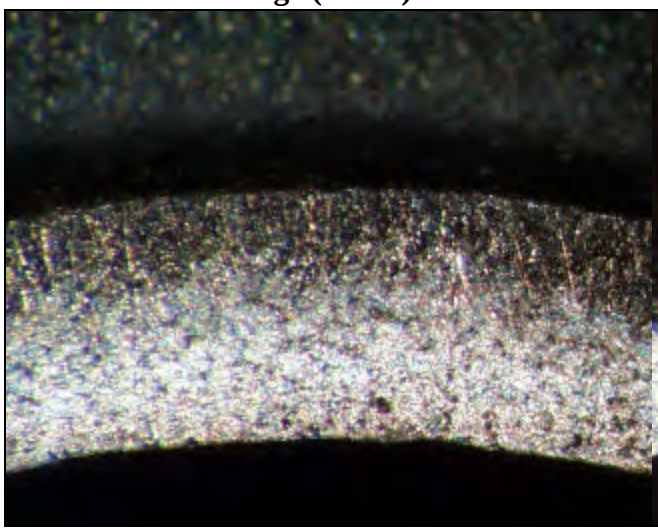
Valve Plate and Reed/Suction (macro)



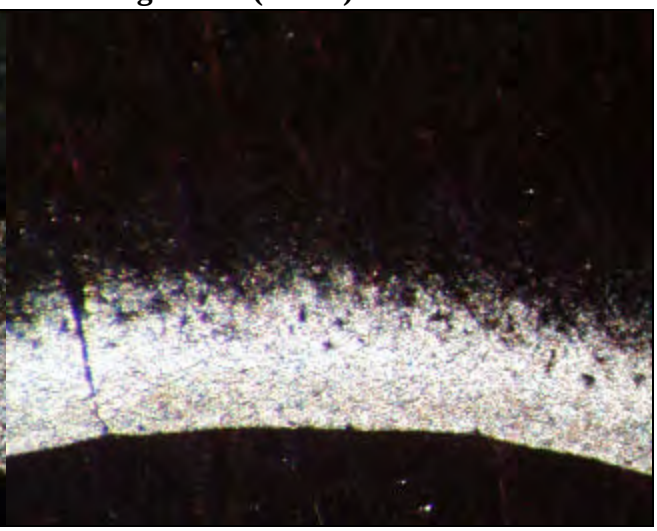
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air and R-22

TEST HISTORY OF:

Unit Number 49
Model # RS43C1E-CAV-250 **Serial #** 96F16505
Run Time (hr.) 12018 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	65
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 15 **(2)** 15 **(3)** 15 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray/stator top
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 17 **(3)** 17 **(4)** 17

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	scored	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean/corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored/soot	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 49
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4965
	Unloaded	0.4965

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	60
Fluoride ion (ppm)	0.78
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g) 0.071
Number of screens 1
Debris in compressor bottom (g) 0.982

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

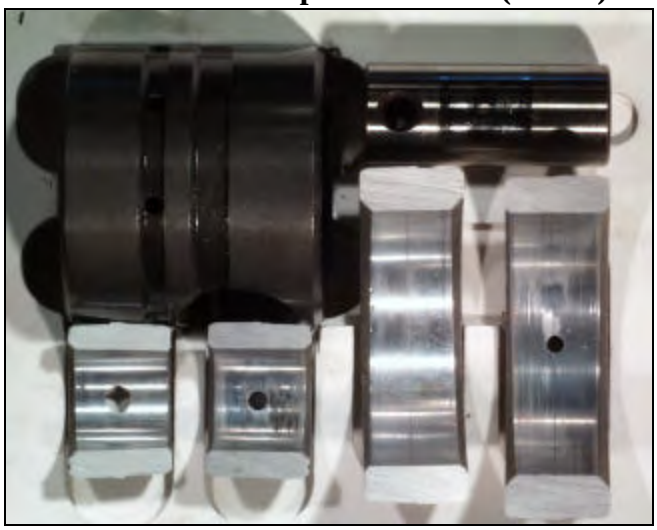
Expansion Valve Inspection Observations discolored

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	medium	gray	gummy
Spring Seat	medium	gray	gummy
Ball	slight	gray	gummy
Front Side	heavy	gray	gummy

Photographic Documentation of R-407C Compressor with Contaminant Air and R-22
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



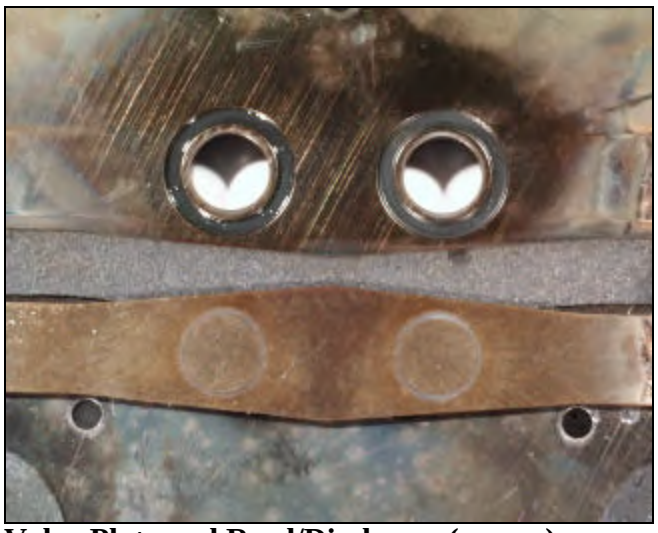
Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

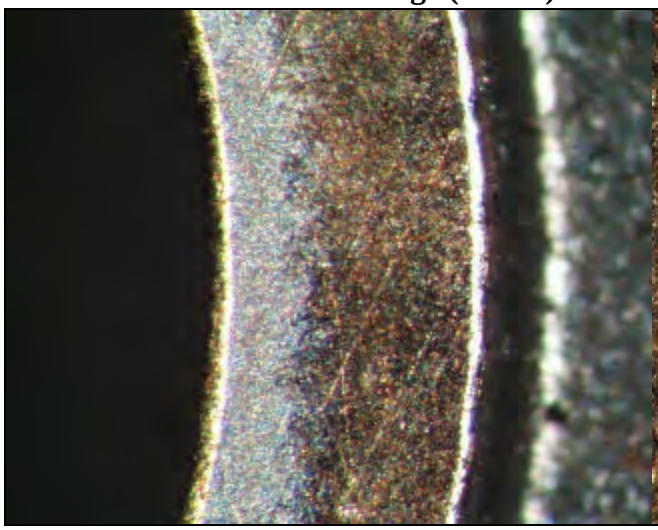
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Compressor with Contaminant Air and R-22
325 psig/75 psig

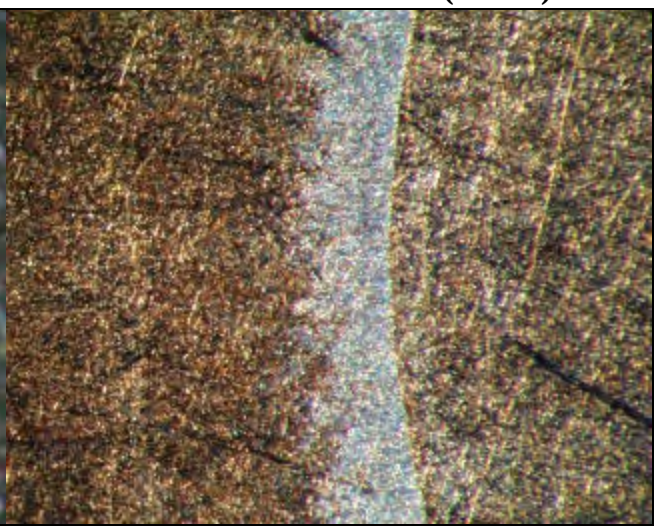


Valve Plate and Reed/Discharge (macro)

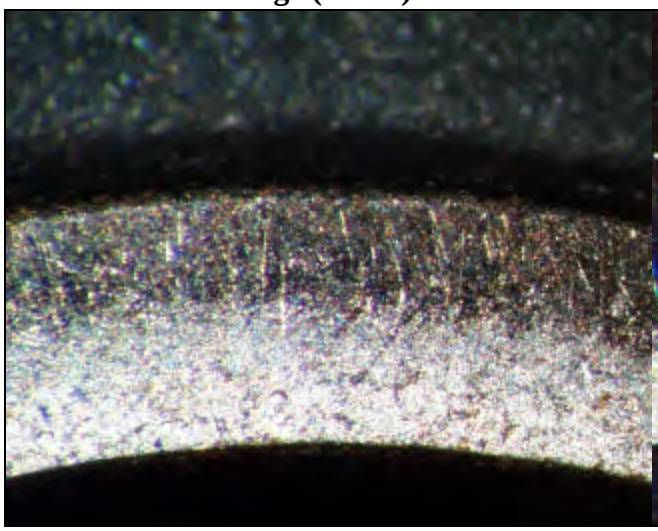
Valve Plate and Reed/Suction (macro)



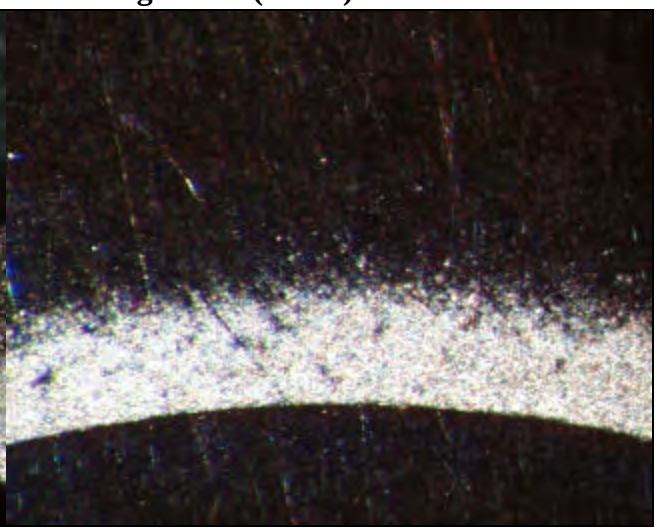
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 50
Model # RS43C1E-CAV-250 **Serial #** 96F16452
Run Time (hr.) 12022 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 12 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 16 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0015
	Unloaded	1.0015
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	carbon	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	low wear	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2495
	Unloaded	1.2495

TEST HISTORY OF:

Unit Number 50
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, medium	
Dimensions	**Loaded**	0.4995
	Unloaded	0.4995

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	95
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	12
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.014
Number of screens	2
Debris in compressor bottom (g)	0.412

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	none

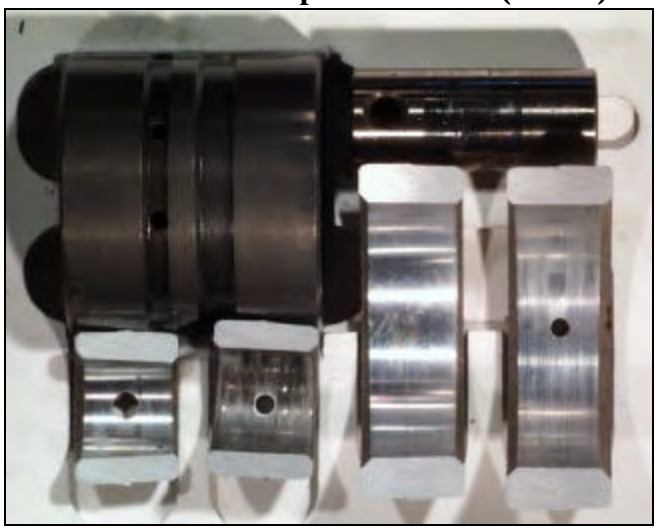
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	slight	gray	gummy
Spring Seat	very slight	gray	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid and Air
325 psig/75 psig

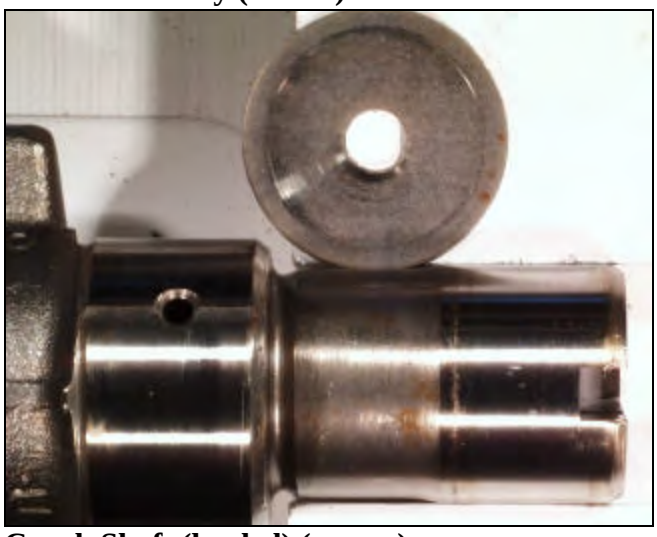
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

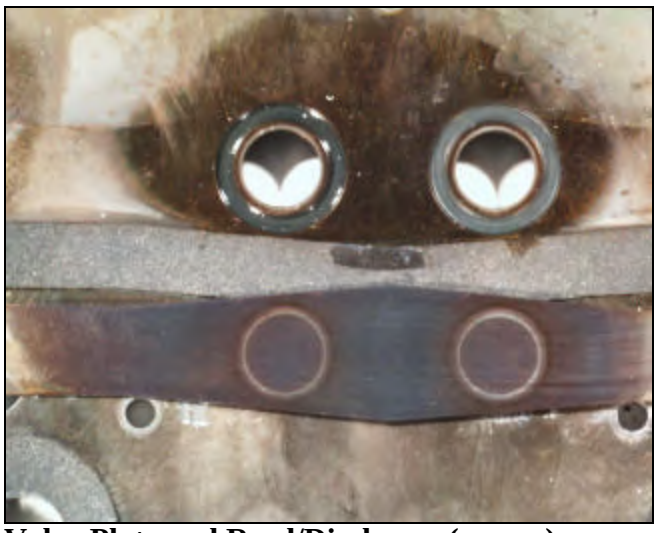
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

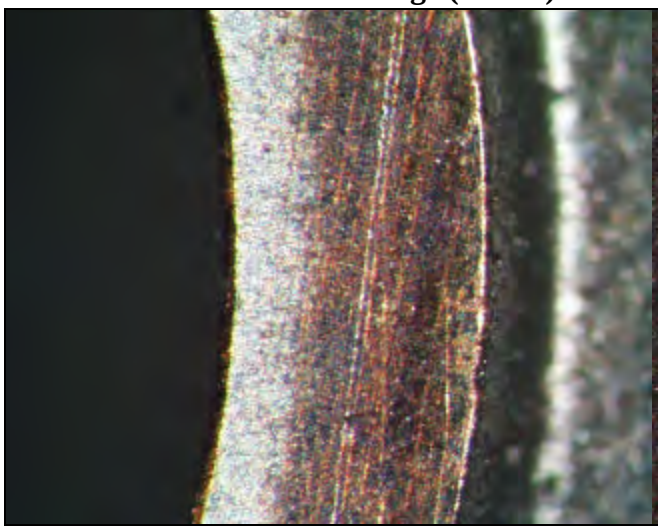
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Compressor with Contaminant Acid and Air 325 psig/75 psig

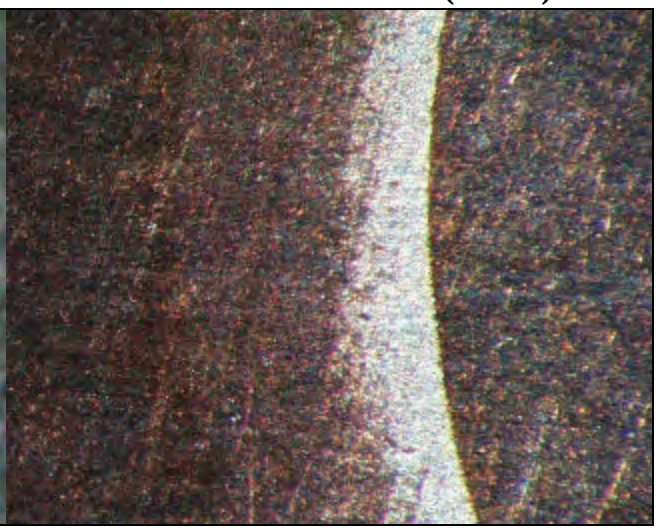


Valve Plate and Reed/Discharge (macro)

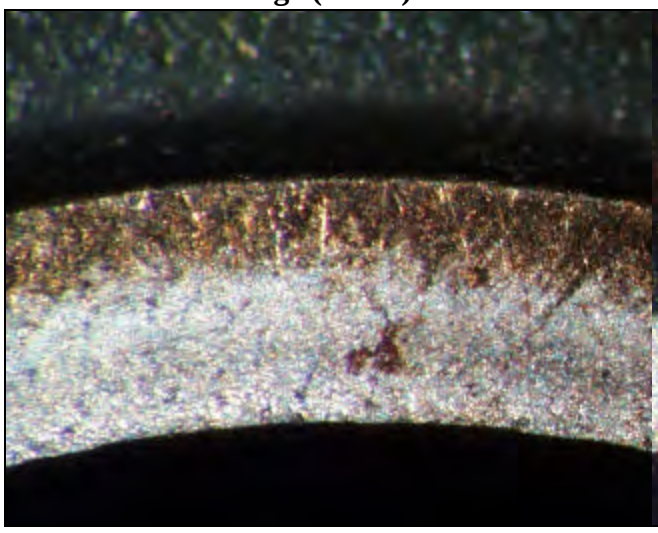
Valve Plate and Reed/Suction (macro)



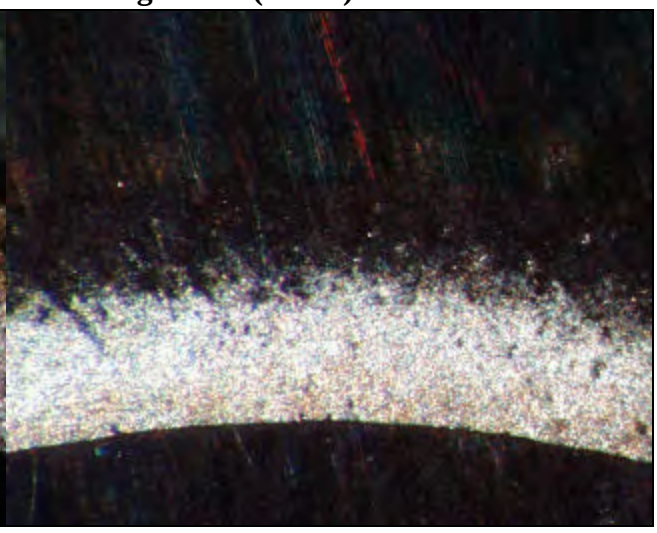
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Water and R-22

TEST HISTORY OF:

Unit Number 51
Model # RS43C1E-CAV-250 **Serial #** 96F16492
Run Time (hr.) 12018 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** Yes
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	65
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 7.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	carbon	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 51
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.03
Water (ppm)	862
Fluoride ion (ppm)	0.86
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.717

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

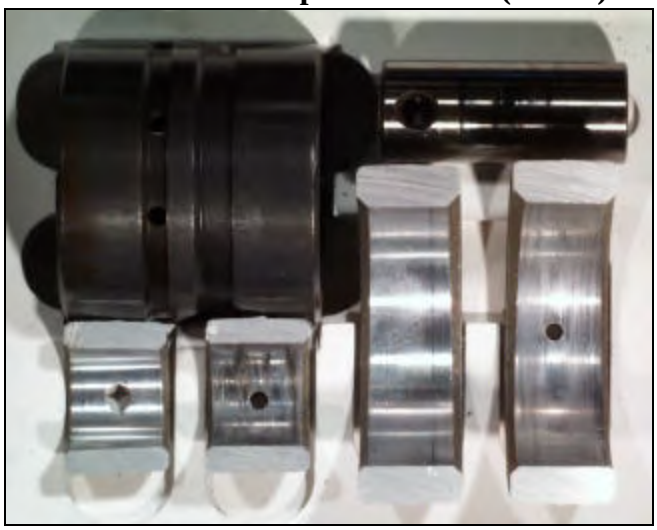
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very heavy	black, brown	gummy
Spring	slight	gold	gummy
Spring Seat	very slight	gold	gummy
Ball	heavy	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Water and R-22
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

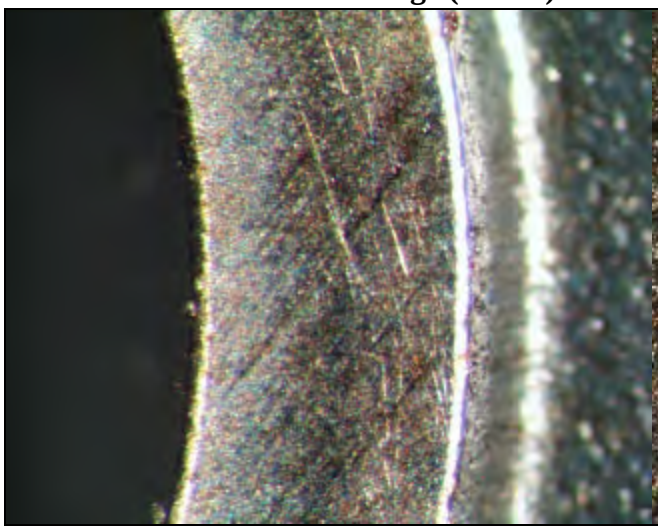
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

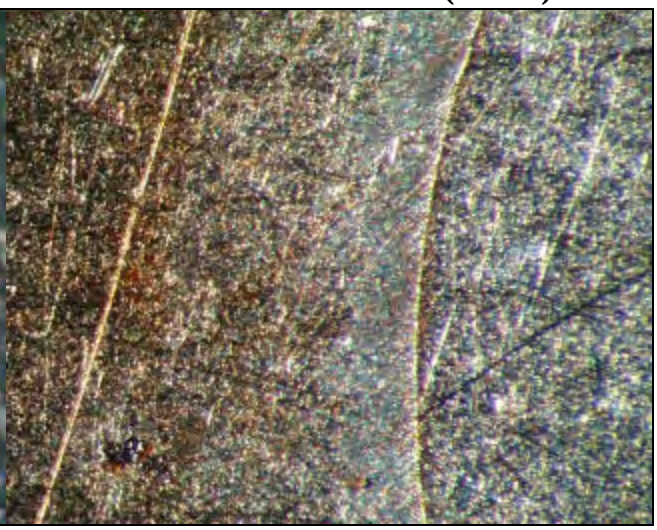
Photographic Documentation of R-407C Compressor with Contaminant Water and R-22
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

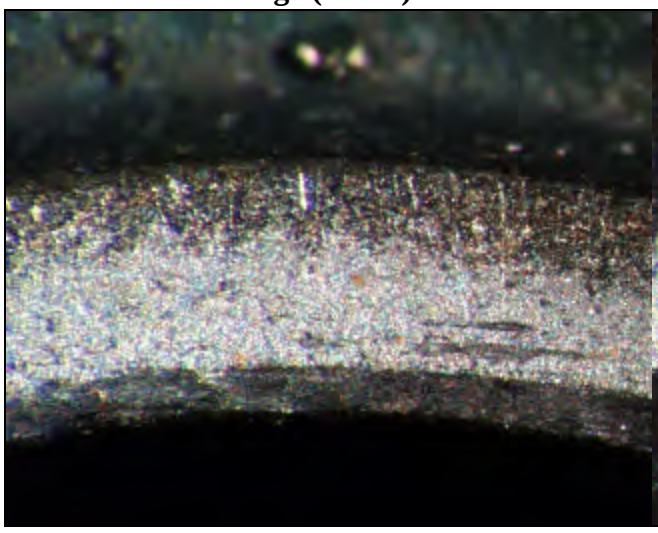
Valve Plate and Reed/Suction (macro)



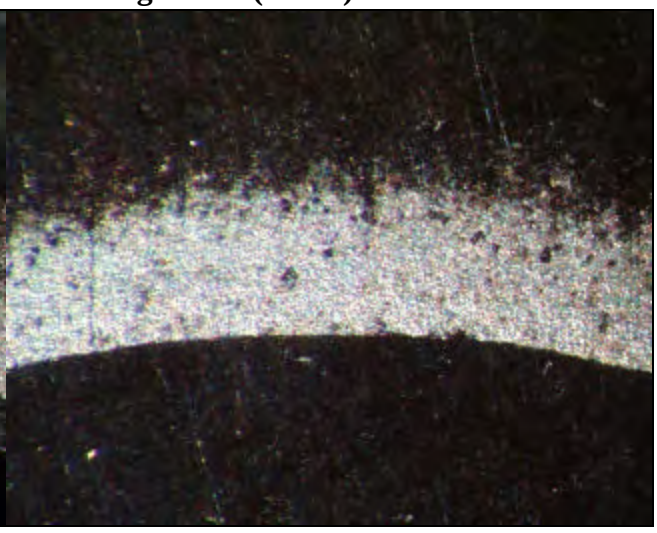
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 52
Model # RS43C1E-CAV-250 **Serial #** 96F16482
Run Time (hr.) 12031 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 3 **(3)** 4 **(4)** 3

Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 8 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2475
	Unloaded	1.2475
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	corrosion	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 52
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.10
Water (ppm)	369
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.041
Number of screens	1
Debris in compressor bottom (g)	0.280

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

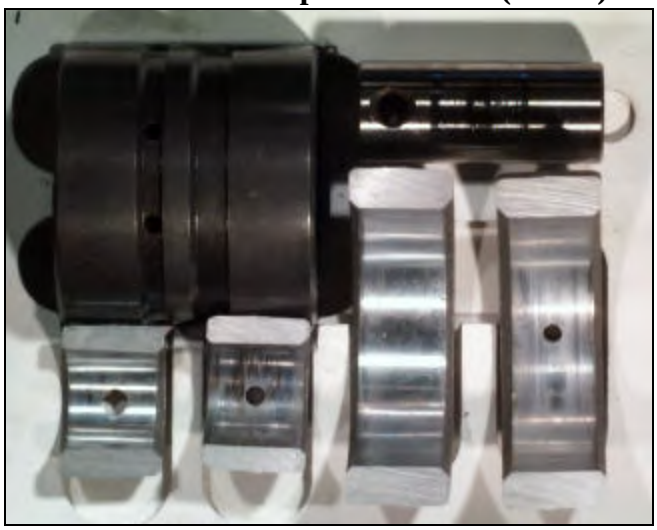
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	brown	gummy
Spring	very slight	brown	gummy
Spring Seat	very slight	gray	gummy
Ball	slight	brown	gummy
Front Side	medium	brown	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid and Water
325 psig/75 psig

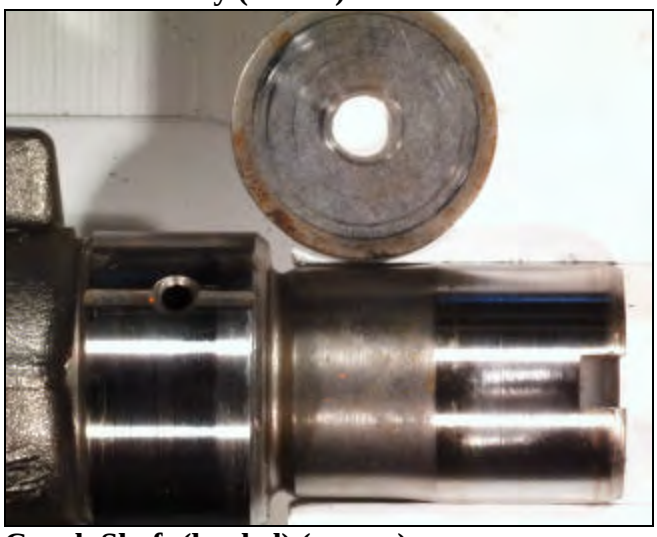
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



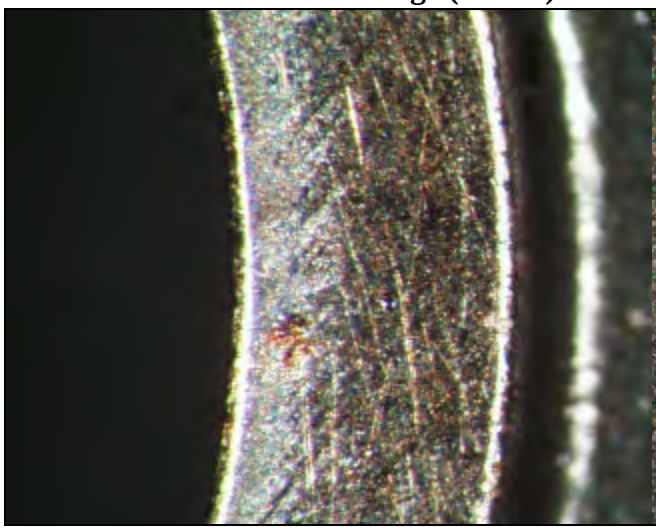
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

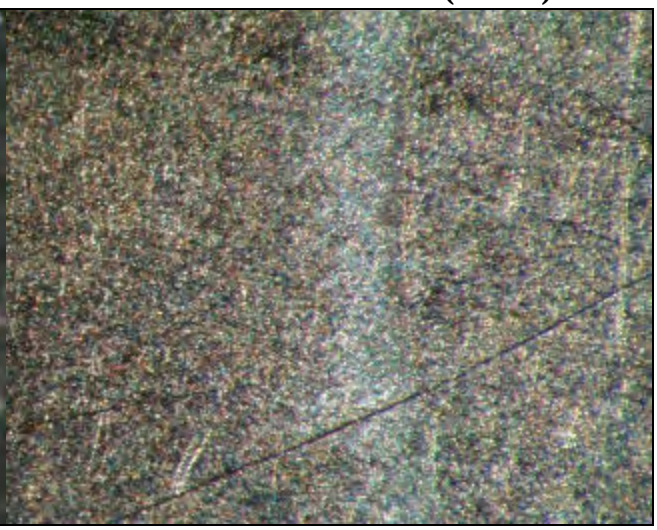
Photographic Documentation of R-407C Compressor with Contaminant Acid and Water
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

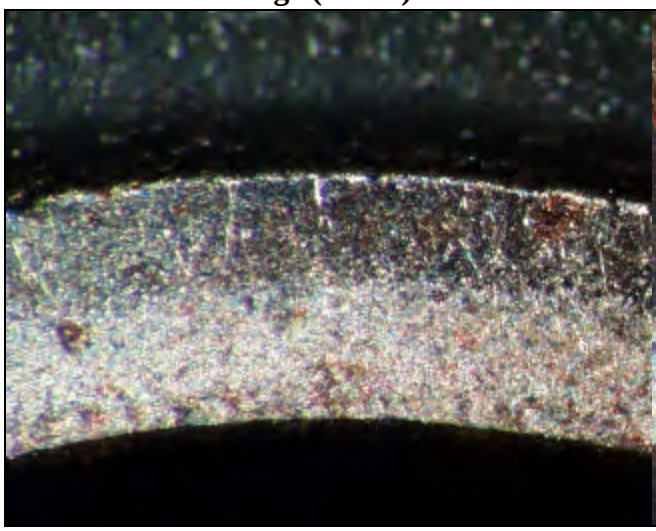
Valve Plate and Reed/Suction (macro)



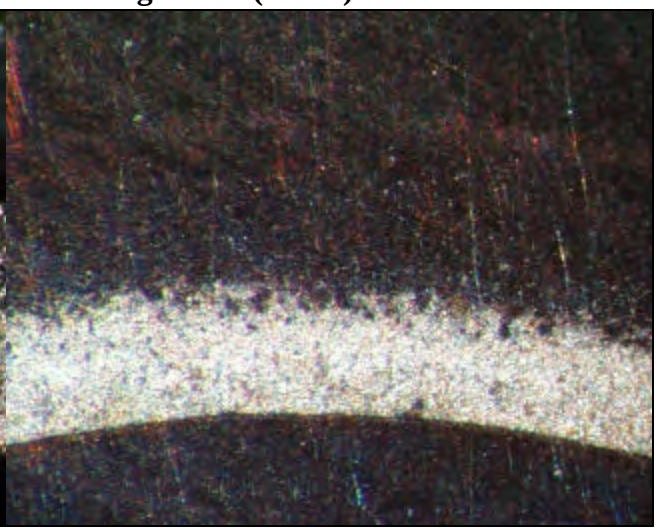
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 53
Model # RS43C1E-CAV-250 **Serial #** 96F16491
Run Time (hr.) 12002 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	bright/clean

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 4 **(4)** 3

Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 11 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2475
	Unloaded	1.2475
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	Cu plating	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	varnish	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish, medium	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 53
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	74
Fluoride ion (ppm)	0.72
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.405

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

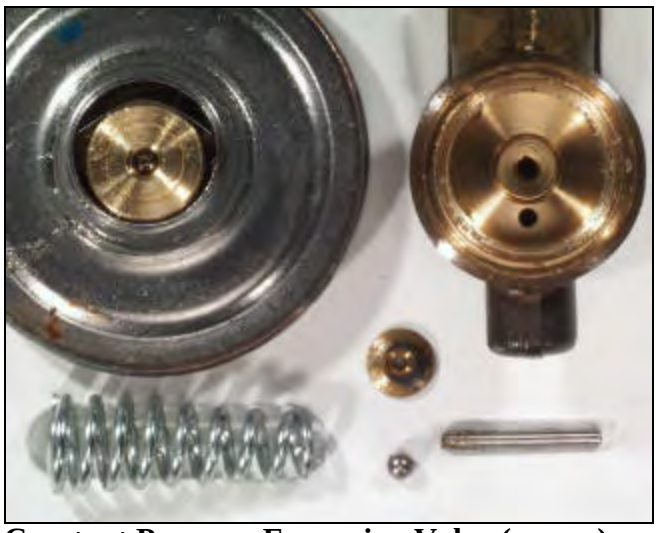
Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	brown	gummy
Spring	none	none	none
Spring Seat	slight	gray	gummy
Ball	slight	black	gummy
Front Side	medium	black	gummy

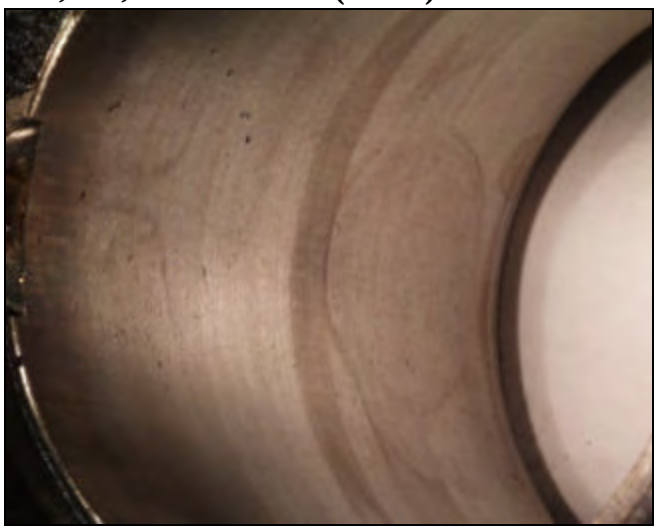
Photographic Documentation of R-407C Compressor with Contaminant Air and Water
325 psig/75 psig



Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

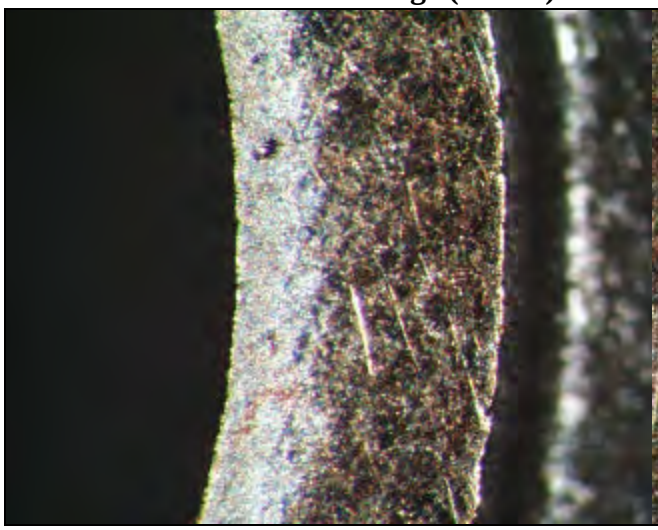
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

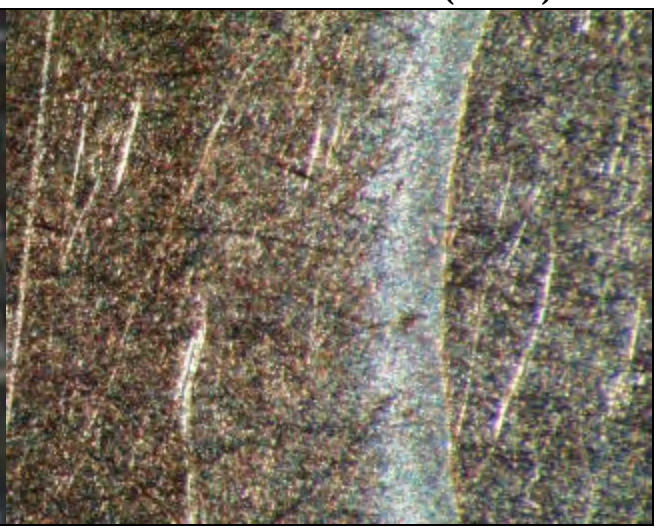
Photographic Documentation of R-407C Compressor with Contaminant Air and Water
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

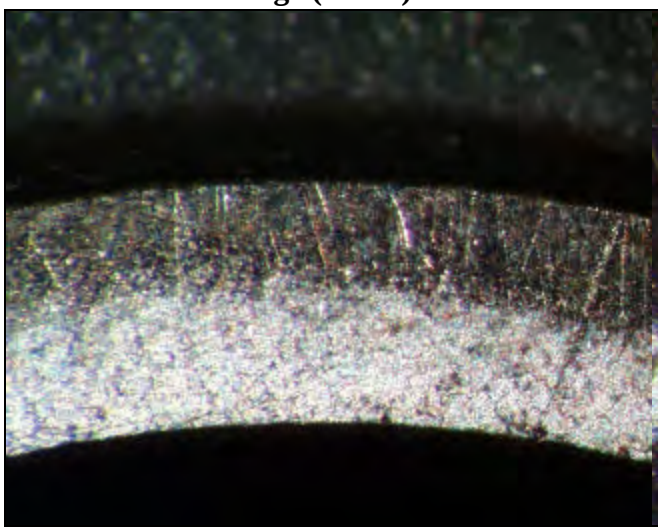
Valve Plate and Reed/Suction (macro)



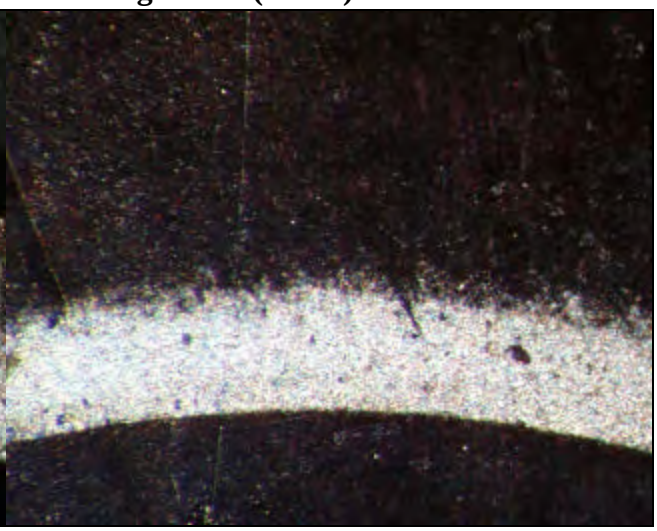
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 54
Model # RS43C1E-CAV-250 **Serial #** 96F16501
Run Time (hr.) 12011 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	65
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5

Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 54
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.02
Water (ppm)	120
Fluoride ion (ppm)	1.7
Chloride ion (ppm)	9.7
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	5
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.019
Number of screens	1
Debris in compressor bottom (g)	0.873

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

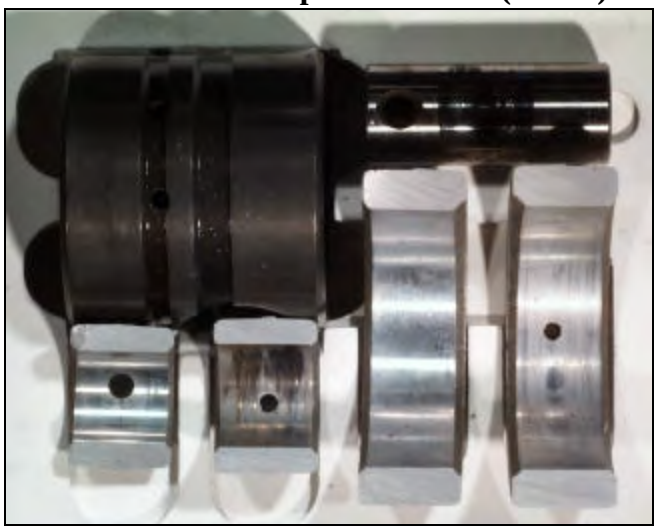
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	very slight	gray	gummy
Spring Seat	very slight	tarnished	hard
Ball	heavy	black	gummy
Front Side	heavy	brown	gummy

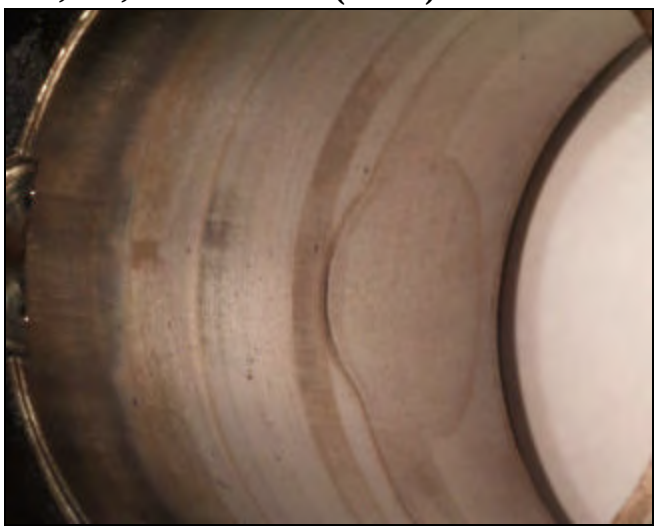
Photographic Documentation of R-407C Compressor with Contaminant Water
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

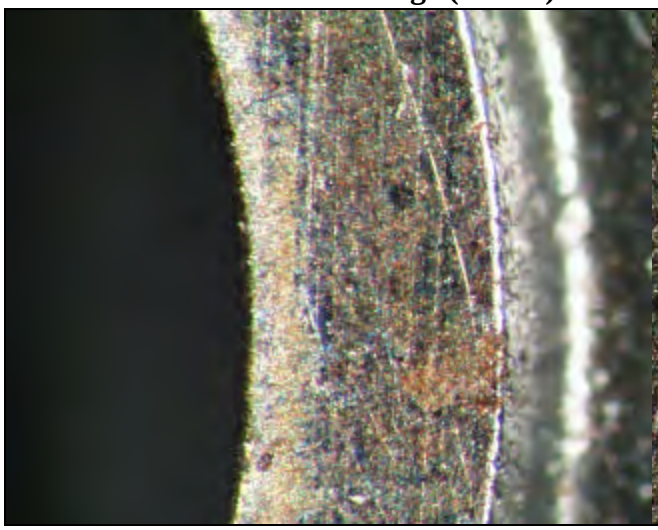
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

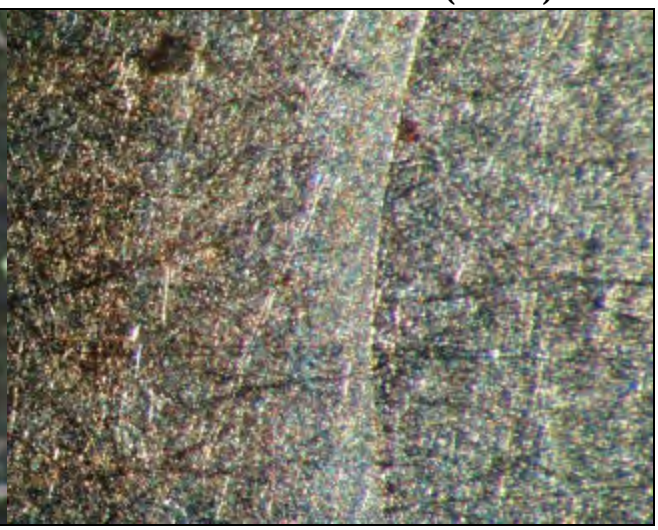
Photographic Documentation of R-407C Compressor with Contaminant Water
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

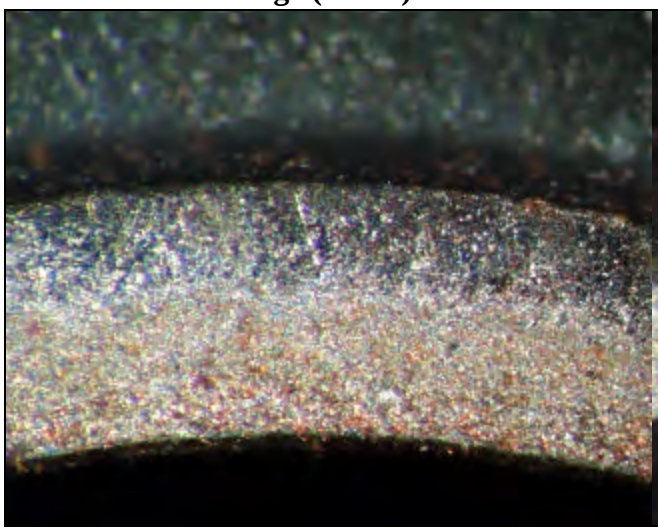
Valve Plate and Reed/Suction (macro)



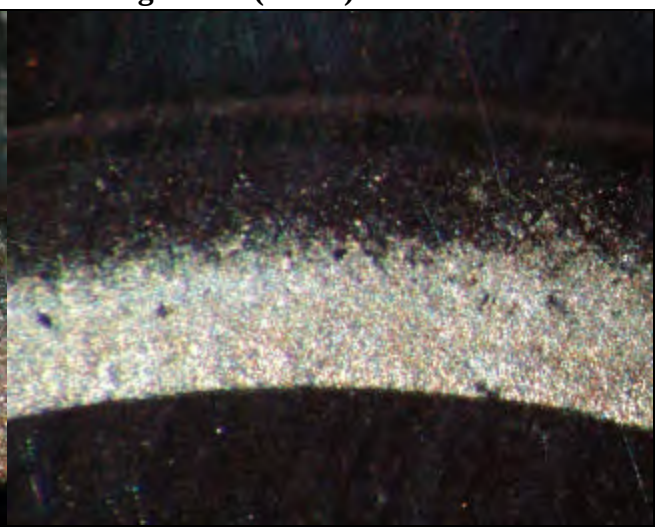
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Water, and R-22

TEST HISTORY OF:

Unit Number 55
Model # RS43C1E-CAV-250 **Serial #** 96F16504
Run Time (hr.) 2674 **Failed?** Yes
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** Yes
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	70
Discharge Temp (°F)	153
Return Gas Temp (°F)	58
SumpTemp (°F)	96
Hi-Pot	pass
High-low leak	fail
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) ND **(2)** ND **(3)** ND **(4)** ND
Remaining torque of stator bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	metal chips
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	clean/bronze plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean/bronze plating	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	damaged	
Piston skirt		
Appearance	wear/scored	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	wear/scored/Cu plating	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2535

TEST HISTORY OF:

Unit Number 55
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	none	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	180
Fluoride ion (ppm)	1.8
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	16
Lead (ppm)	1
Silicon (ppm)	6
Tin (ppm)	26
Zinc (ppm)	2

Trash in liquid screen (g)	0.021
Number of screens	2
Debris in compressor bottom (g)	0.823

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	broken
Appearance	corrosion

Suction surface appearance
corrosion/damaged

Suction reed

Condition	bent/cracked
Appearance	corrosion
Trepan	none
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	broken
Appearance	corrosion
Trepan	none
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	very slight	gray	hard
Equalizer Hole	slight	gray	hard
Tip of Pin	heavy	black	gummy
Spring	heavy	black	gummy
Spring Seat	very slight	brown	gummy
Ball	very slight	brown	gummy
Front Side	very slight	brown	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid, Water, and R-22
325 psig/70 psig

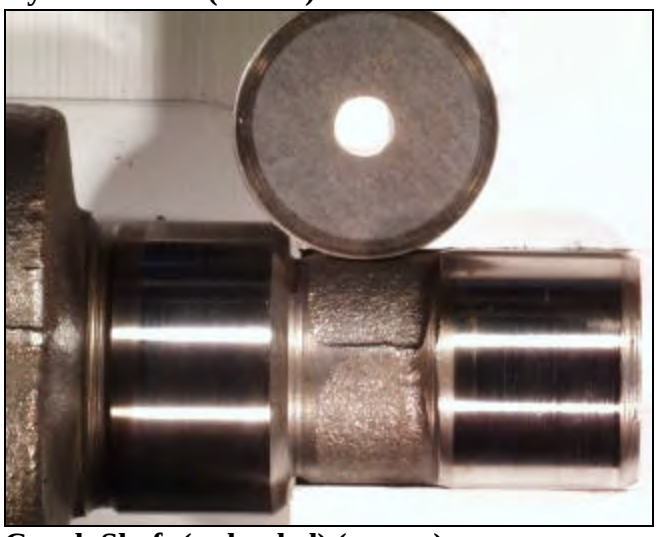
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

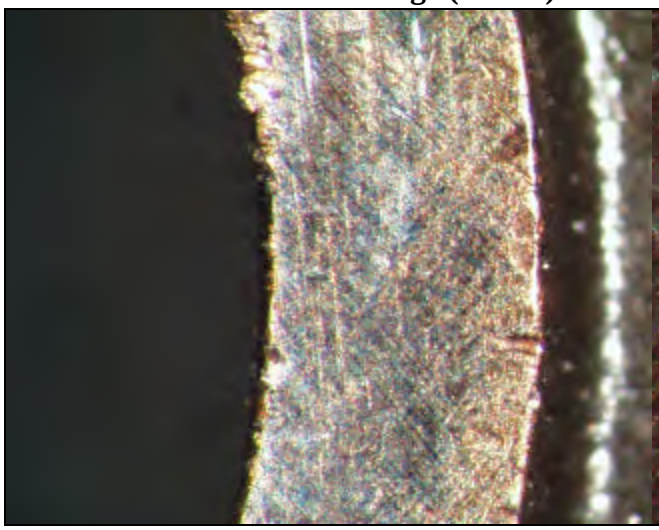


Crank Shaft (unloaded) (macro)

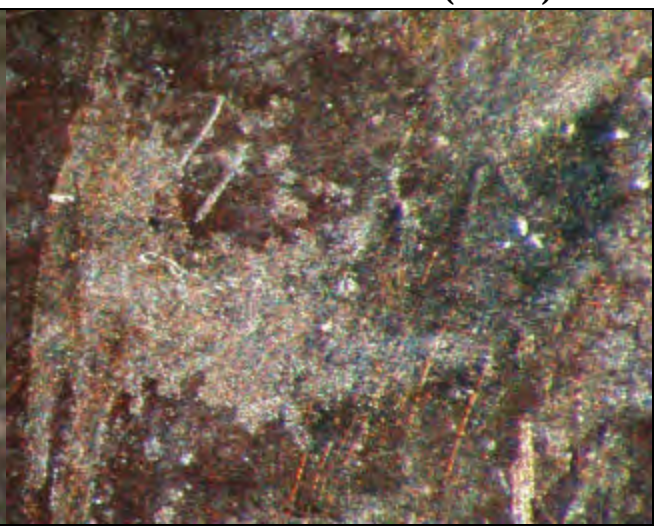
Photographic Documentation of R-407C Compressor with Contaminant Acid, Water, and R-22
325 psig/70 psig

Valve Plate and Reed/Discharge (macro)

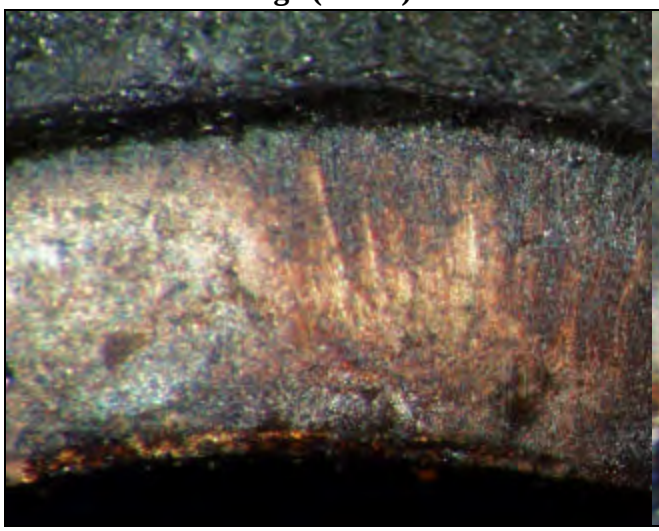
Valve Plate and Reed/Suction (macro)



Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)

Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Air, Water, and R-22

TEST HISTORY OF:

Unit Number 56
Model # RS43C1E-CAV-250 **Serial #** 96F16478
Run Time (hr.) 12010 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** Yes
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	65
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 15 **(3)** 7.5 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	soot
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 17.5 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	carbon	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/corrosion	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number	56		
Contaminants:			
Control Unit?	No		
Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.15
Water (ppm)	206
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	13
Aluminum (ppm)	1
Copper (ppm)	3
Iron (ppm)	6
Lead (ppm)	3
Silicon (ppm)	7
Tin (ppm)	0
Zinc (ppm)	14

Trash in liquid screen (g)	0.002
Number of screens	1
Debris in compressor bottom (g)	0.685

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

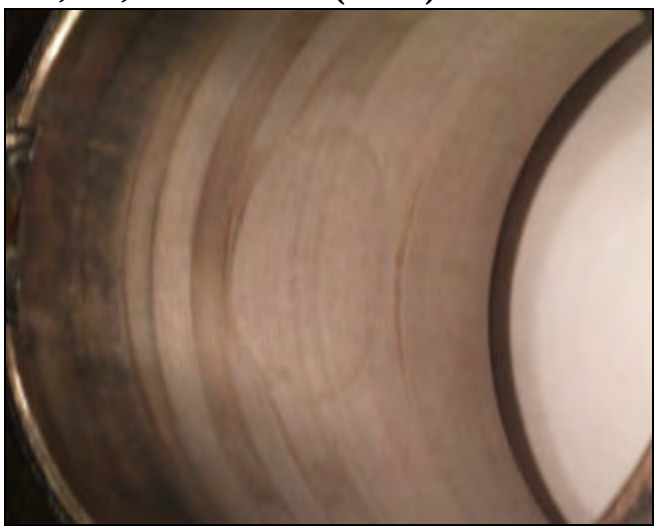
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	gray	gummy
Spring	slight	black	gummy
Spring Seat	slight	black	gummy
Ball	medium	gray	gummy
Front Side	medium	black	hard

Photographic Documentation of R-407C Compressor with Contaminant
Acid, Air, Water, and R-22
325 psig/75 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

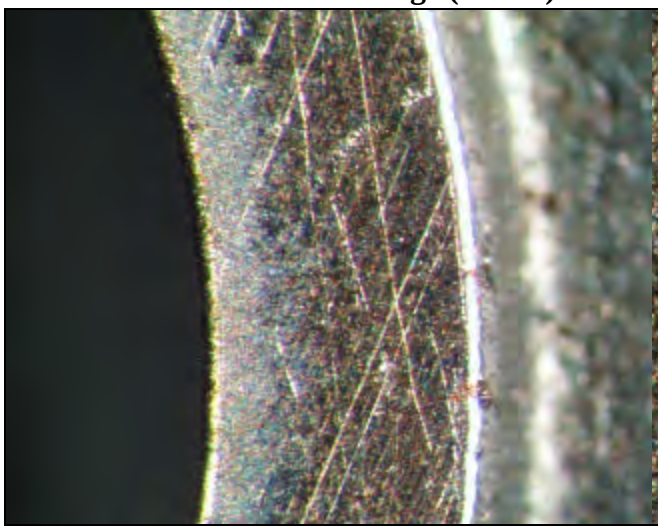
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

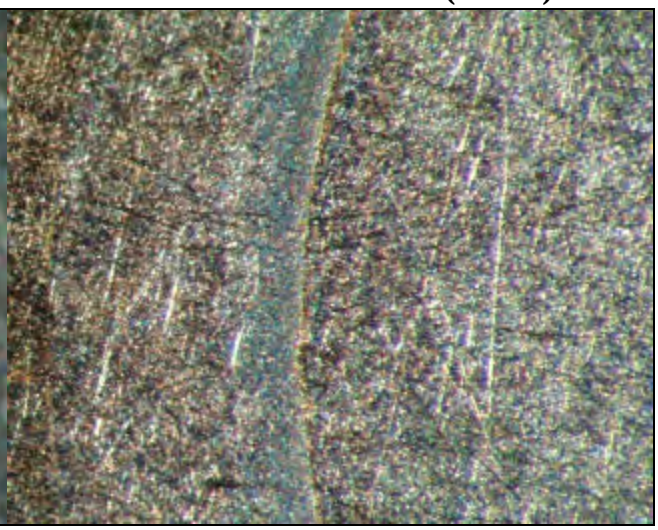
Photographic Documentation of R-407C Compressor with Contaminant
Acid, Air, Water, and R-22
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

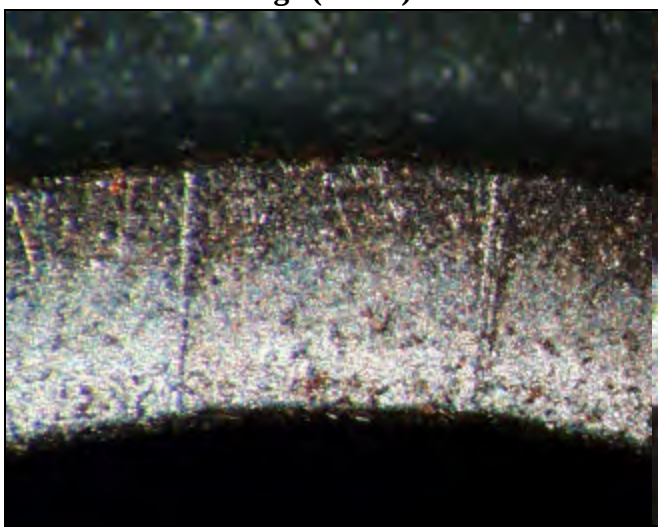
Valve Plate and Reed/Suction (macro)



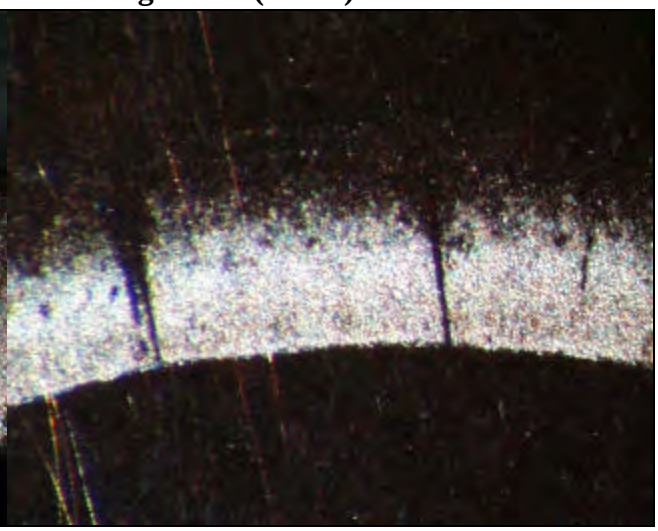
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air, Water, and R-22

TEST HISTORY OF:

Unit Number 57
Model # RS43C1E-CAV-250 **Serial #** 96F16494
Run Time (hr.) 12021 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	pass
Top shell appearance	bright, clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 12 **(2)** 11 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	No
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 5 **(2)** 4 **(3)** 4 **(4)** 4

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 6 **(3)** 5 **(4)** 6

Crank journals		
Appearance	clean/scored	
Wear	polish, slight	
Dimensions	**Loaded**	1.2450
	Unloaded	1.2450
Lower crank bearing journal		
Appearance	varnish	
Wear	polish, slight	
Dimensions	**Loaded**	0.9965
	Unloaded	0.9965
Bottom thrust washer (crank side)		
Appearance	corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0005
	Unloaded	1.0000
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3700
	Unloaded	1.3700
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3735
	Unloaded	1.3735
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2485
	Unloaded	1.2485

TEST HISTORY OF:

Unit Number 57
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4960
	Unloaded	0.4960

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	187
Fluoride ion (ppm)	0.75
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.006
Number of screens	1
Debris in compressor bottom (g)	0.899

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

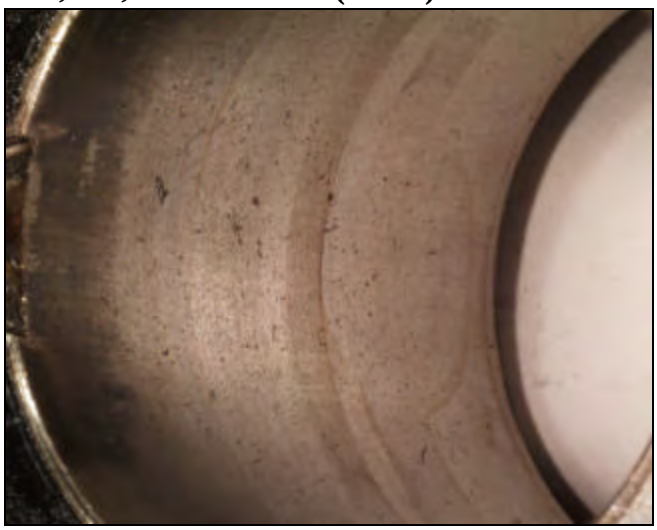
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	slight	brown	gummy
Spring Seat	slight	brown	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Air, Water, and R-22
325 psig/75 psig

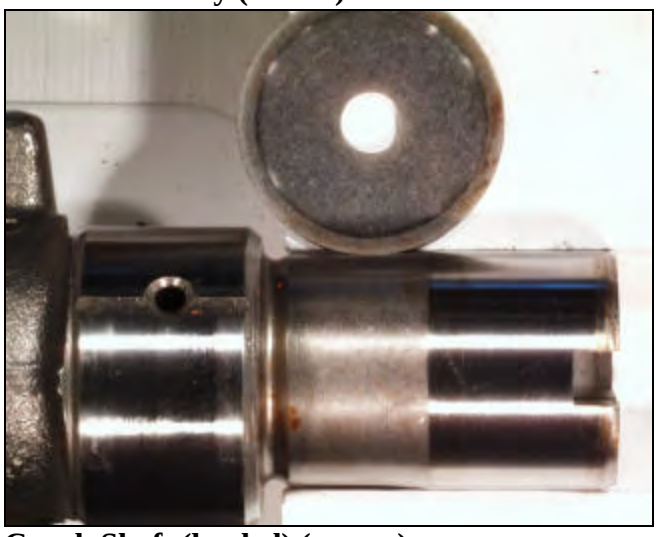
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)



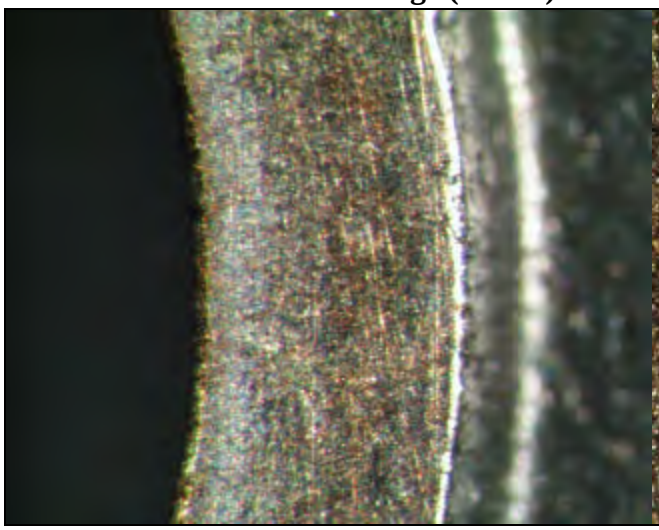
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

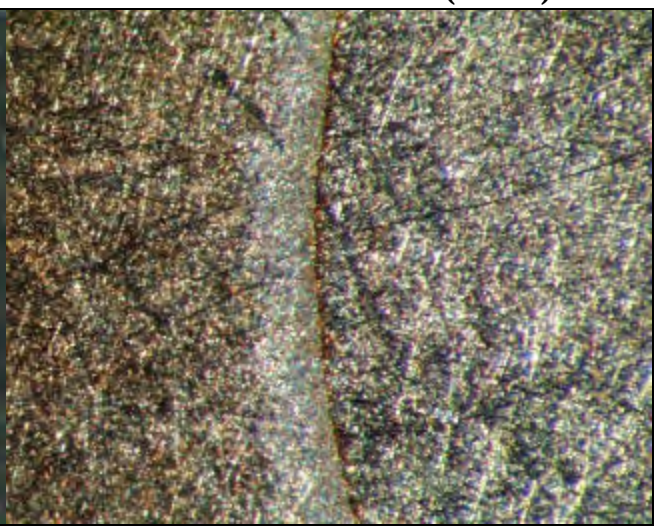
Photographic Documentation of R-407C Compressor with Contaminant Air, Water, and R-22
325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

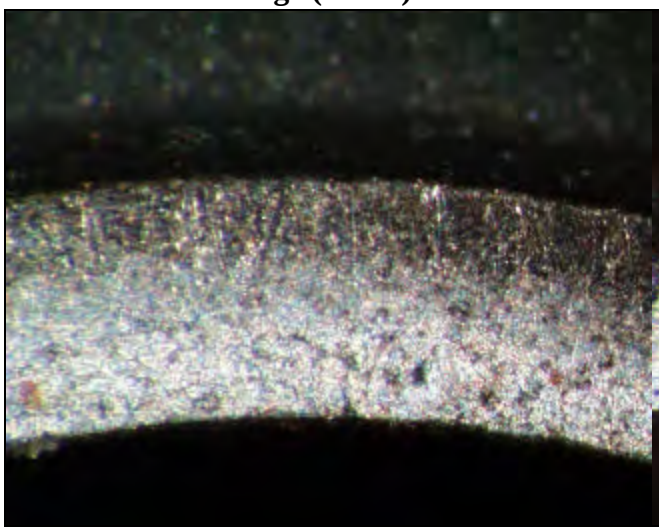
Valve Plate and Reed/Suction (macro)



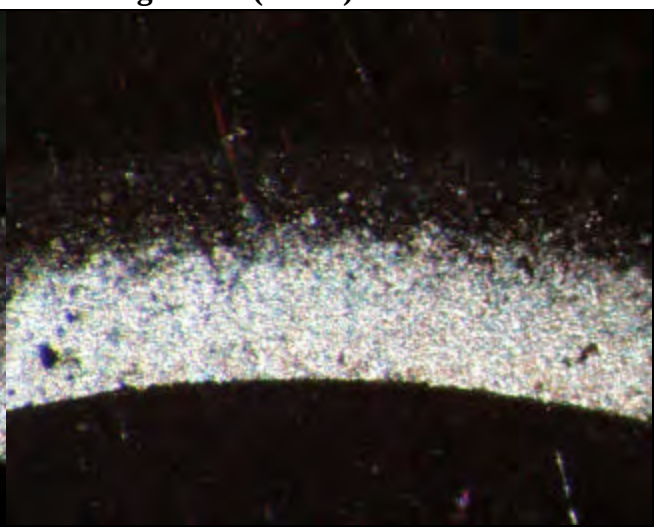
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 58
Model # RS43C1E-CAV-250 **Serial #** 96F16484
Run Time (hr.) 12012 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	75
Discharge Temp (°F)	141
Return Gas Temp (°F)	58
SumpTemp (°F)	81
Hi-Pot	pass
High-low leak	fail
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 9 **(2)** 11 **(3)** 9 **(4)** 12

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 14 **(3)** 15 **(4)** 14

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3715
	Unloaded	1.3715
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 58
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating	
Wear	medium	
Dimensions	**Loaded**	0.4998
	Unloaded	0.4998

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	68
Fluoride ion (ppm)	0.85
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.002
Number of screens	1
Debris in compressor bottom (g)	0.429

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

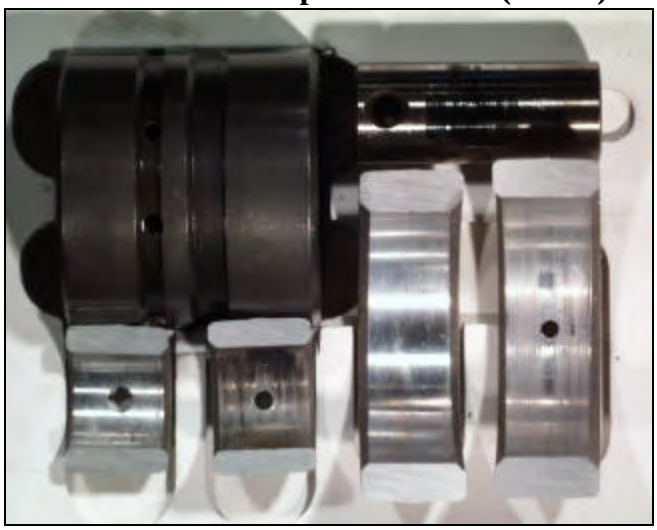
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	medium	black	gummy
Spring Seat	very slight	gray	hard
Ball	medium	black	gummy
Front Side	medium	gray	gummy

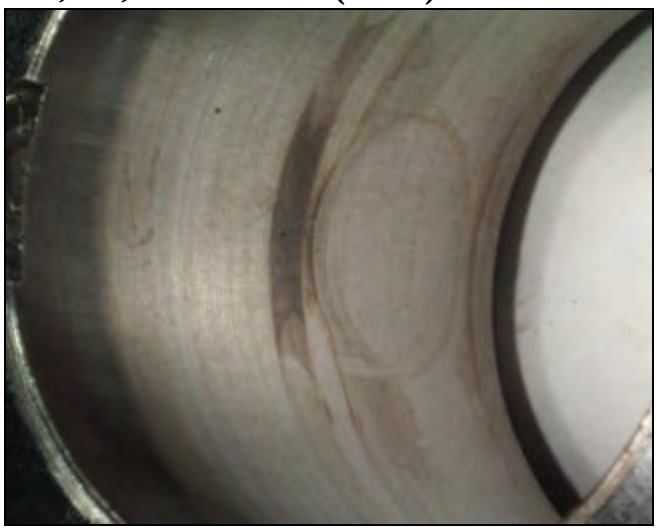
Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and Water 325 psig/75 psig

Constant Pressure Expansion Valve (macro)

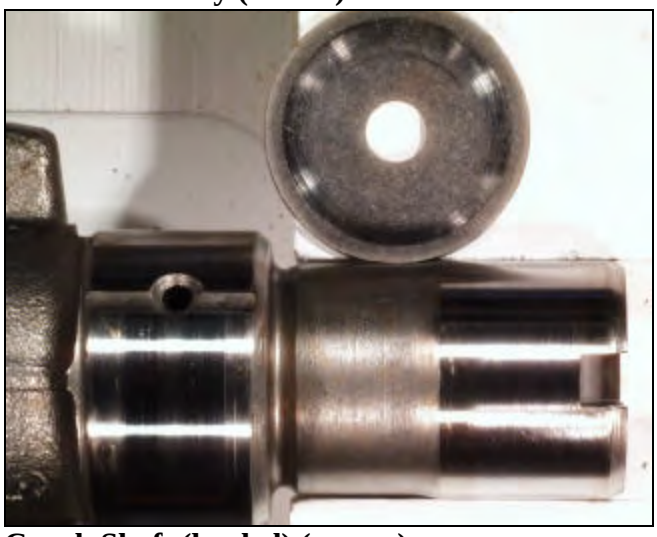
Ball, Pin, Seat of CPEV (micro)



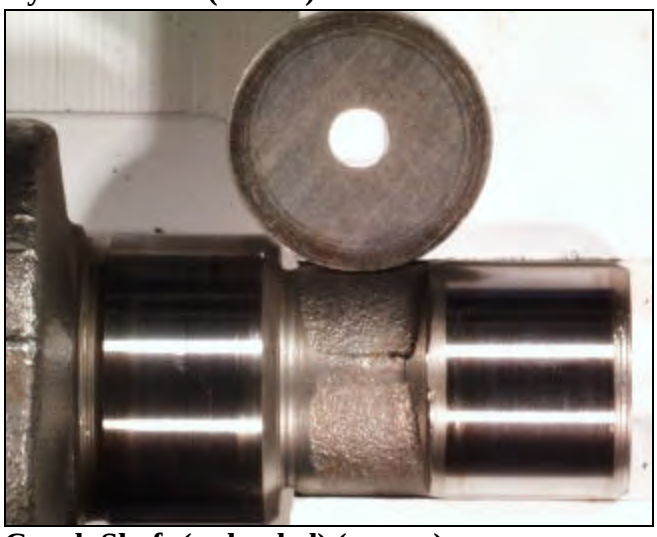
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

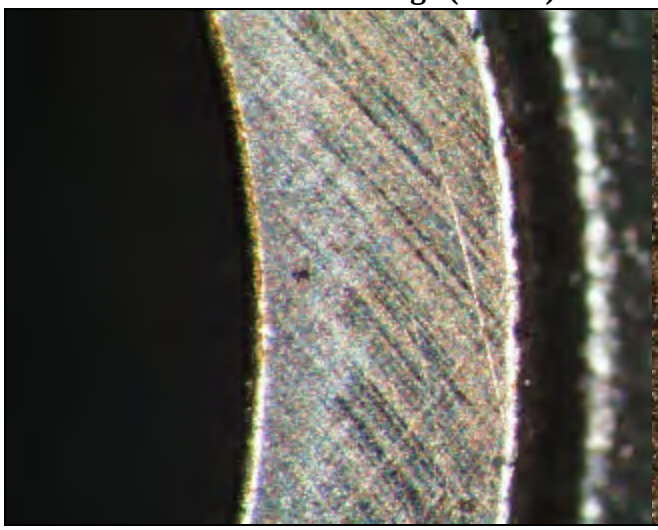


Crank Shaft (unloaded) (macro)

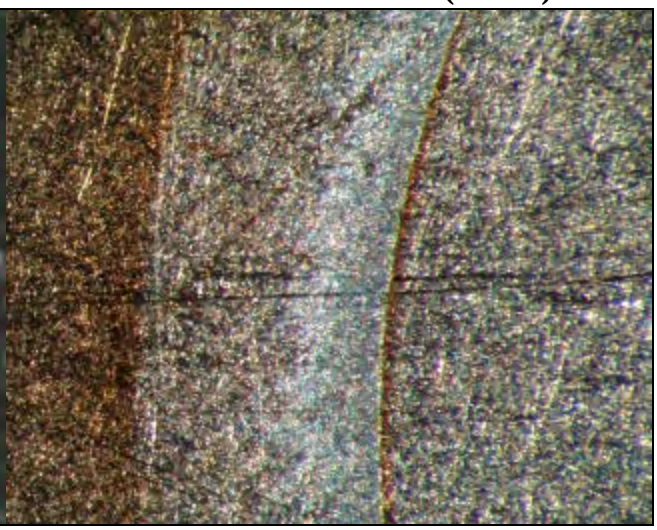
Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and Water 325 psig/75 psig

Valve Plate and Reed/Discharge (macro)

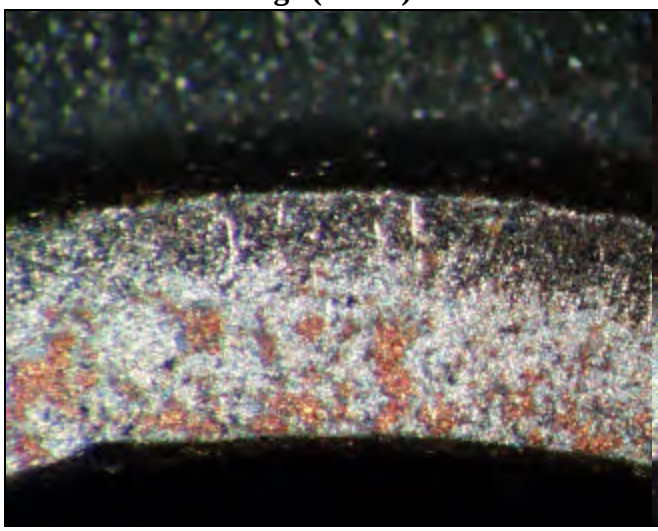
Valve Plate and Reed/Suction (macro)



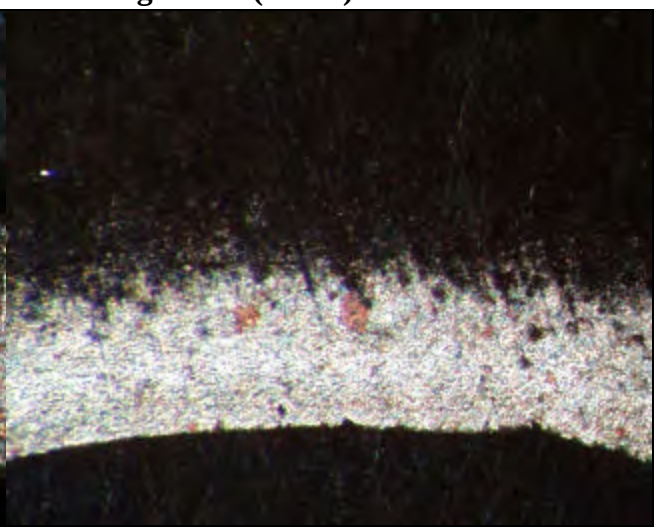
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Control Compressor

TEST HISTORY OF:

Unit Number 59
Model # RS43C1E-CAV-250 **Serial #** 96F16481
Run Time (hr.) 12369 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	325
Suction Pressure (psig)	70
Discharge Temp (°F)	153
Return Gas Temp (°F)	58
SumpTemp (°F)	96
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 3.3 **(2)** 3.8 **(3)** 3.3 **(4)** 3.3
Remaining torque of stator bolts
(1) 2.9 **(2)** 2.9 **(3)** 2.9 **(4)** 2.9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean/bronze plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 59
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	187
Fluoride ion (ppm)	0.82
Chloride ion (ppm)	12
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.014
Number of screens	2
Debris in compressor bottom (g)	0.917

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

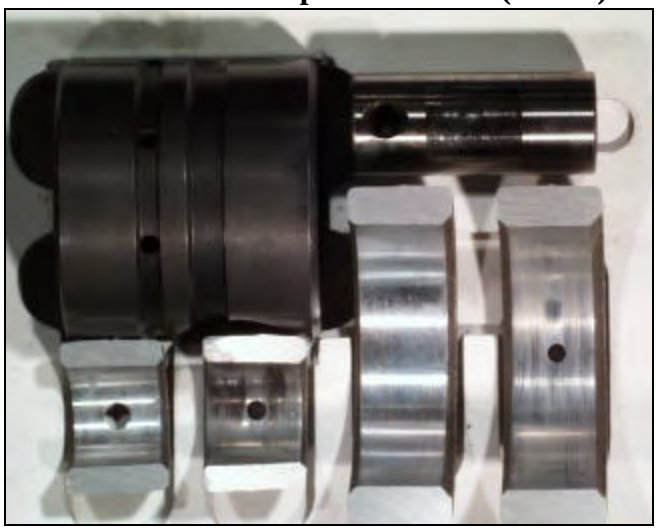
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	very slight	brown	gummy
Tip of Pin	medium	brown	gummy
Spring	medium	black, gray	gummy
Spring Seat	medium	brown	gummy
Ball	medium	brown	gummy
Front Side	none	none	none

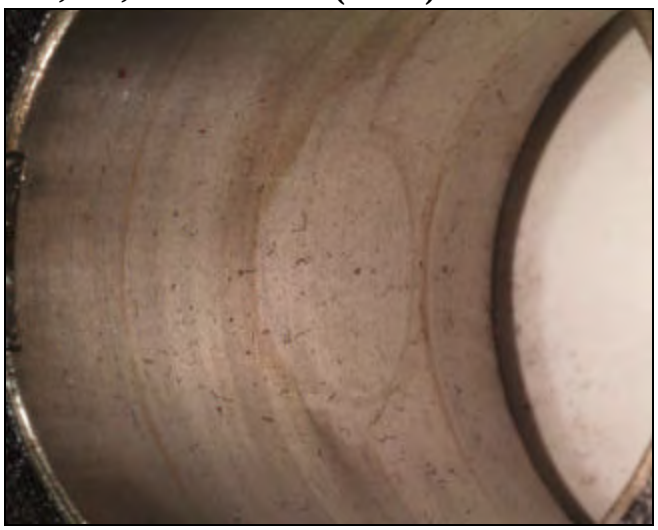
Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Constant Pressure Expansion Valve (macro)

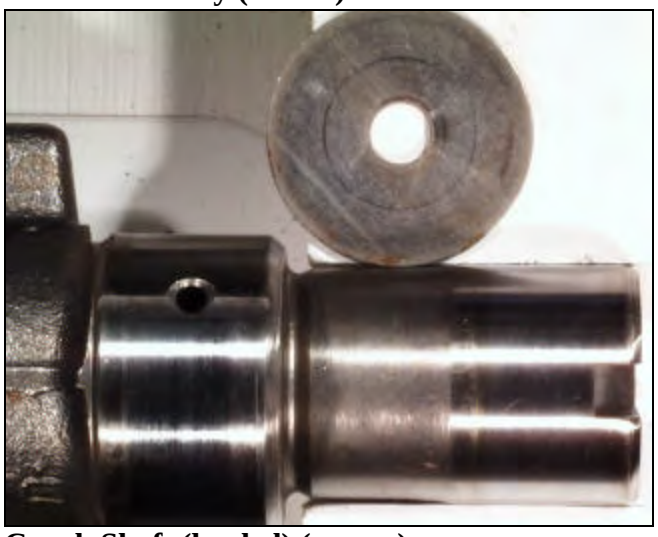
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



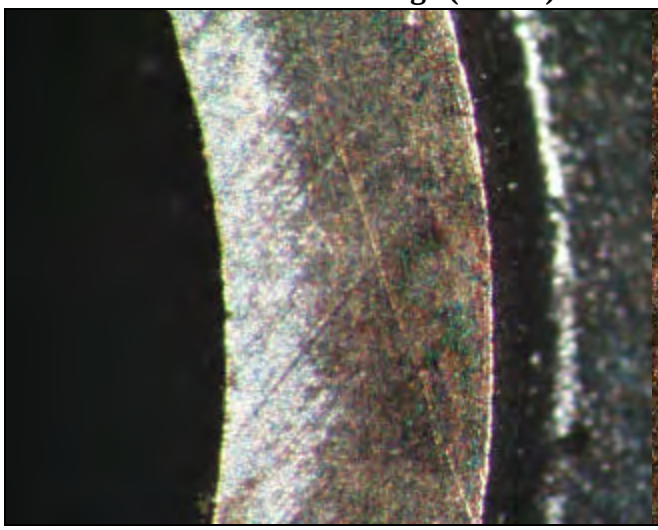
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

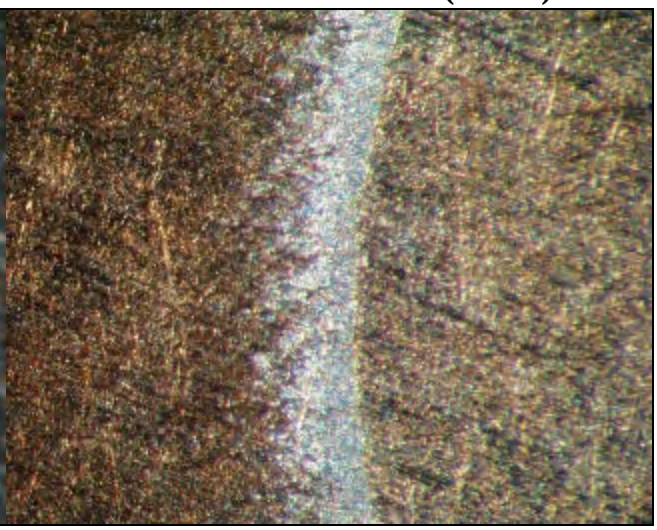
Photographic Documentation of R-407C Control Compressor
325 psig/70 psig

Valve Plate and Reed/Discharge (macro)

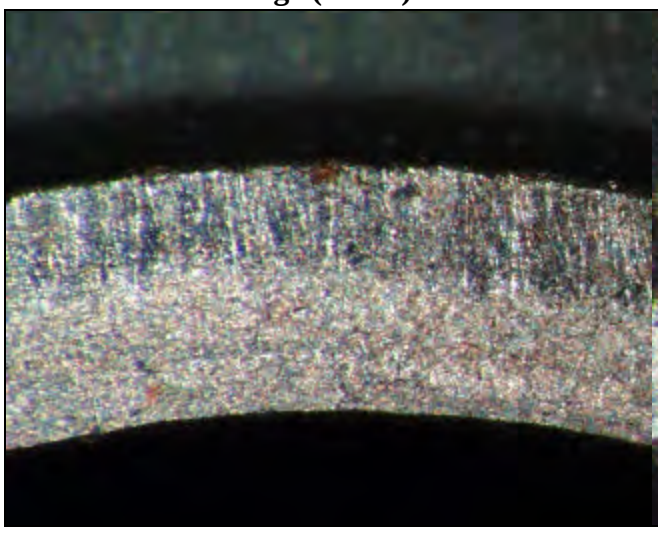
Valve Plate and Reed/Suction (macro)



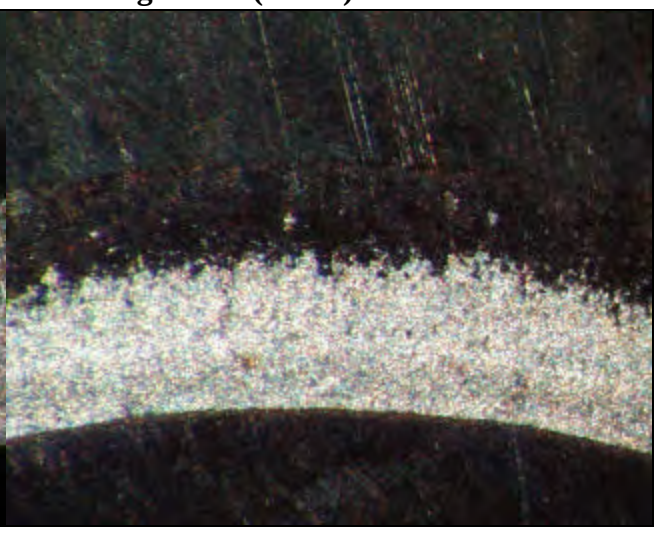
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Control Compressor

TEST HISTORY OF:

Unit Number 60
Model # RS43C1E-CAV-250 **Serial #** 96F16843
Run Time (hr.) 12027 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	35
Discharge Temp (°F)	193
Return Gas Temp (°F)	61
SumpTemp (°F)	162
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 5.4 **(3)** 3.3 **(4)** 2.9

Remaining torque of stator bolts
(1) 11.7 **(2)** 11.7 **(3)** 11.7 **(4)** 11.7

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 14 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 6 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean/scored	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 60
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)
Appearance contact wear/correct washer
Wear polish
Dimensions **Loaded** 0.5005
Unloaded 0.5005
Piston pin washers appearance
contact wear
Piston pin
Appearance scored
Wear polish
Dimensions **Loaded** 0.4975
Unloaded 0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	179
Fluoride ion (ppm)	1.8
Chloride ion (ppm)	9.7
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.894

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion
Suction reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance corrosion
Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring none

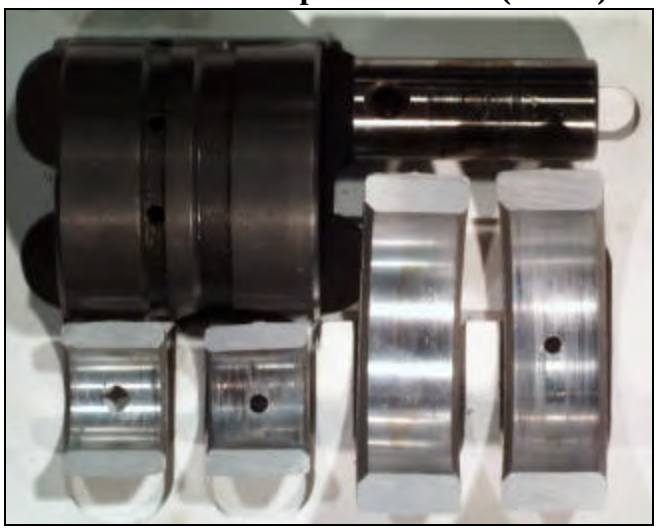
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	slight	brown	gummy
Equalizer Hole	very slight	gray	hard
Tip of Pin	very heavy	brown	gummy
Spring	medium	brown	gummy
Spring Seat	medium	brown	gummy
Ball	medium	brown	gummy
Front Side	slight	brown	gummy

Photographic Documentation of R-407C Control Compressor
200 psig/35 psig

Constant Pressure Expansion Valve (macro)

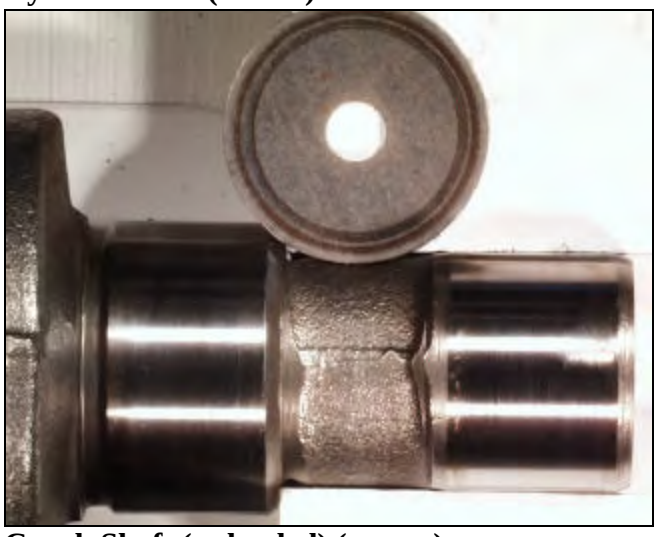
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

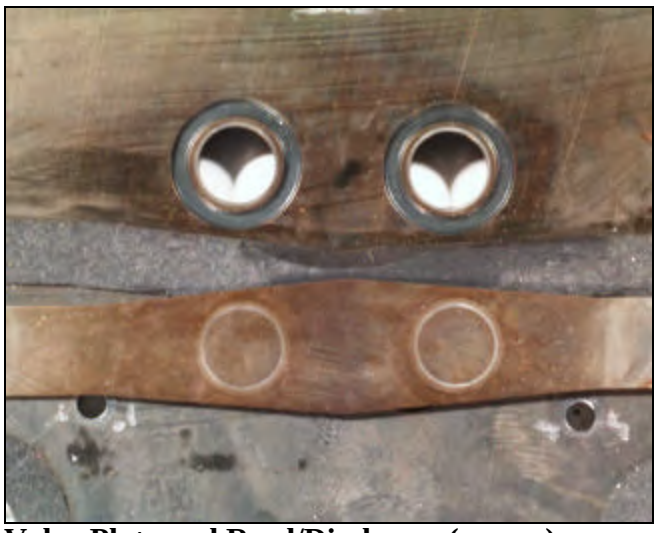
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



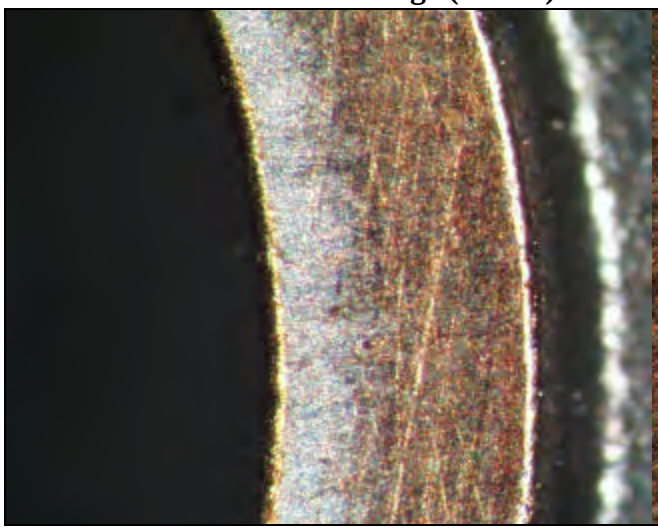
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Control Compressor
200 psig/35 psig

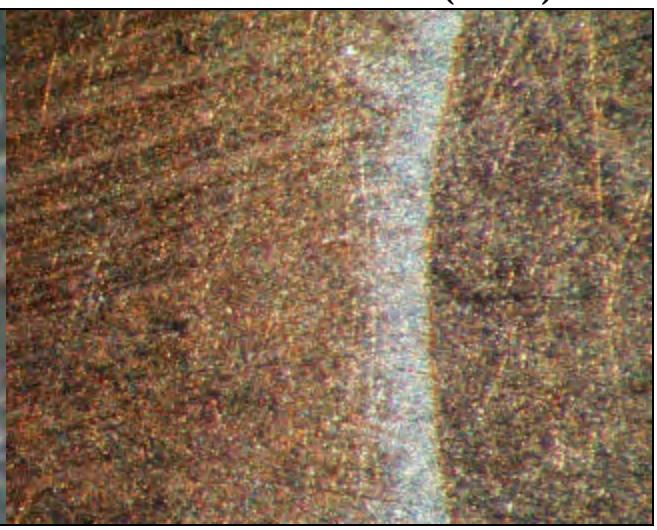


Valve Plate and Reed/Discharge (macro)

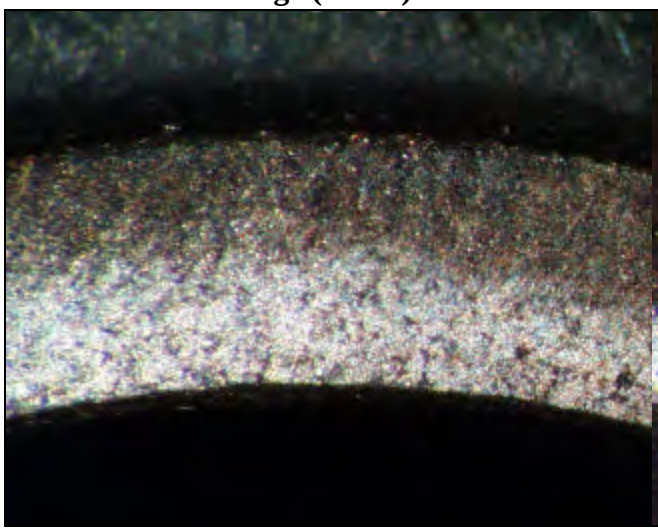
Valve Plate and Reed/Suction (macro)



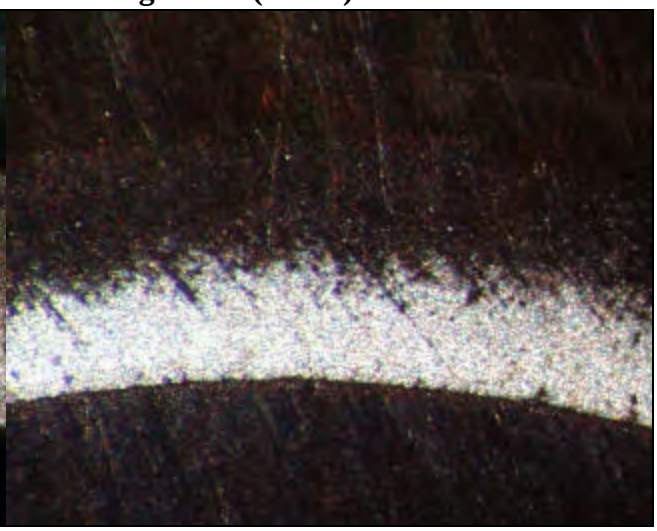
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Control Compressor

TEST HISTORY OF:

Unit Number 61
Model # RS43C1E-CAV-250 **Serial #** 96F16493
Run Time (hr.) 12014 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	35
Discharge Temp (°F)	193
Return Gas Temp (°F)	61
SumpTemp (°F)	162
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 3 **(2)** 3 **(3)** 3 **(4)** 3
Remaining torque of stator bolts
(1) 14 **(2)** 14 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty/Cu plate
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/bronze plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 61
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	167
Fluoride ion (ppm)	1.6
Chloride ion (ppm)	9.9
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	8
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.314

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

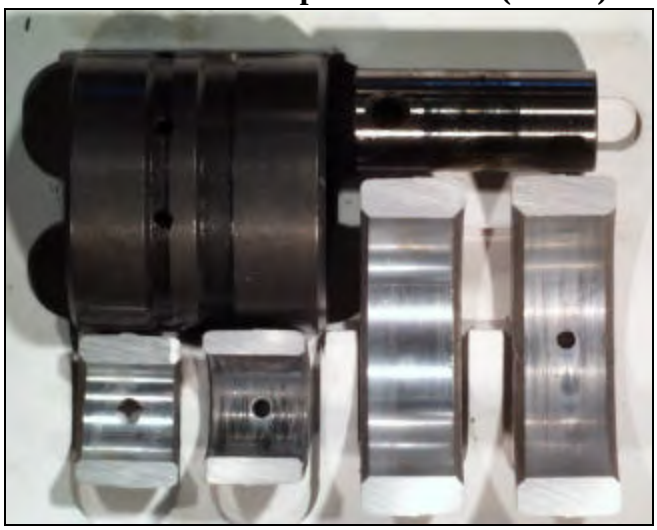
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	brown	hard
Rear Pin	very slight	gray	hard
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	gray	hard
Spring Seat	medium	black	hard
Ball	heavy	black	gummy
Front Side	very slight	gray	hard

Photographic Documentation of R-407C Control Compressor
200 psig/35 psig

Constant Pressure Expansion Valve (macro)

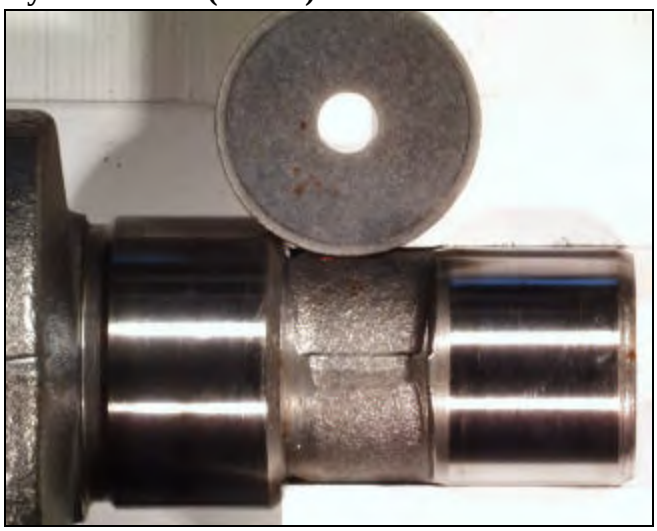
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

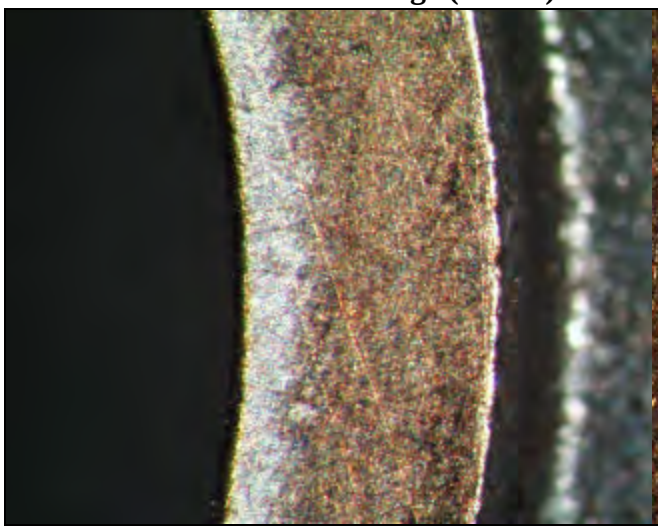


Crank Shaft (unloaded) (macro)

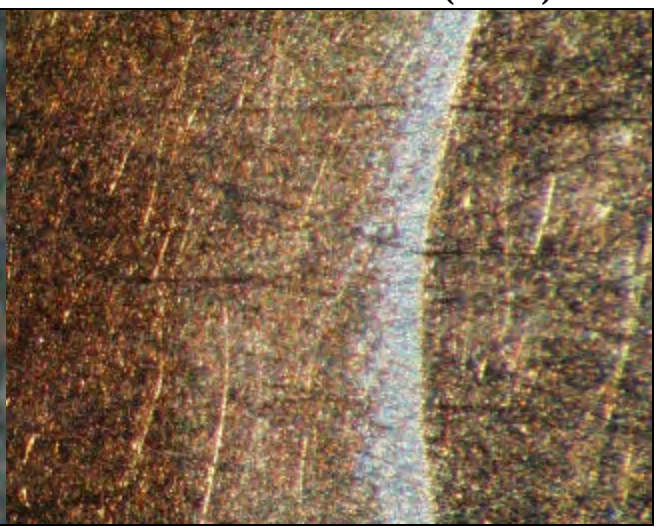
Photographic Documentation of R-407C Control Compressor
200 psig/35 psig

Valve Plate and Reed/Discharge (macro)

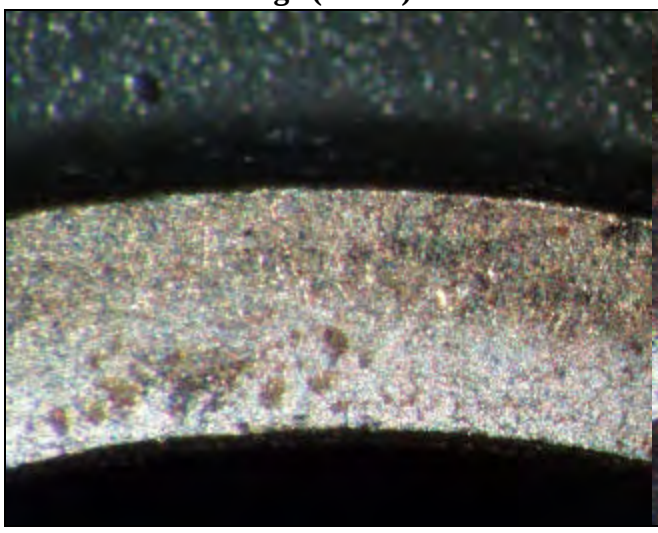
Valve Plate and Reed/Suction (macro)



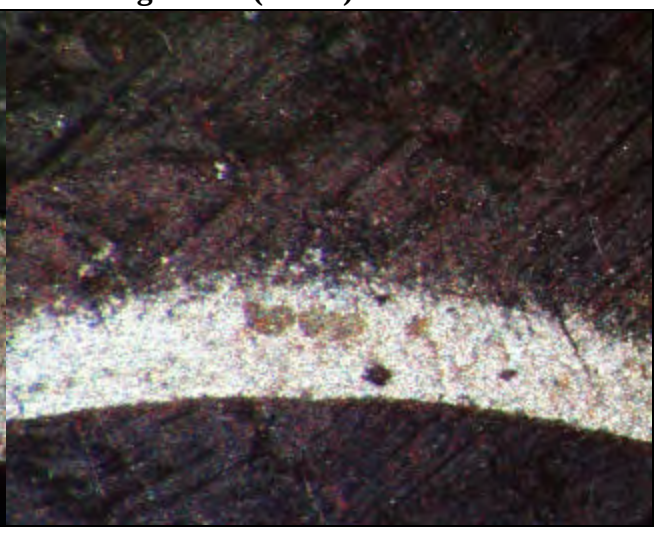
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant R-22

TEST HISTORY OF:

Unit Number 62
Model # RS43C1E-CAV-250 **Serial #** 96F16476
Run Time (hr.) 12027 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	low wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 62
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, medium	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.13
Water (ppm)	153
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	8
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.074
Number of screens	2
Debris in compressor bottom (g)	0.586

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

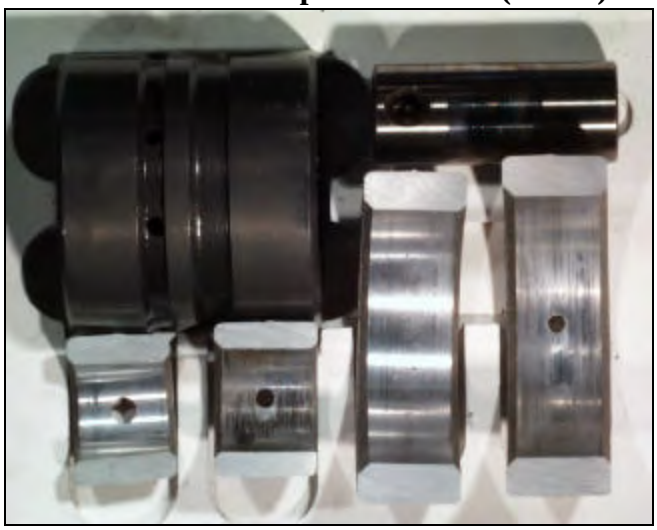
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	slight	gray	hard
Tip of Pin	heavy	black	gummy
Spring	slight	gray	gummy
Spring Seat	slight	gray	gummy
Ball	medium	gray	gummy
Front Side	medium	gray	gummy

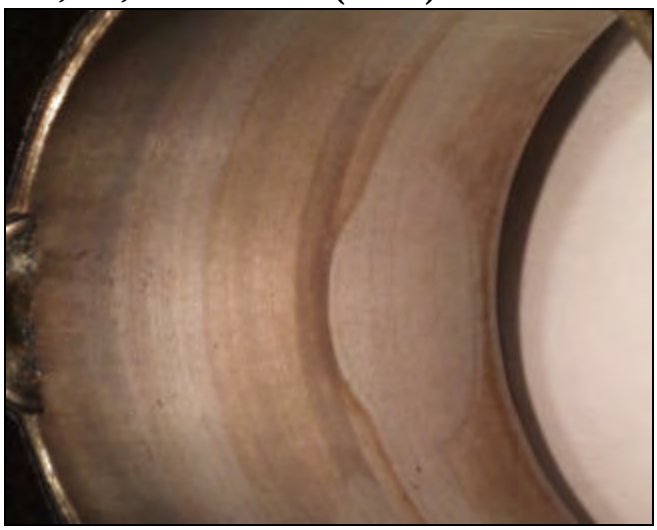
Photographic Documentation of R-407C Compressor with Contaminant R-22
200 psig/40 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

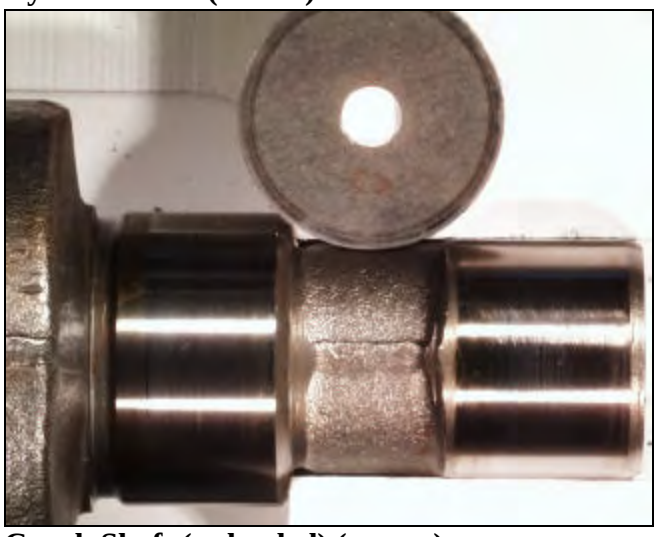


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

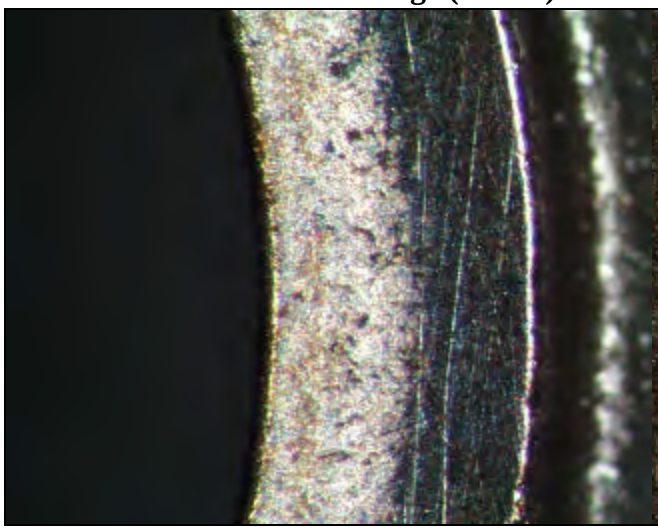


Crank Shaft (unloaded) (macro)

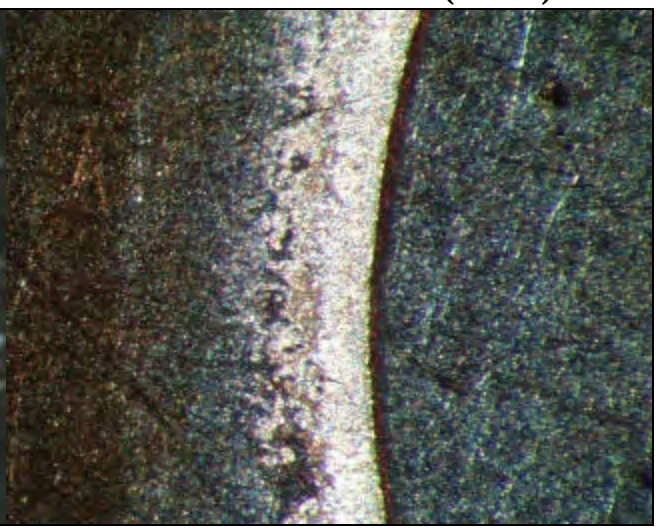
Photographic Documentation of R-407C Compressor with Contaminant R-22
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

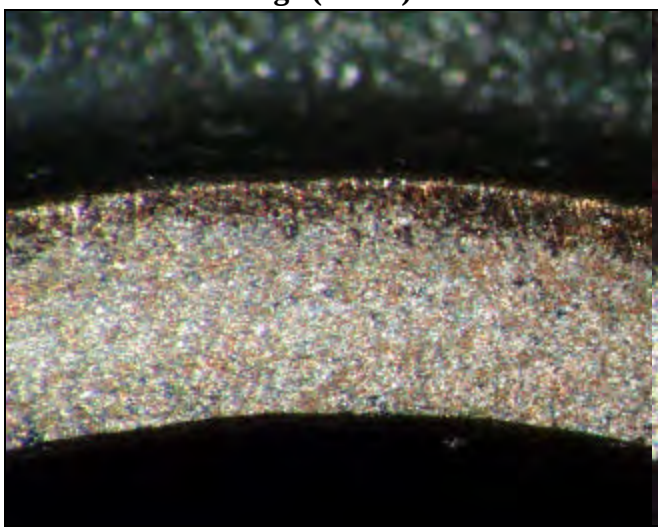
Valve Plate and Reed/Suction (macro)



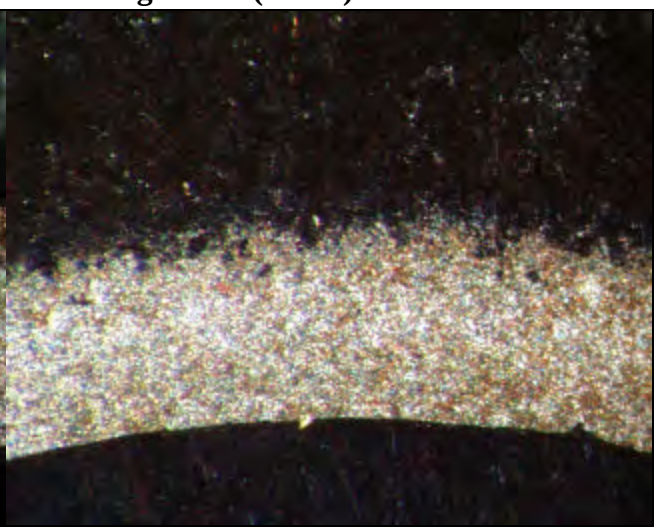
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 63
Model # RS43C1E-CAV-250 **Serial #** 96F16503
Run Time (hr.) 12045 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 2.5 **(4)** 2.5
Remaining torque of stator bolts
(1) 17.5 **(2)** 12.5 **(3)** 15 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 2.5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	medium	
Bottom washer (casting side)		
Appearance	scored/corrosion	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	damaged	
Piston skirt		
Appearance	medium wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3755
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number	63		
Contaminants:			
Control Unit?	No		
Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	39
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	9.2
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	2
Lead (ppm)	1
Silicon (ppm)	6
Tin (ppm)	3
Zinc (ppm)	2

Trash in liquid screen (g)	0.095
Number of screens	2
Debris in compressor bottom (g)	0.854

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

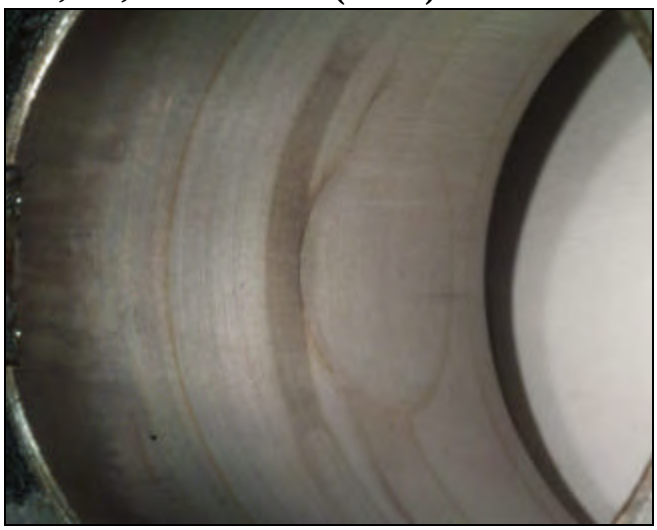
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black, brown	gummy
Spring	medium	gray	gummy
Spring Seat	medium	gray	gummy
Ball	heavy	brown	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid
200 psig/40 psig

Constant Pressure Expansion Valve (macro)

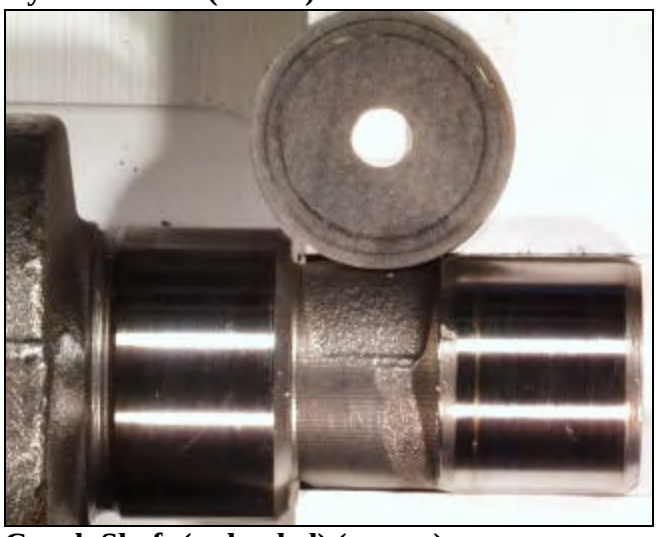
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

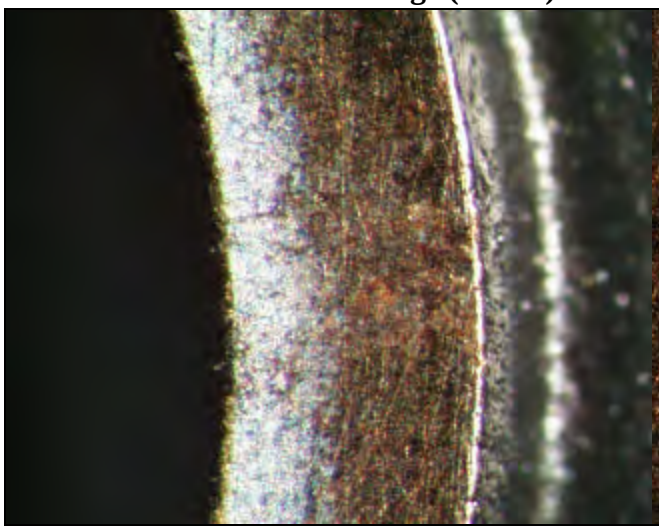


Crank Shaft (unloaded) (macro)

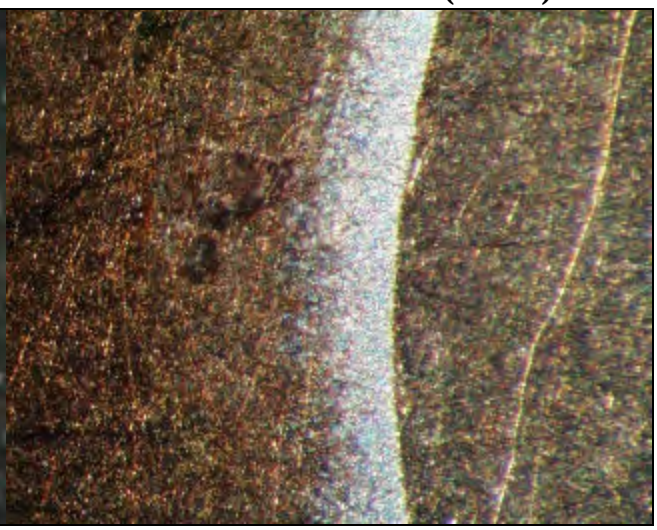
Photographic Documentation of R-407C Compressor with Contaminant Acid
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

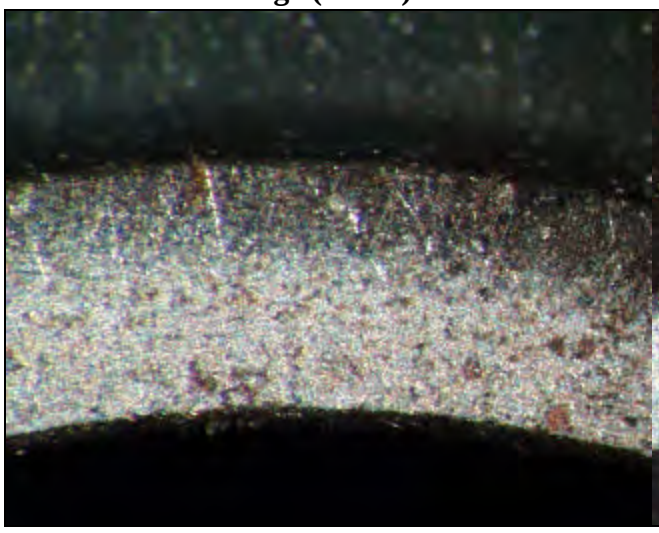
Valve Plate and Reed/Suction (macro)



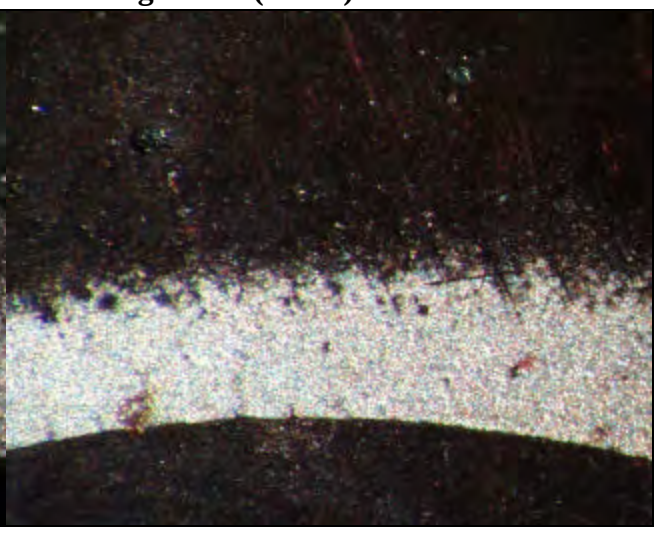
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 64
Model # RS43C1E-CAV-250 **Serial #** 96F16495
Run Time (hr.) 12042 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 200
Suction Pressure (psig) 40
Discharge Temp (°F) 180
Return Gas Temp (°F) 62
SumpTemp (°F) 147

Hi-Pot pass
High-low leak fail
Top shell appearance clean
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray/discolored
Remaining torque of discharge muffler
(1) 2 **(2)** 1 **(3)** 1 **(4)** 1
Remaining torque of stator bolts
(1) 15 **(2)** 12.5 **(3)** 10 **(4)** 12.5
Suction muffler appearance gray
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance gray/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance black
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 10 **(4)** 10
Head gasket brittle? yes/bonded
Head suction cavity appearance dirty
Head discharge cavity appearance dirty
Cage bearing top appearance dirty/wear metals
Remaining torque of cage bearing bolts
(1) 2.5 **(2)** 2.5 **(3)** 2.5 **(4)** 5

Crank journals
Appearance scored/heavily discolored
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean/heavily discolored
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/bronze plating/corrosion
Wear polish
Bottom washer (casting side)
Appearance scored/bronze plating
Wear polish
Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0035
Unloaded 1.0035
Shaft in cage bearing
Appearance heavily discolored
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear
Varnish ring medium
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 64
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	corrosion/discolored	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.22
Water (ppm)	140
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	9.7
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.083
Number of screens	2
Debris in compressor bottom (g)	0.681

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

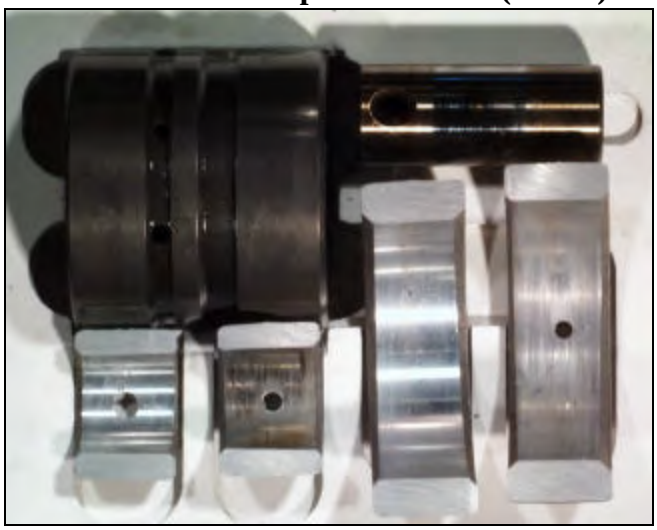
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	heavy	black, brown	gummy
Spring Seat	slight	brown	gummy
Ball	heavy	black	gummy
Front Side	medium	brown	gummy

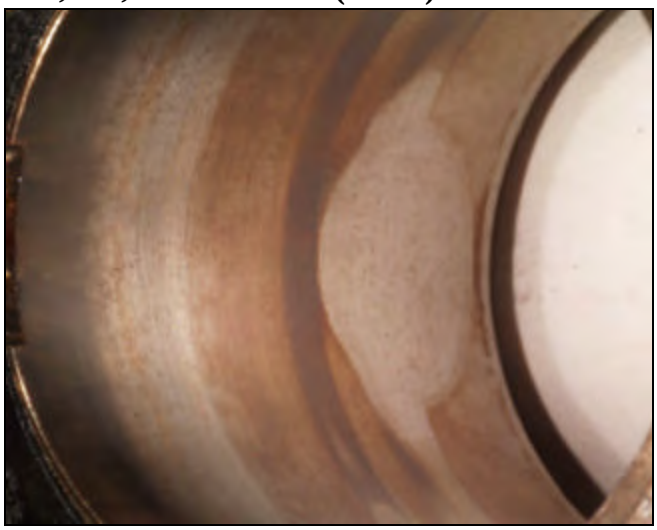
Photographic Documentation of R-407C Compressor with Contaminant Air
200 psig/40 psig

Constant Pressure Expansion Valve (macro)

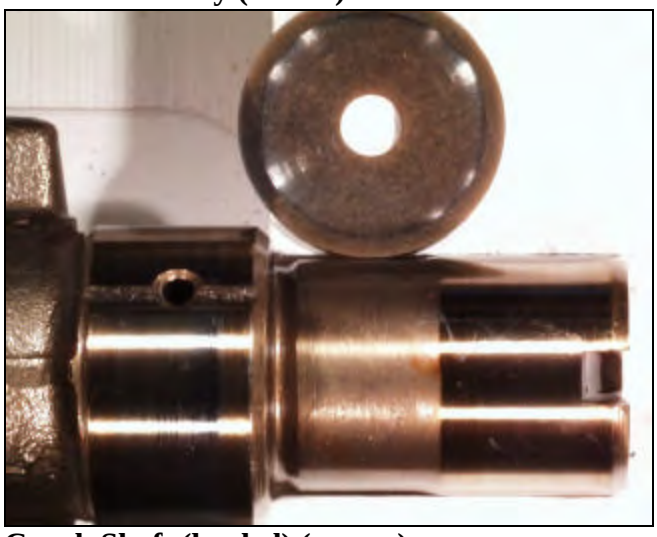
Ball, Pin, Seat of CPEV (micro)



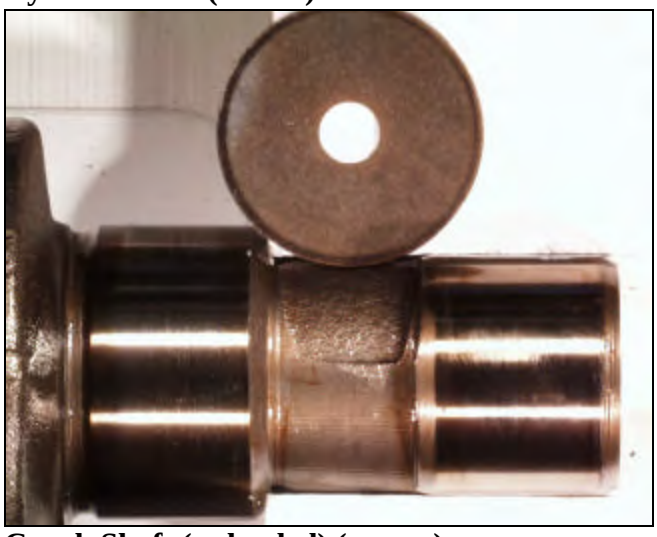
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

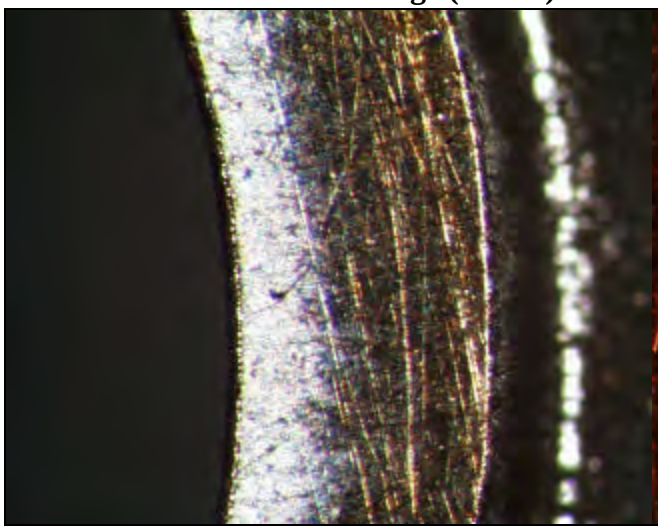


Crank Shaft (unloaded) (macro)

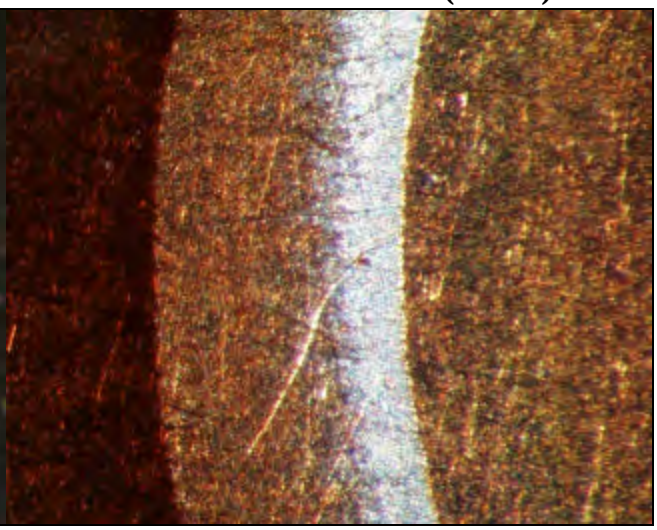
Photographic Documentation of R-407C Compressor with Contaminant Air
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

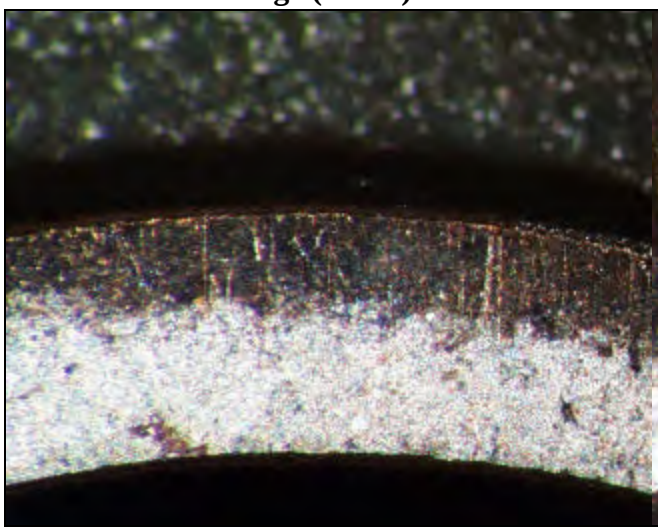
Valve Plate and Reed/Suction (macro)



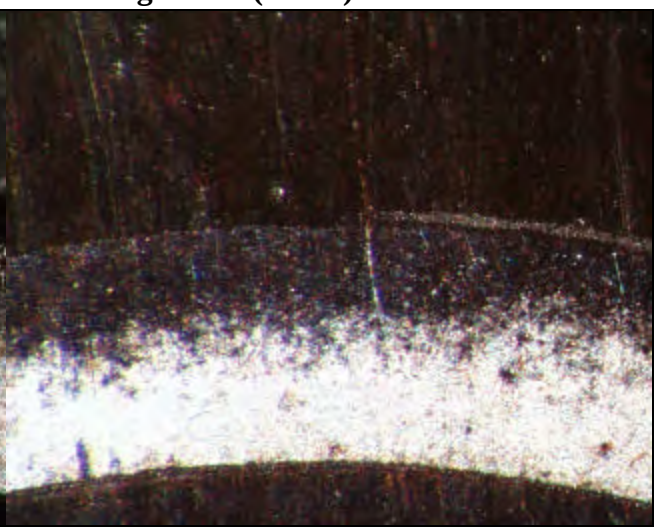
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid and R-22

TEST HISTORY OF:

Unit Number 65
Model # RS43C1E-CAV-250 **Serial #** 96F16441
Run Time (hr.) 12002 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 4 **(4)** 5

Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 11 **(4)** 12

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 4 **(4)** 5

Crank journals		
Appearance	clean/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	Cu plating	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	clean/bronze plating	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	no wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2490

TEST HISTORY OF:

Unit Number	65		
Contaminants:			
Control Unit?	No		
Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Trash in liquid screen (g)	0.085
Number of screens	2
Debris in compressor bottom (g)	0.453

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.23
Water (ppm)	122
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	9.8
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	7
Tin (ppm)	0
Zinc (ppm)	2

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black, brown	gummy
Spring	medium	black, gray	gummy
Spring Seat	very slight	gray	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

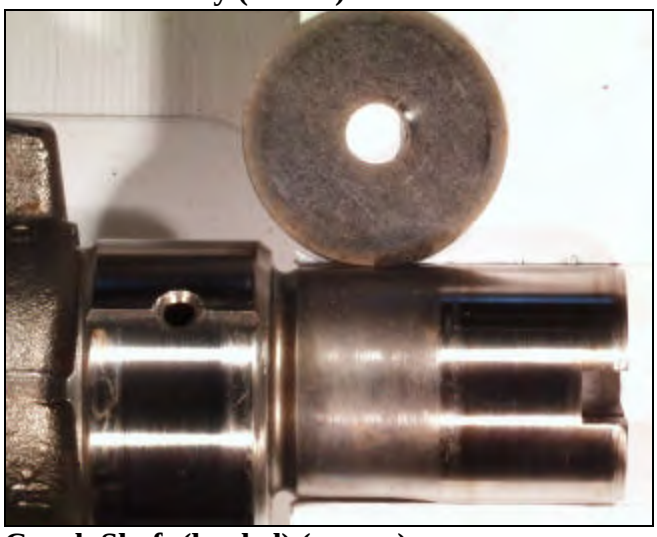
Photographic Documentation of R-407C Compressor with Contaminant Acid and R-22
200 psig/40 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



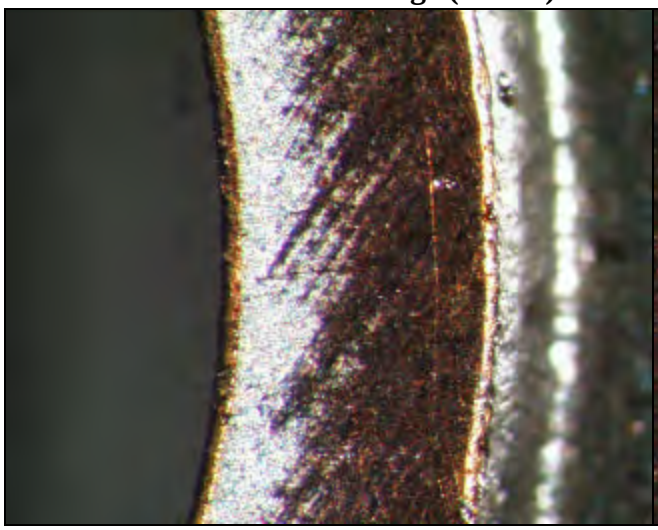
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

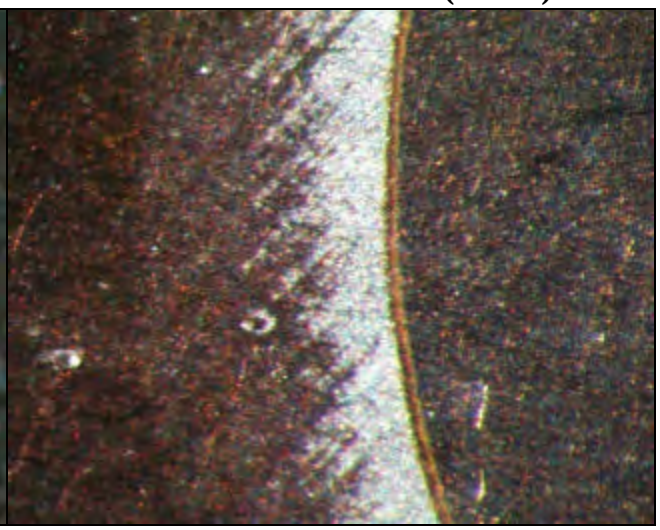
Photographic Documentation of R-407C Compressor with Contaminant Acid and R-22
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

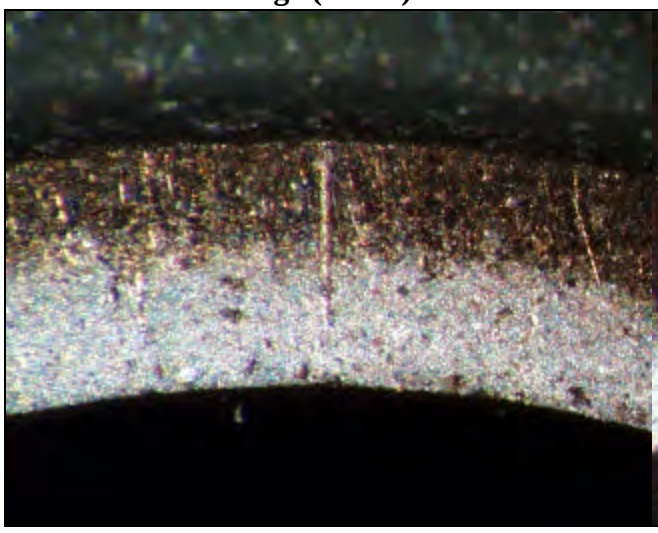
Valve Plate and Reed/Suction (macro)



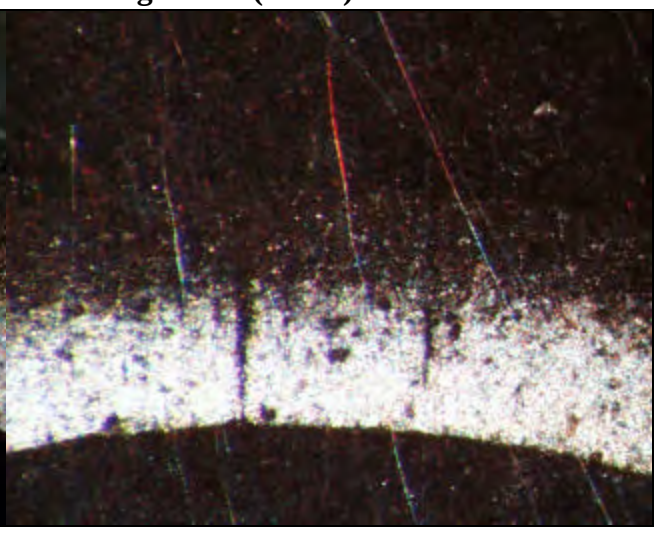
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Air, and R-22

TEST HISTORY OF:

Unit Number 66
Model # RS43C1E-CAV-250 **Serial #** 96F16438
Run Time (hr.) 12011 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 11 **(4)** 12

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating/corrosion	
Wear	medium	
Bottom washer (casting side)		
Appearance	clean/bronze plating	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3725
	Unloaded	1.3725
Cylinder bore		
Appearance	low wear	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760

TEST HISTORY OF:

Unit Number 66
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.22
Water (ppm)	246
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	9.3
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	4

Trash in liquid screen (g)	0.027
Number of screens	1
Debris in compressor bottom (g)	0.375

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion/black/soot

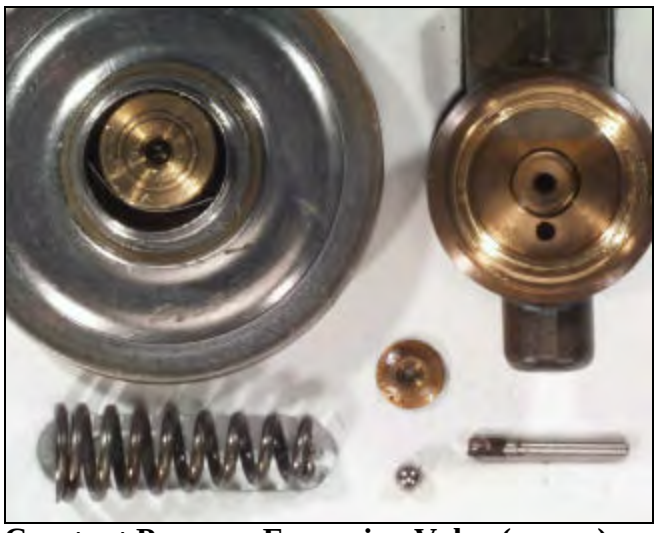
Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	medium

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	medium	black	gummy
Spring Seat	slight	black	gummy
Ball	medium	black	gummy
Front Side	slight	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and R-22
200 psig/40 psig



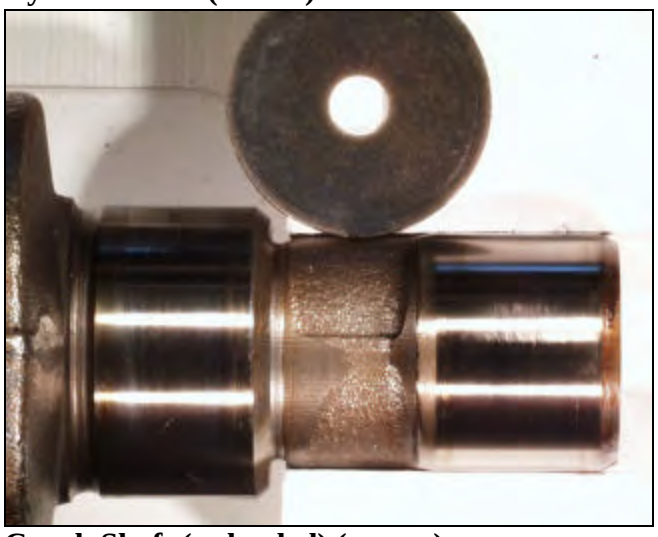
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

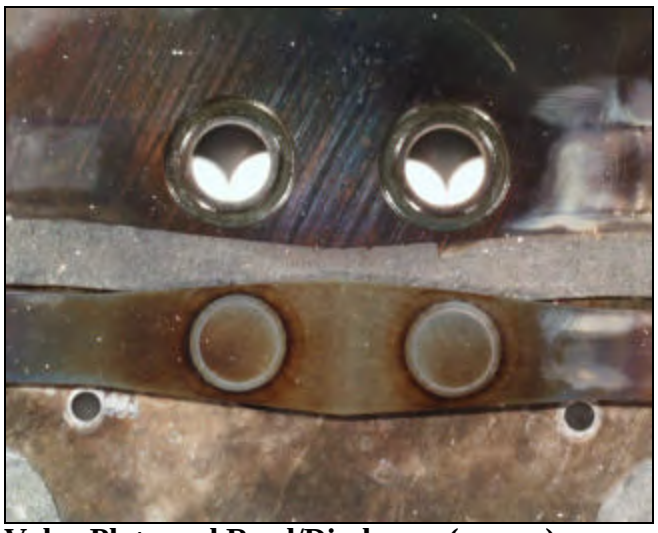
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



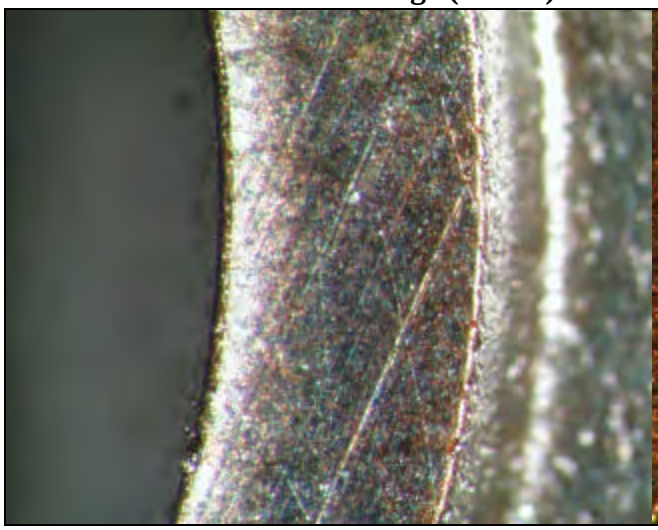
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and R-22 200 psig/40 psig

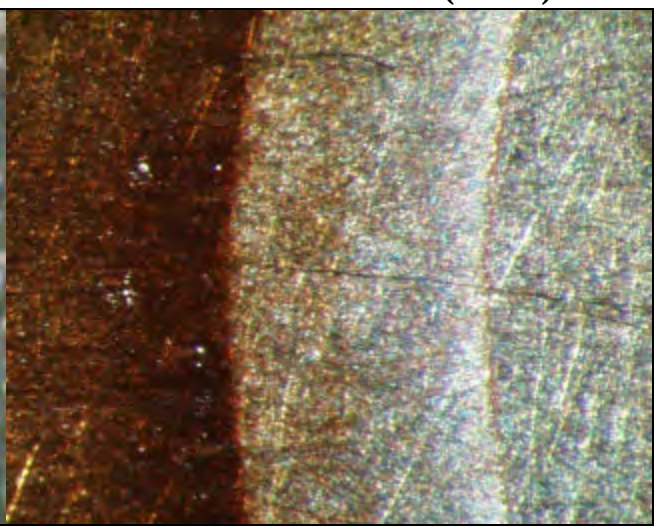


Valve Plate and Reed/Discharge (macro)

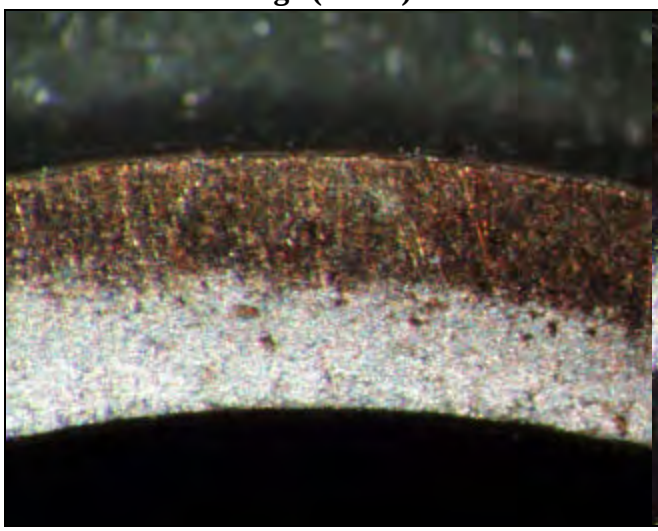
Valve Plate and Reed/Suction (macro)



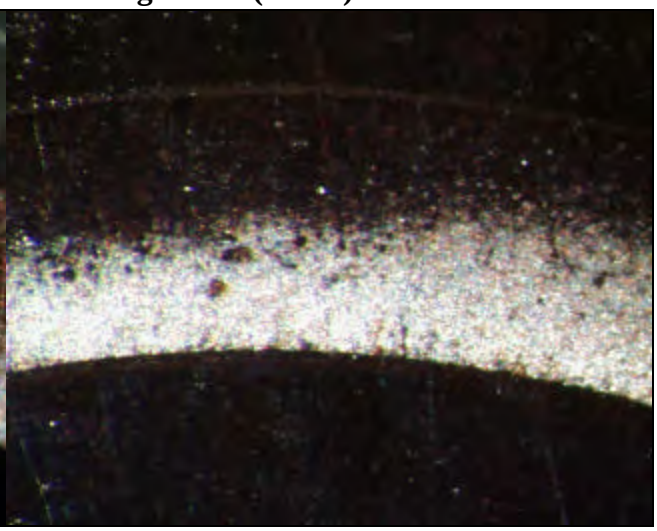
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air and R-22

TEST HISTORY OF:

Unit Number 67
Model # RS43C1E-CAV-250 **Serial #** 96F16489
Run Time (hr.) 12052 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** Yes
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 15 **(4)** 16

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 3 **(3)** 3 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2480
	Unloaded	1.2480
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3705
	Unloaded	1.3705
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3745
	Unloaded	1.3745
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2490

TEST HISTORY OF:

Unit Number 67
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, medium	
Dimensions	**Loaded**	0.5000
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish, medium	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.14
Water (ppm)	506
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	9.1
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	13
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.025
Number of screens	3
Debris in compressor bottom (g)	0.185

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

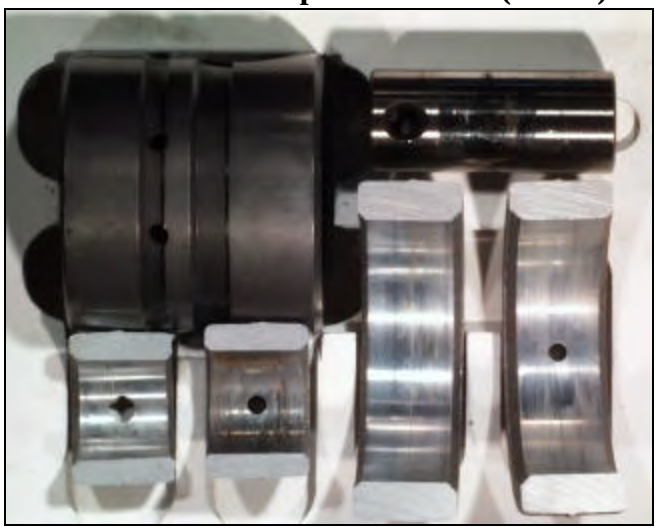
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	slight	brown, gray	gummy
Spring Seat	none	none	none
Ball	NA	NA	NA
Front Side	slight	gray	gummy

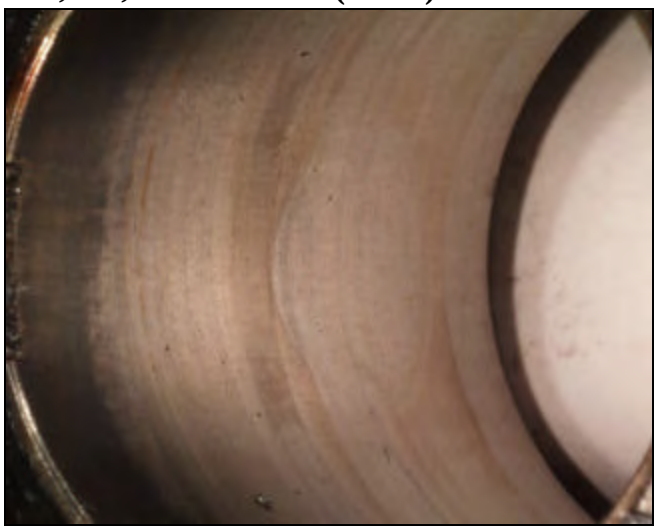
Photographic Documentation of R-407C Compressor with Contaminant Air and R-22
200 psig/40 psig

Constant Pressure Expansion Valve (macro)

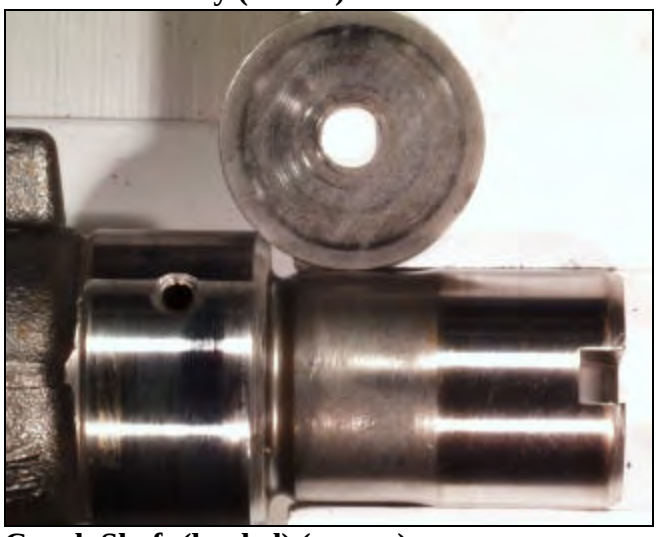
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



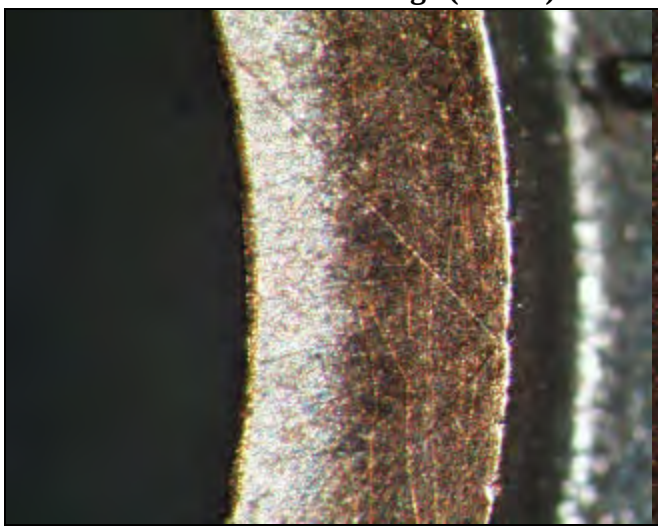
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

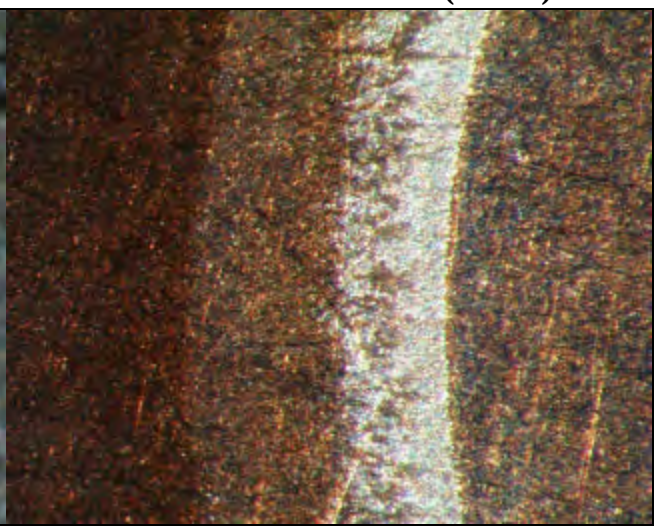
Photographic Documentation of R-407C Compressor with Contaminant Air and R-22
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

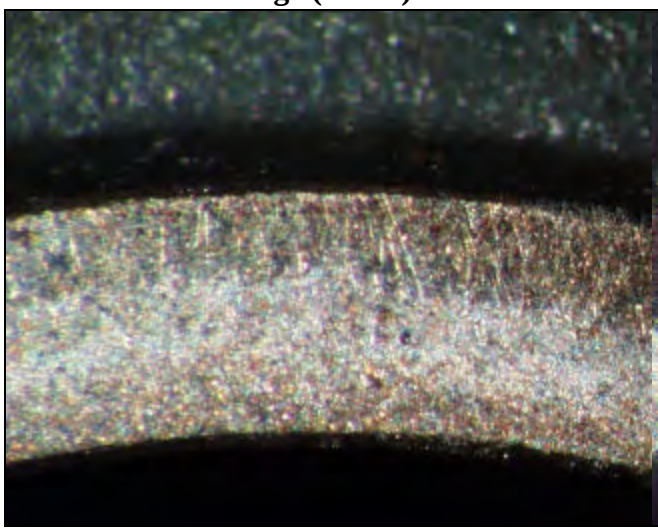
Valve Plate and Reed/Suction (macro)



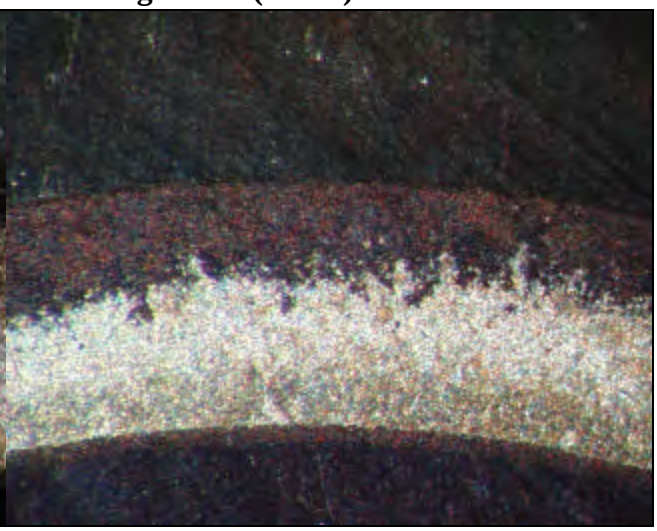
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 68
Model # RS43C1E-CAV-250 **Serial #** 96F16435
Run Time (hr.) 12014 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 10 **(2)** 12.5 **(3)** 10 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 7.5 **(3)** 5 **(4)** 2.5

Crank journals		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/bronze plating/corrosion	
Wear	polish	
Bottom washer (casting side)		
Appearance	scored/bronze plating	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 68
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.27
Water (ppm)	82
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	5
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	2
Debris in compressor bottom (g)	1.066

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

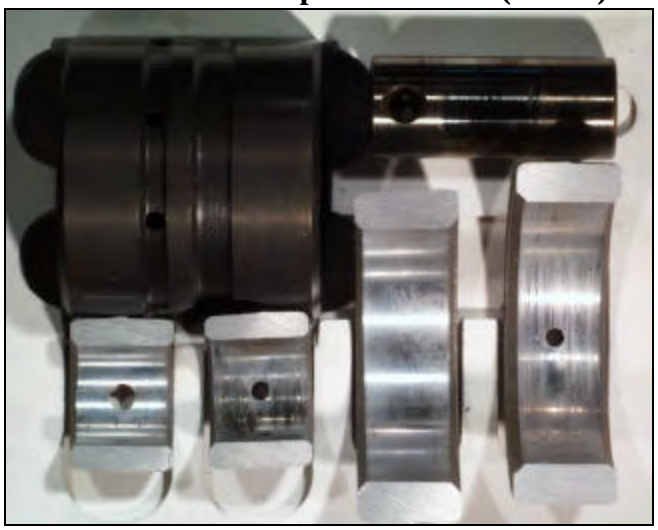
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	gray	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid and Air 200 psig/40 psig

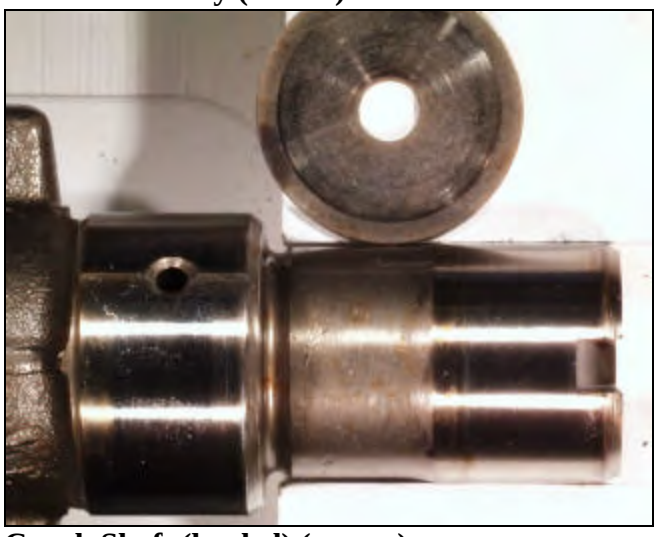
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

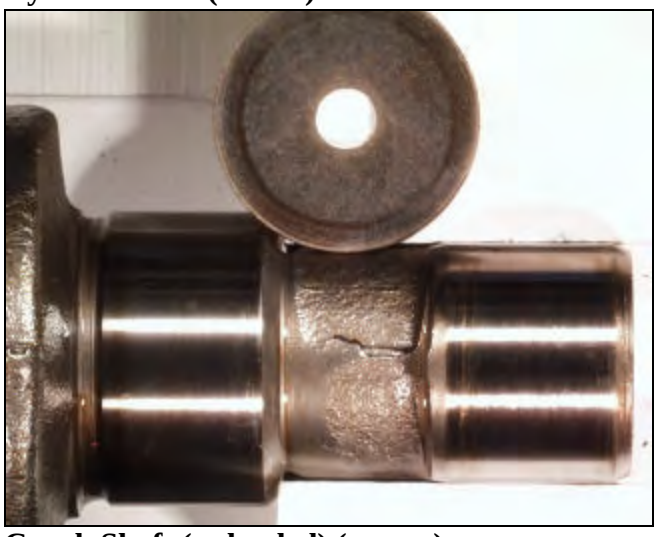


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

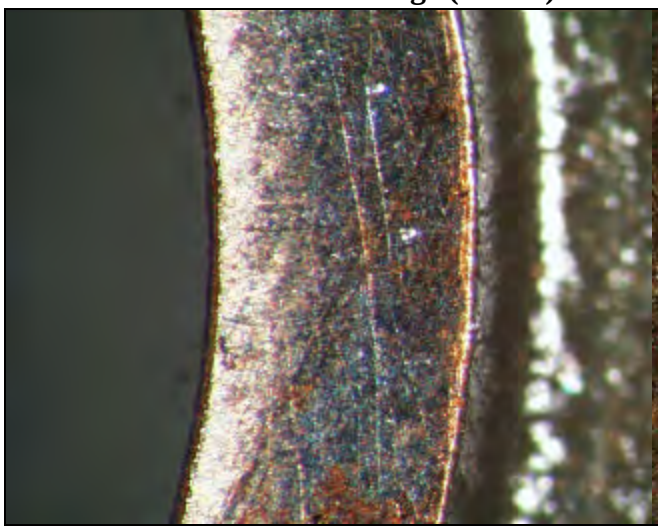


Crank Shaft (unloaded) (macro)

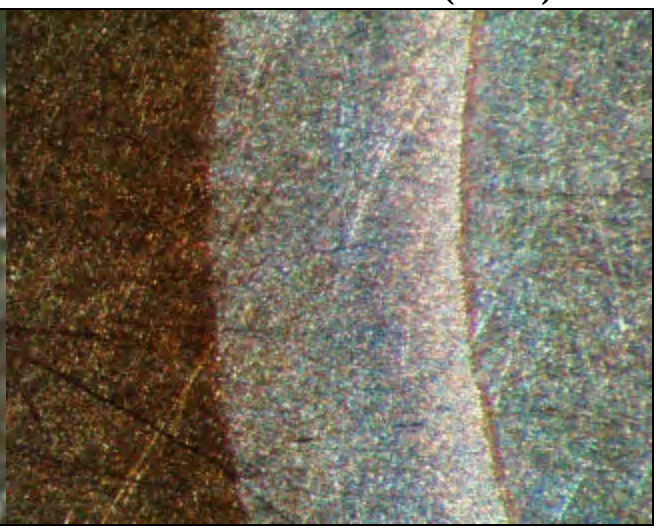
Photographic Documentation of R-407C Compressor with Contaminant Acid and Air 200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

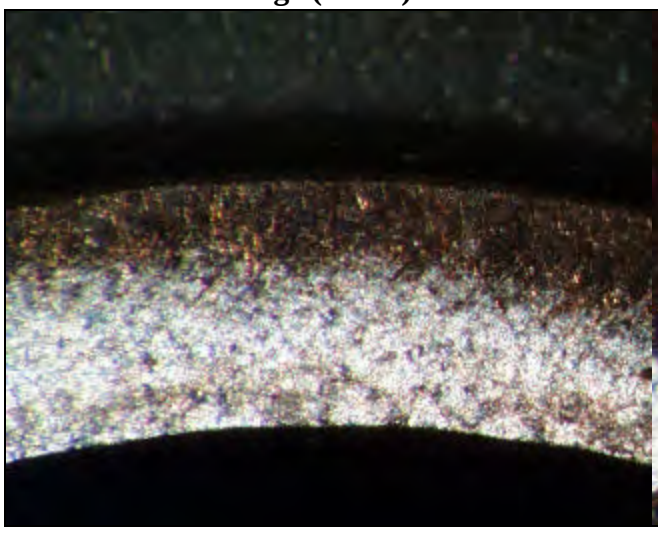
Valve Plate and Reed/Suction (macro)



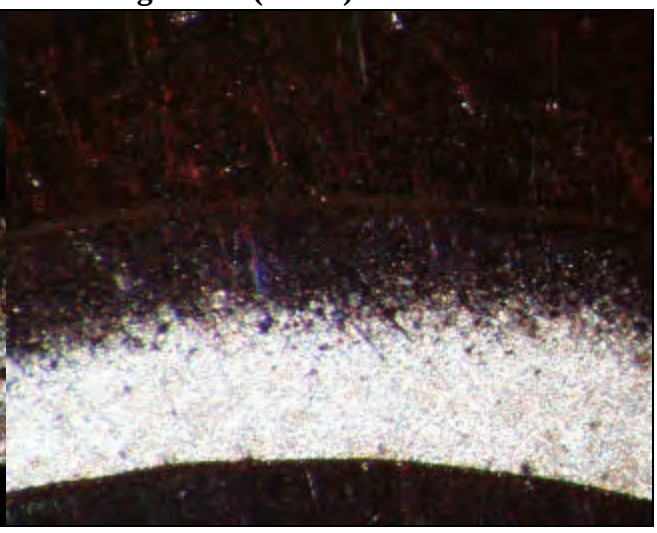
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Water and R-22

TEST HISTORY OF:

Unit Number	69		
Model #	RS43C1E-CAV-250	**Serial #**	96F16440
Run Time (hr.)	5333	**Failed?**	Yes
Refrigerant	407C		
Lubricant	RL32S		
Contaminants:			
Control Unit?	No		
Acid?	No	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Discharge Pressure (psig)	200
Suction Pressure (psig)	35
Discharge Temp (°F)	193
Return Gas Temp (°F)	61
SumpTemp (°F)	162
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black/gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler

(1) ND **(2)** ND **(3)** ND **(4)** ND

Remaining torque of stator bolts

(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	clean
OEM flux?	No
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed

(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts

(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	damaged	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 69
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	110
Fluoride ion (ppm)	0.90
Chloride ion (ppm)	9.6
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.016
Number of screens	1
Debris in compressor bottom (g)	0.967

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	broken
Appearance	corrosion

Suction surface appearance
corrosion/damaged

Suction reed

Condition	bent
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

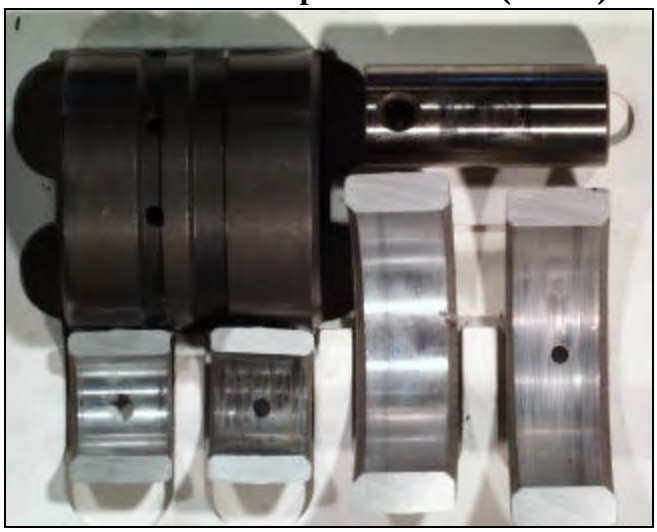
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	very slight	gray	hard
Equalizer Hole	very heavy	black	gummy
Tip of Pin	very heavy	black	gummy
Spring	medium	black, gray	gummy
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	slight	brown	gummy

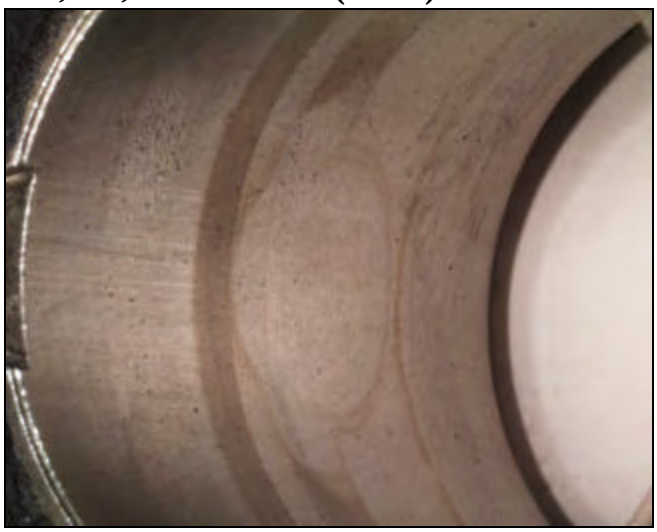
Photographic Documentation of R-407C Compressor with Contaminant Water and R-22
200 psig/35 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

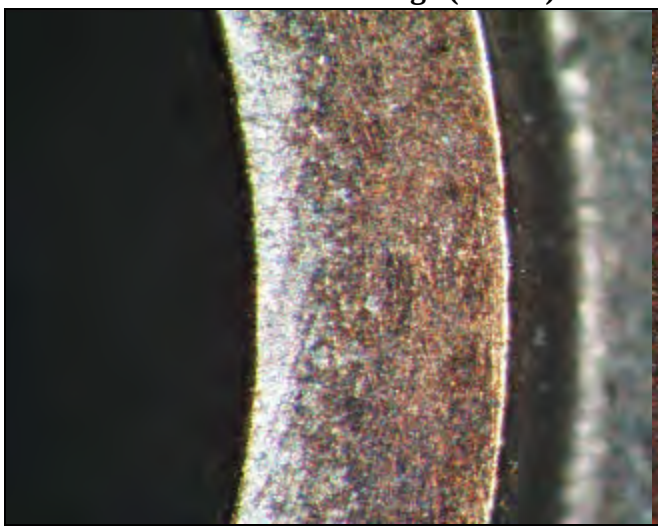
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

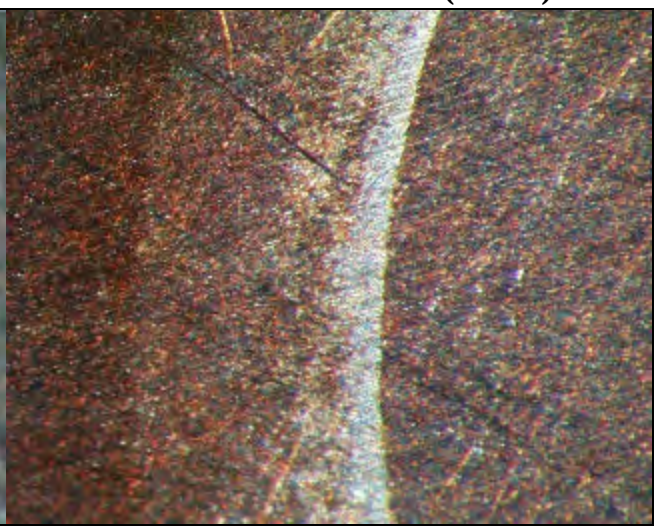
Photographic Documentation of R-407C Compressor with Contaminant Water and R-22
200 psig/35 psig

Valve Plate and Reed/Discharge (macro)

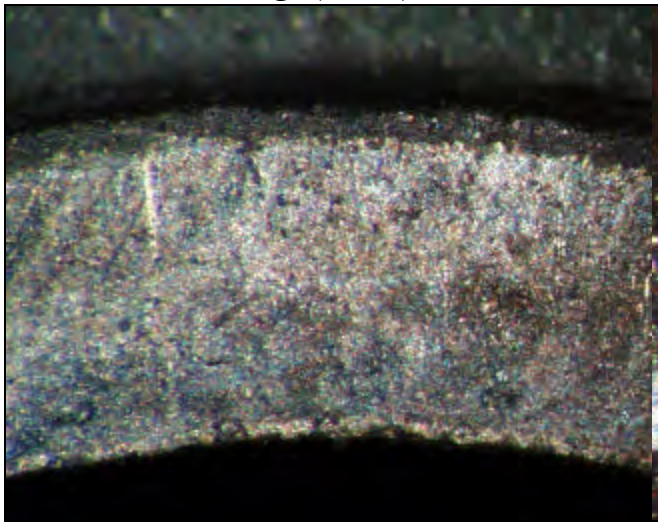
Valve Plate and Reed/Suction (macro)



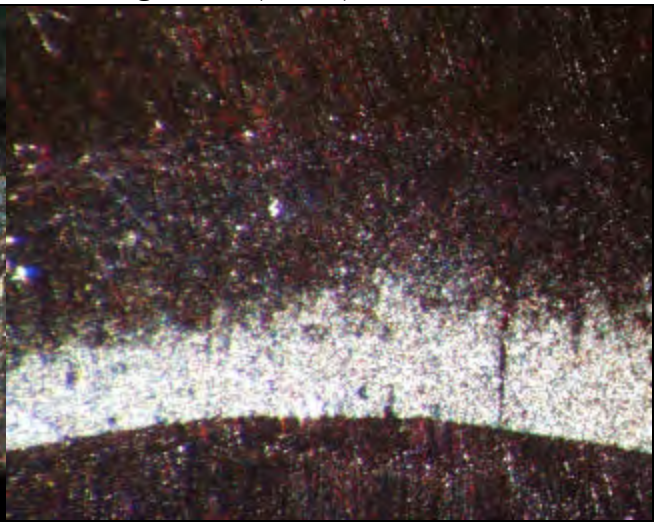
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 70
Model # RS43C1E-CAV-250 **Serial #** 96F16448
Run Time (hr.) 12019 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 12.5 **(2)** 15 **(3)** 12.5 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 7

Crank journals		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 70
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.31
Water (ppm)	225
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	9.3
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.011
Number of screens	1
Debris in compressor bottom (g)	1.004

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

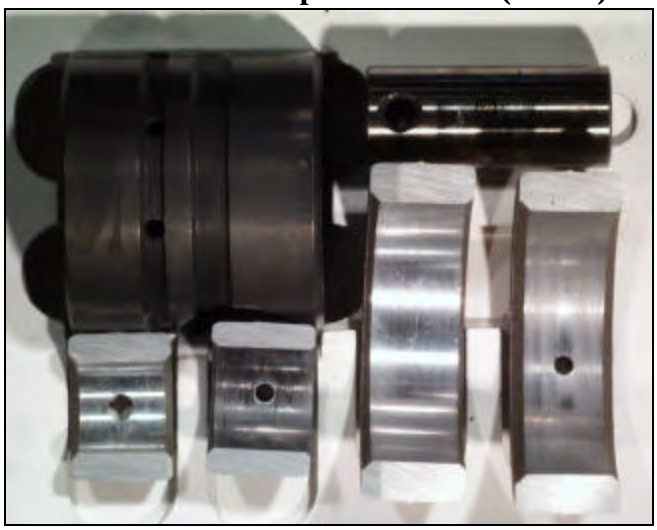
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	hard
Spring	very heavy	black, gray	gummy
Spring Seat	heavy	brown	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid and Water
200 psig/40 psig

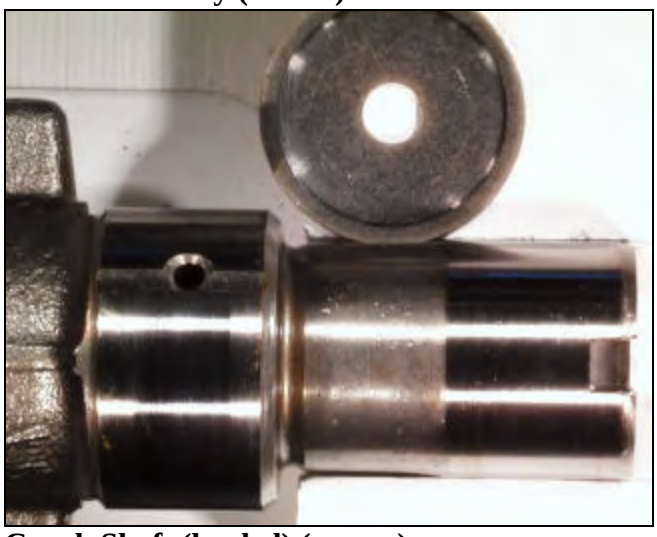
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

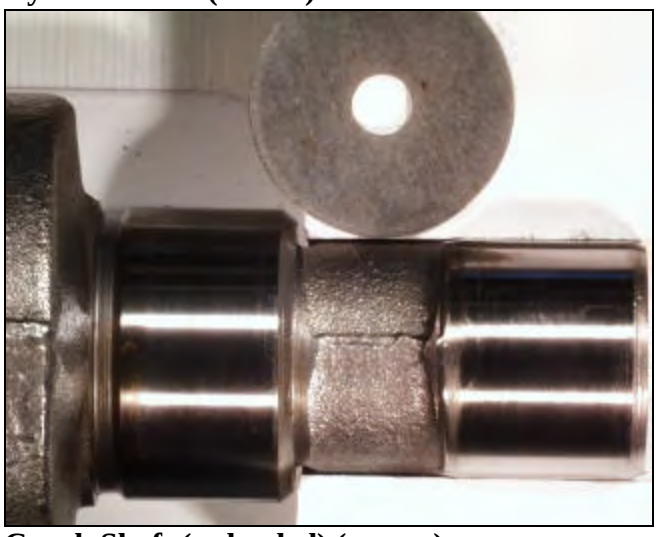


Piston Assembly (macro)

Cylinder Bore (macro)

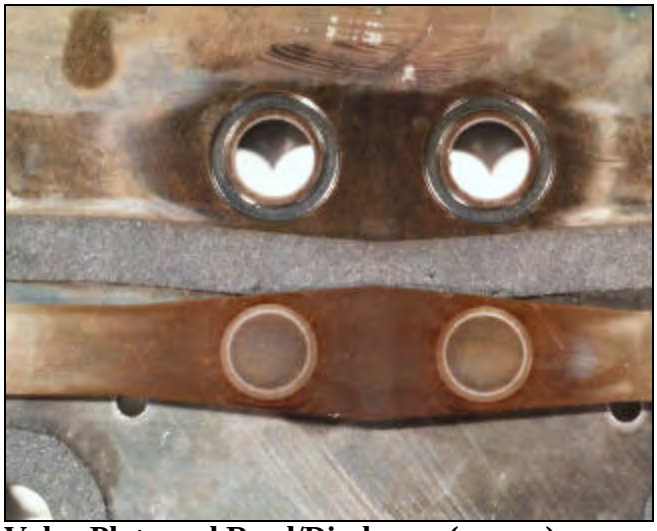


Crank Shaft (loaded) (macro)



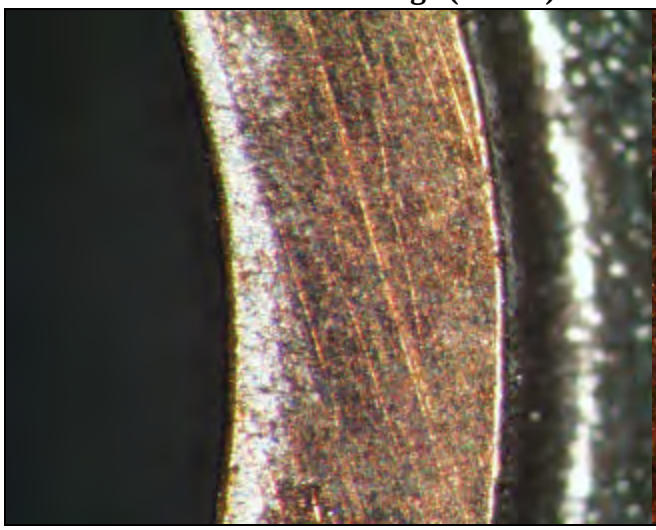
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Compressor with Contaminant Acid and Water
200 psig/40 psig

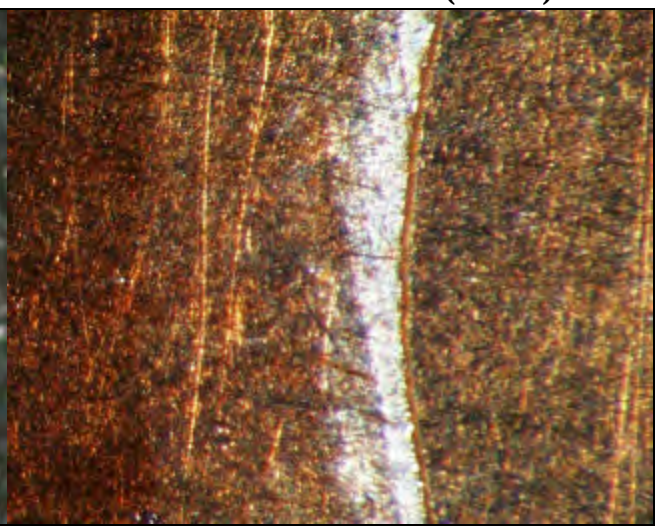


Valve Plate and Reed/Discharge (macro)

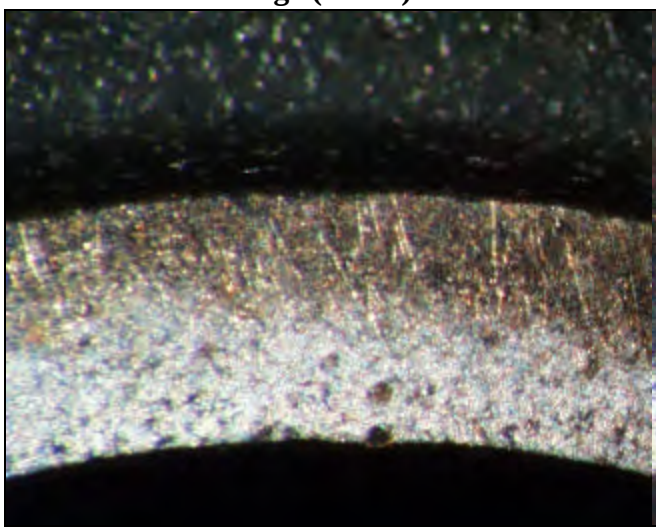
Valve Plate and Reed/Suction (macro)



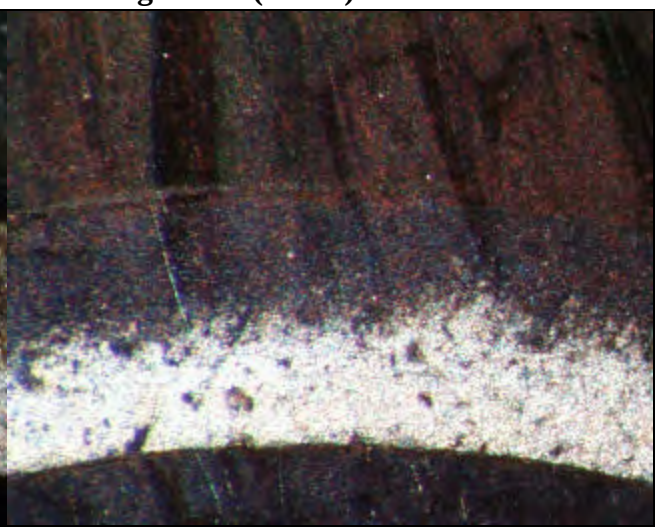
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 71
Model # RS43C1E-CAV-250 **Serial #** 96F16433
Run Time (hr.) 7319 **Failed?** Yes
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	35
Discharge Temp (°F)	193
Return Gas Temp (°F)	61
SumpTemp (°F)	162
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) ND **(2)** ND **(3)** ND **(4)** ND
Remaining torque of stator bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	clean
OEM flux?	No
Loose restrictor?	No
Discharge plate appearance	clean/Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear/scored	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 71
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5020
	Unloaded	0.5020

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	200
Fluoride ion (ppm)	0.90
Chloride ion (ppm)	9.2
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	8
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.001
Number of screens	1
Debris in compressor bottom (g)	1.017

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	broken
Appearance	corrosion

Suction surface appearance
corrosion/damaged

Suction reed

Condition	broken/bent/cracked
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

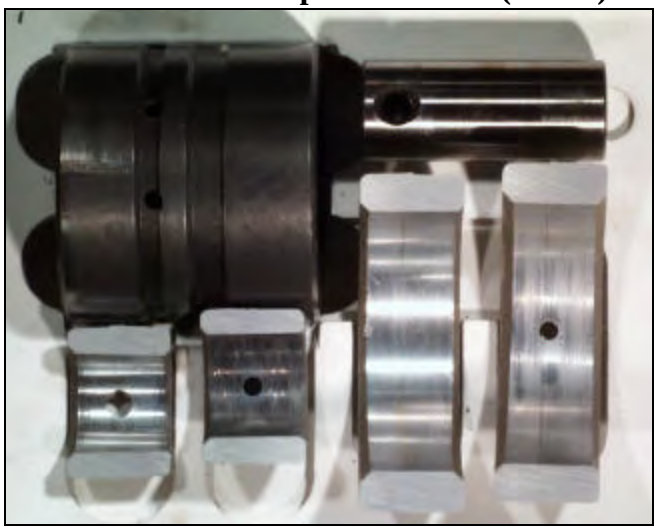
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	very slight	gray	hard
Equalizer Hole	very slight	gray	hard
Tip of Pin	heavy	black	gummy
Spring	medium	black, gray	hard
Spring Seat	medium	gray	hard
Ball	medium	black	gummy
Front Side	very slight	gray	hard

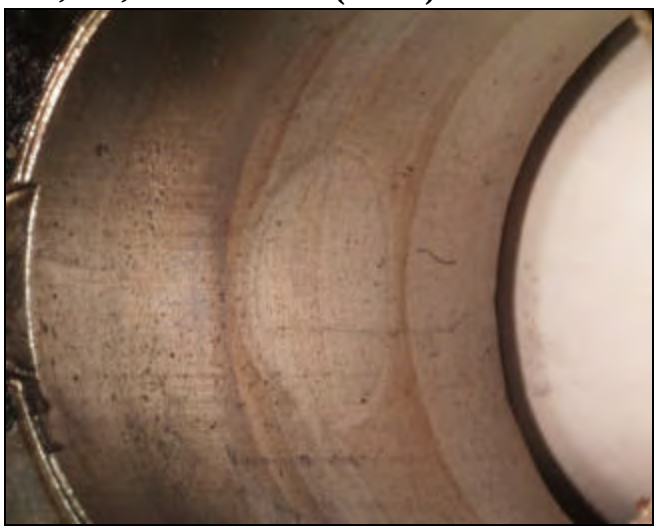
Photographic Documentation of R-407C Compressor with Contaminant Air and Water
200 psig/35 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



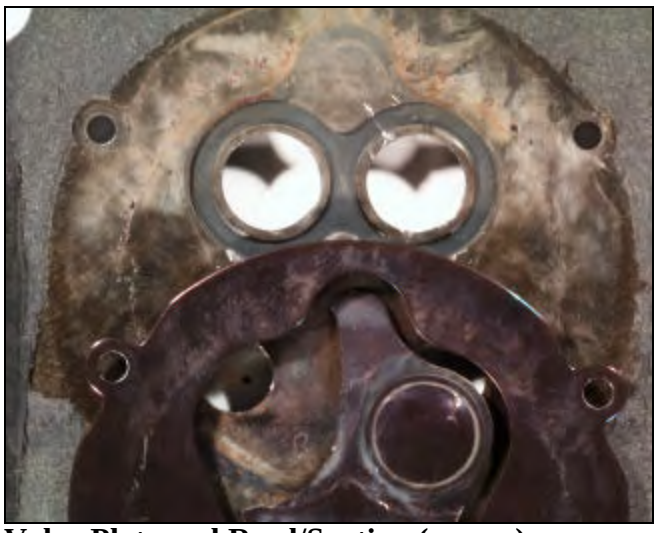
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

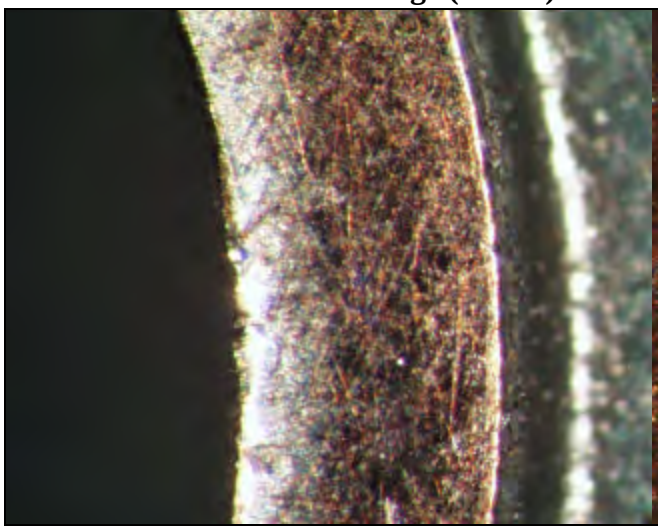
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-407C Compressor with Contaminant Air and Water
200 psig/35 psig

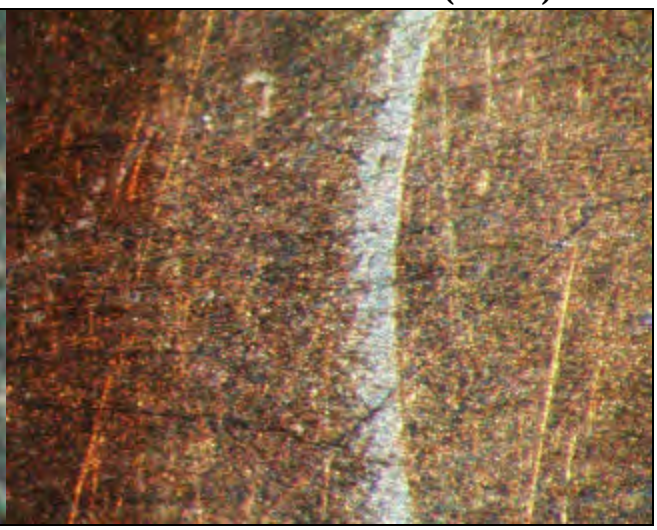
Valve Plate and Reed/Discharge (macro)



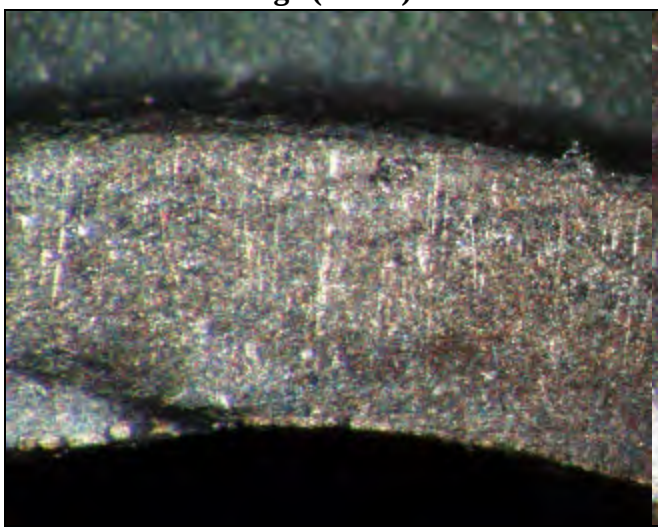
Valve Plate and Reed/Suction (macro)



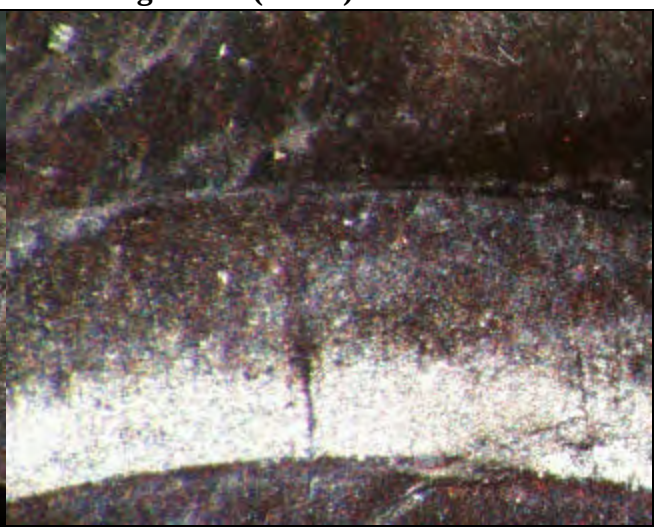
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 72
Model # RS43C1E-CAV-250 **Serial #** 96F16434
Run Time (hr.) 12013 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 7.5 **(2)** 5 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 10 **(2)** 12.5 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 7.5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	scored/Cu plating	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	carbon	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 72
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	321
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.050
Number of screens	1
Debris in compressor bottom (g)	0.810

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/soot

Suction reed

Condition	good
Appearance	corrosion/carbon
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/soot

Discharge surface appearance
corrosion/soot

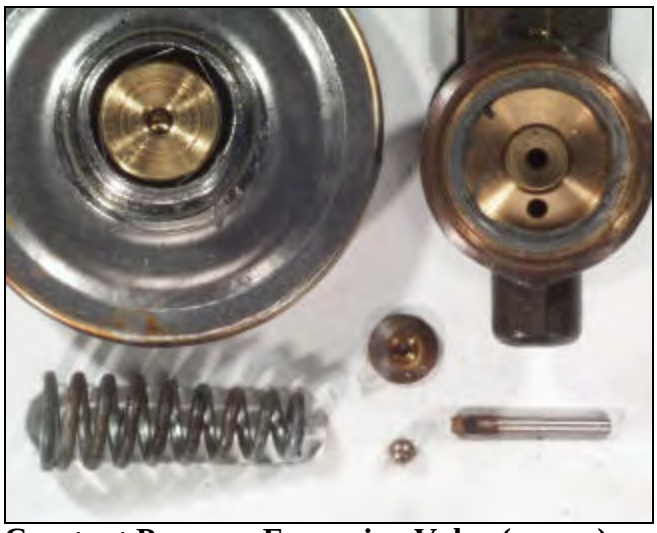
Discharge reed

Condition	good
Appearance	corrosion/soot
Trepan	slight
Varnish ring	slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	medium	black, gray	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Water
200 psig/40 psig



Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)

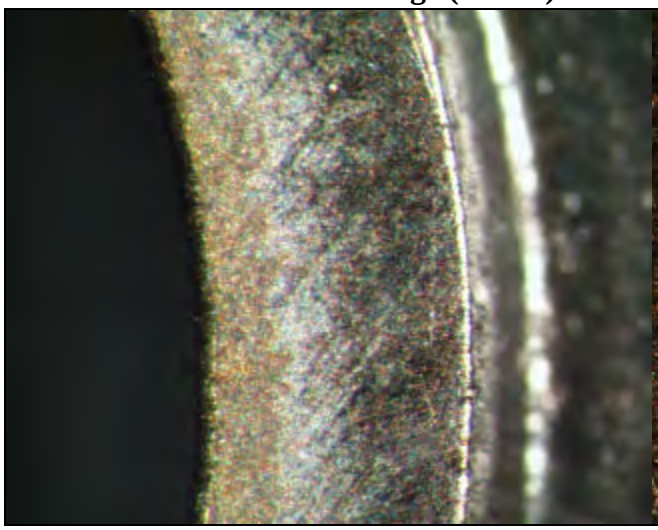
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

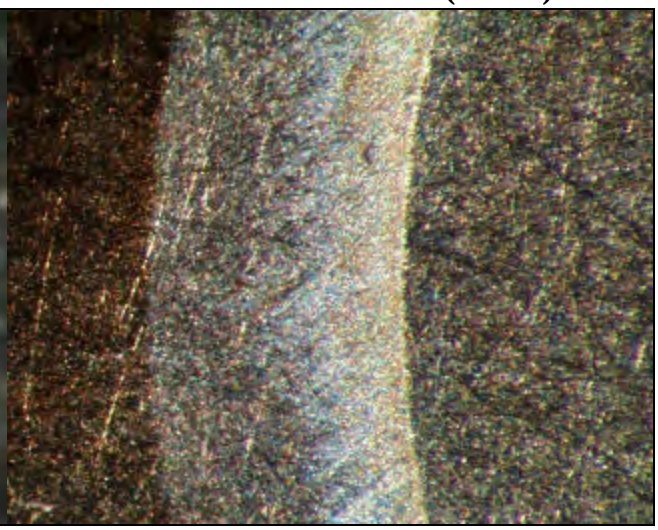
Photographic Documentation of R-407C Compressor with Contaminant Water
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

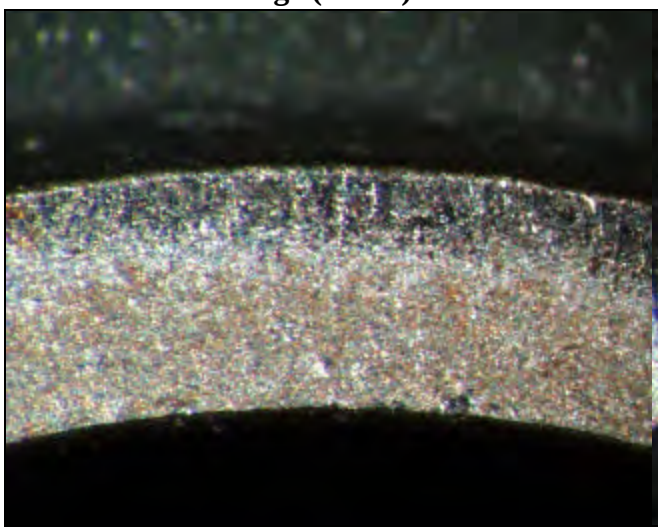
Valve Plate and Reed/Suction (macro)



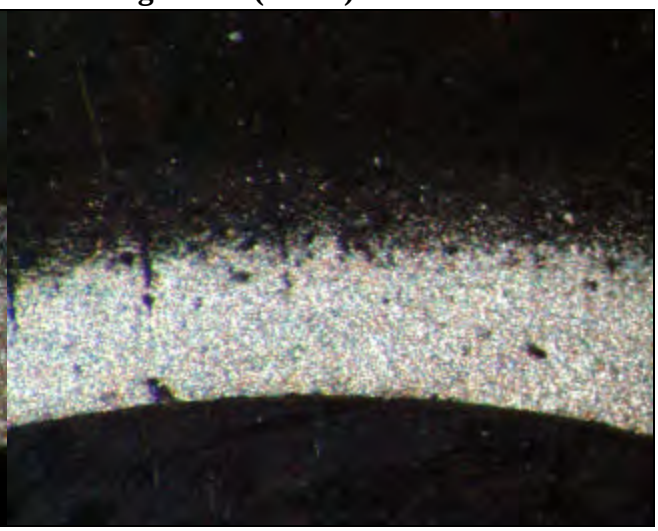
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Water, and R-22

TEST HISTORY OF:

Unit Number 73
Model # RS43C1E-CAV-250 **Serial #** 96F16445
Run Time (hr.) 12006 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** Yes
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	180
Return Gas Temp (°F)	62
SumpTemp (°F)	147
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 7 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 17.5 **(3)** 17.5 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 7.5 **(2)** 7.5 **(3)** 7.5 **(4)** 7.5

Crank journals		
Appearance	scored/Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	scored/Cu plating/corrosion	
Wear	medium	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 73
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)
Appearance contact wear/correct washer/corrosion
Wear slight
Dimensions **Loaded** 0.5015
Unloaded 0.5015

Piston pin washers appearance
contact wear

Piston pin
Appearance scored
Wear slight
Dimensions **Loaded** 0.4970
Unloaded 0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.13
Water (ppm)	70
Fluoride ion (ppm)	1.6
Chloride ion (ppm)	9.3
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.013
Number of screens	1
Debris in compressor bottom (g)	0.747

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion
Suction reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance corrosion
Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	heavy	black, gray	gummy
Spring Seat	medium	black	gummy
Ball	medium	black, gray	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant Acid, Water, and R-22 200 psig/40 psig

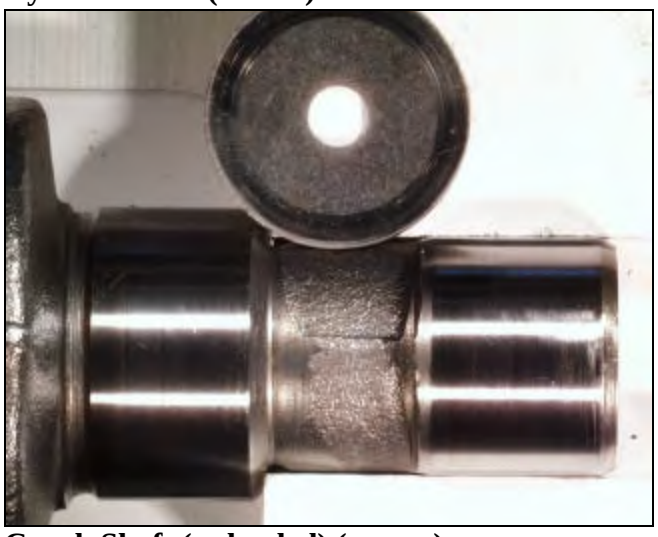
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

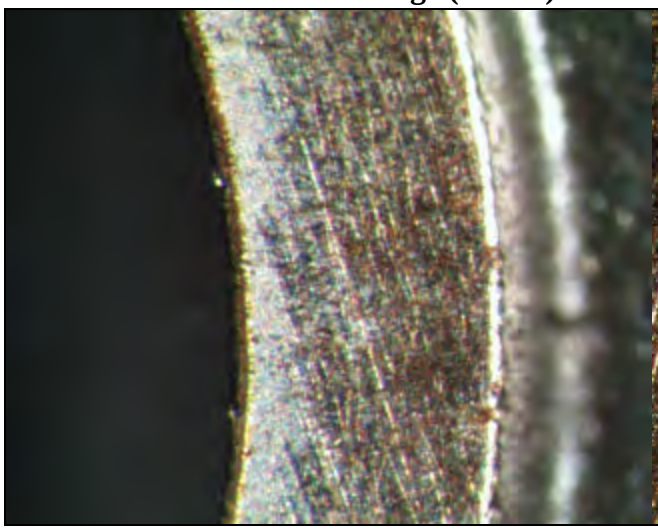


Crank Shaft (unloaded) (macro)

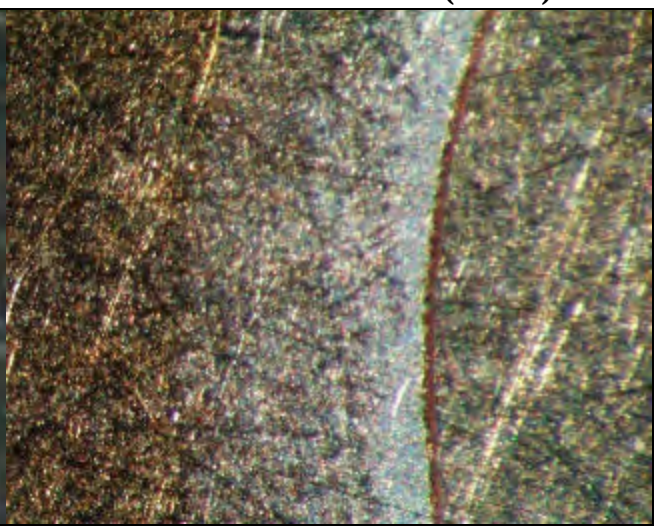
Photographic Documentation of R-407C Compressor with Contaminant Acid, Water, and R-22 200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

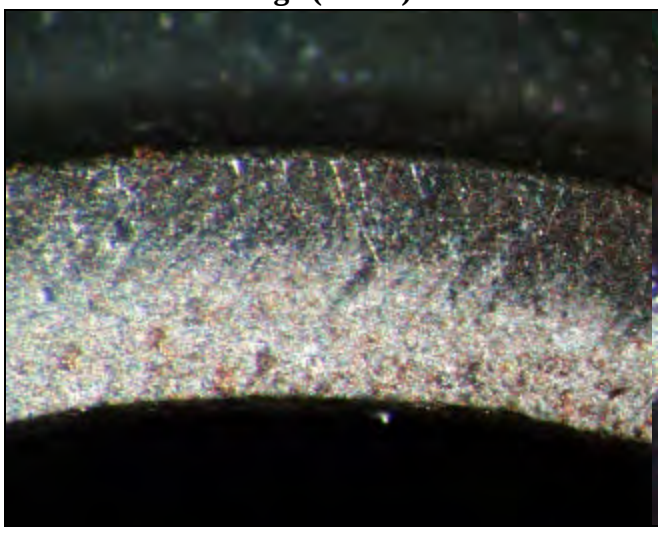
Valve Plate and Reed/Suction (macro)



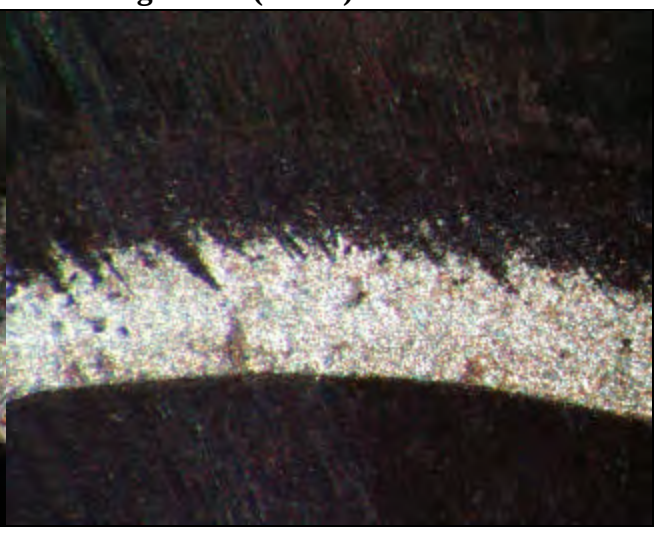
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Air, Water, and R-22

TEST HISTORY OF:

Unit Number 74
Model # RS43C1E-CAV-250 **Serial #** 96F16439
Run Time (hr.) 12023 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** Yes
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	193
Return Gas Temp (°F)	62
SumpTemp (°F)	162
Hi-Pot	pass
High-low leak	fail
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4.2 **(2)** 2.1 **(3)** 2.1 **(4)** 2.1

Remaining torque of stator bolts
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 14.6

Suction muffler appearance	gray
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 14.6

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2

Crank journals
Appearance clean/corrosion
Wear polish
Dimensions **Loaded** 1.2495
Unloaded 1.2495

Lower crank bearing journal
Appearance clean/corrosion
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance scored/corrosion
Wear polish

Bottom washer (casting side)
Appearance clean
Wear slight

Lower bronze bearings
Appearance clean/scored
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040

Shaft in cage bearing
Appearance corrosion
Wear slight

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3720
Unloaded 1.3720

Cylinder bore
Appearance no wear/corrosion
Varnish ring medium
Dimensions **Loaded** 1.3765
Unloaded 1.3765

Connecting rod (large end)
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 74
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)
- **Appearance** contact wear/correct washer
- **Wear** slight
- **Dimensions** **Loaded** 0.5020
  Unloaded 0.5020

Piston pin washers appearance
contact wear

Piston pin
- **Appearance** corrosion
- **Wear** slight
- **Dimensions** **Loaded** 0.4975
  Unloaded 0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	76
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	1
Lead (ppm)	1
Silicon (ppm)	11
Tin (ppm)	0
Zinc (ppm)	2

Trash in liquid screen (g)	0.065
Number of screens	2
Debris in compressor bottom (g)	0.658

Valve Plate Assembly Inspection

Suction side (reed backer)
- **Condition** good
- **Appearance** corrosion

Suction surface appearance
corrosion

Suction reed
- **Condition** good
- **Appearance** corrosion
- **Trepan** very slight
- **Varnish ring** slight

Discharge side (reed backer)
- **Condition** good
- **Appearance** corrosion/blued

Discharge surface appearance
corrosion/black

Discharge reed
- **Condition** good
- **Appearance** corrosion/blued/Cu plating
- **Trepan** very slight
- **Varnish ring** slight

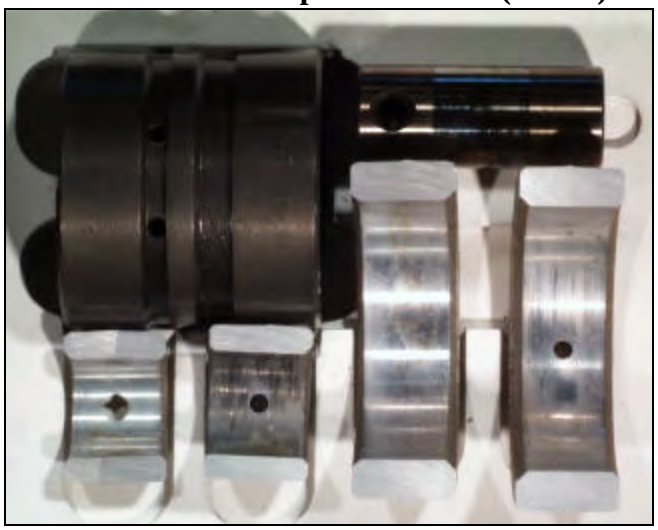
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	black	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	hard
Spring Seat	slight	black	gummy
Ball	very slight	black	gummy
Front Side	slight	black	gummy

Photographic Documentation of R-407C Compressor with Contaminant
Acid, Air, Water, and R-22
200 psig/40 psig

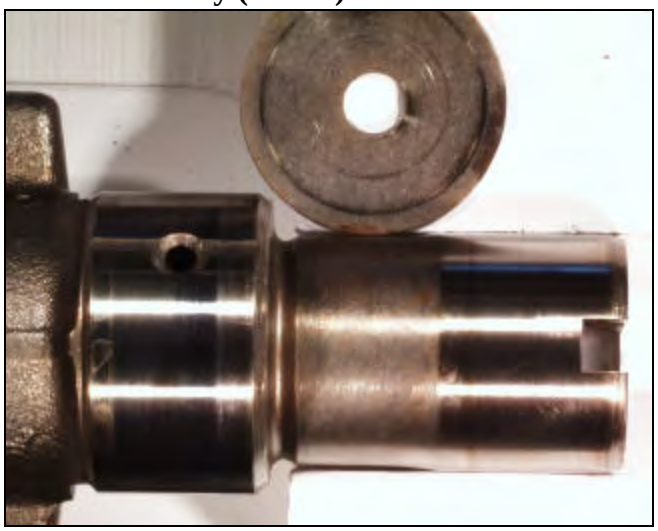
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

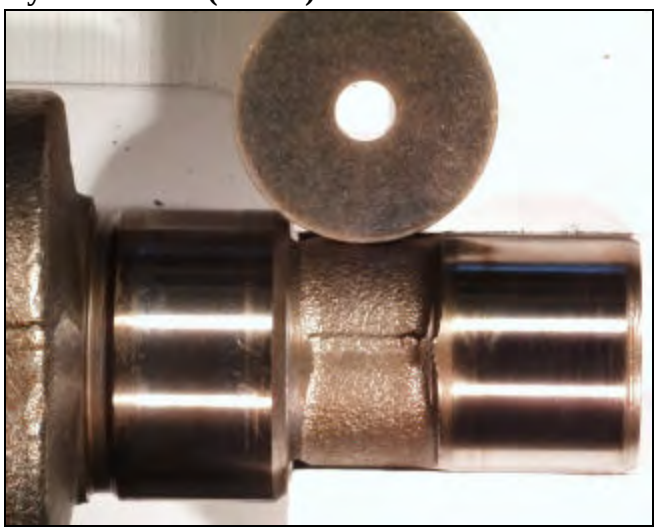


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

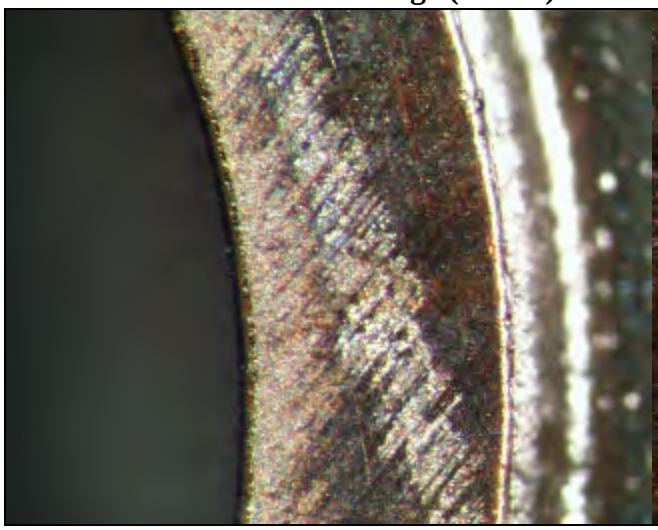


Crank Shaft (unloaded) (macro)

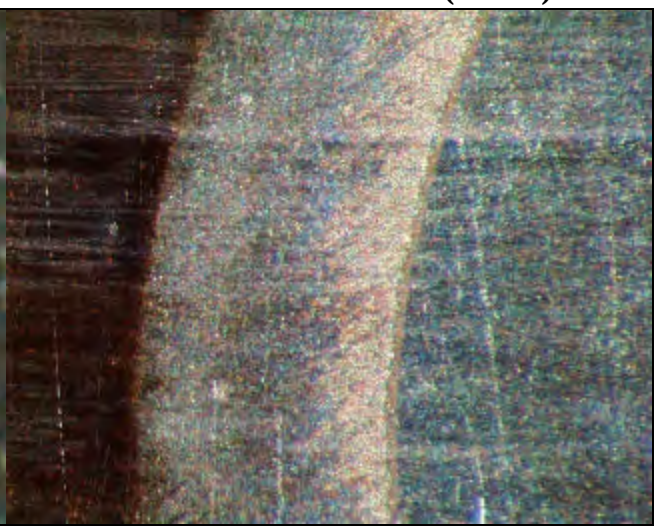
Photographic Documentation of R-407C Compressor with Contaminant
Acid, Air, Water, and R-22
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

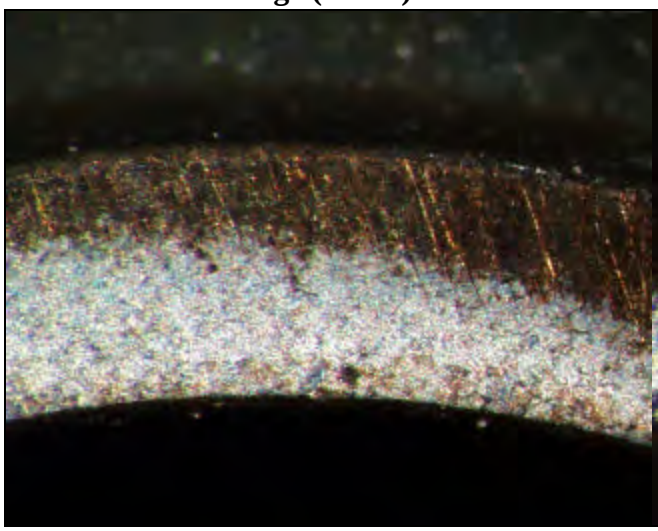
Valve Plate and Reed/Suction (macro)



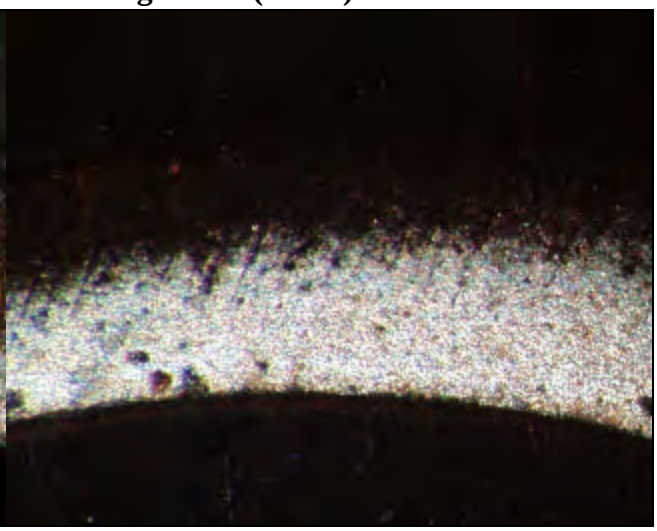
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Air, Water, and R-22

TEST HISTORY OF:

Unit Number 75
Model # RS43C1E-CAV-250 **Serial #** 96F16437
Run Time (hr.) 12009 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** Yes
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	200
Suction Pressure (psig)	40
Discharge Temp (°F)	193
Return Gas Temp (°F)	62
SumpTemp (°F)	162
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 2 **(2)** 2 **(3)** 2.5 **(4)** 2

Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 11 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.2445
	Unloaded	1.2445
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9970
	Unloaded	0.9970
Bottom thrust washer (crank side)		
Appearance	clean/scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3690
	Unloaded	1.3690
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2485
	Unloaded	1.2485

TEST HISTORY OF:

Unit Number 75
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	Yes
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	medium	
Dimensions	**Loaded**	0.4955
	Unloaded	0.4960

Final Lubricant Values

Total Acid Number (TAN)	0.25
Water (ppm)	71
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.046
Number of screens	1
Debris in compressor bottom (g)	0.906

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	slight	black	gummy
Tip of Pin	medium	black, brown	gummy
Spring	medium	gray	gummy
Spring Seat	medium	gray	gummy
Ball	slight	black	gummy
Front Side	medium	black	gummy

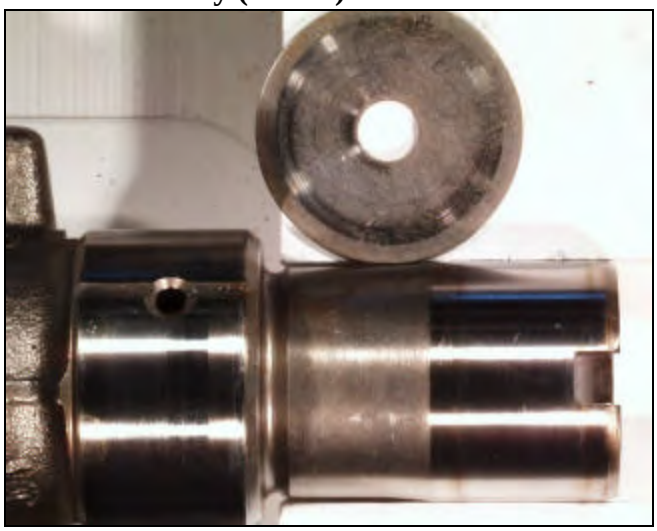
Photographic Documentation of R-407C Compressor with Contaminant Air, Water, and R-22
200 psig/40 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



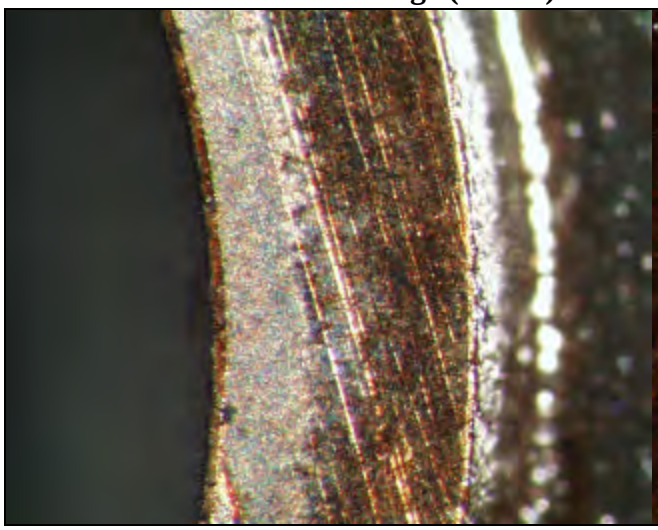
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

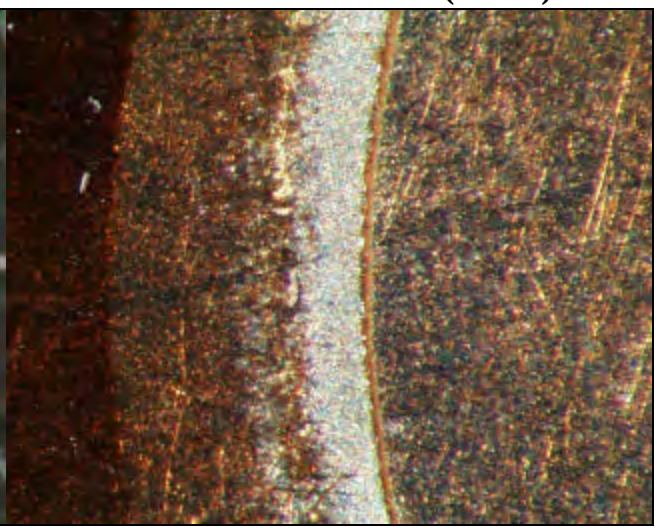
Photographic Documentation of R-407C Compressor with Contaminant Air, Water, and R-22
200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

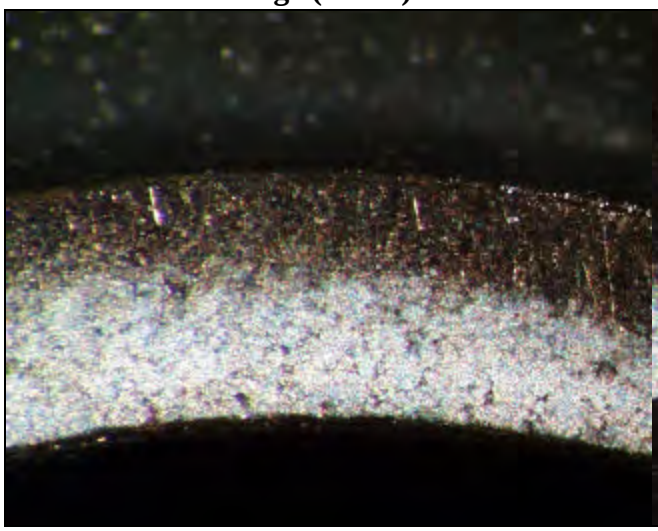
Valve Plate and Reed/Suction (macro)



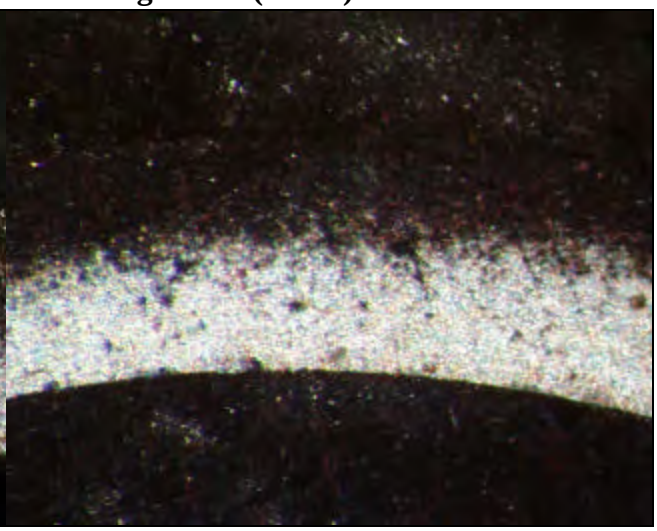
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-407C Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 76
Model # RS43C1E-CAV-250 **Serial #** 96F16449
Run Time (hr.) 12040 **Failed?** No
Refrigerant 407C
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 200
Suction Pressure (psig) 40
Discharge Temp (°F) 180
Return Gas Temp (°F) 62
SumpTemp (°F) 147

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 9 **(2)** 10 **(3)** 9 **(4)** 11
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 15 **(4)** 15
Head gasket brittle? yes
Head suction cavity appearance clean
Head discharge cavity appearance Cu plate
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals
Appearance scored
Wear polish, slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish, slight
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored
Wear medium
Bottom washer (casting side)
Appearance clean/bronze plating
Wear polish, slight
Lower bronze bearings
Appearance clean/corrosion
Wear polish, slight
Dimensions **Loaded** 1.0025
Unloaded 1.0025
Shaft in cage bearing
Appearance corrosion
Wear polish, slight
Piston top appearance clean
Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3715
Unloaded 1.3715
Cylinder bore
Appearance low wear
Varnish ring medium
Dimensions **Loaded** 1.3750
Unloaded 1.3750
Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2505
Unloaded 1.2505

TEST HISTORY OF:

Unit Number 76
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5000
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.18
Water (ppm)	57
Fluoride ion (ppm)	1.7
Chloride ion (ppm)	9.2
Aluminum (ppm)	0
Copper (ppm)	2
Iron (ppm)	1
Lead (ppm)	2
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	3

Trash in liquid screen (g)	0.102
Number of screens	2
Debris in compressor bottom (g)	1.062

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	medium

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	slight

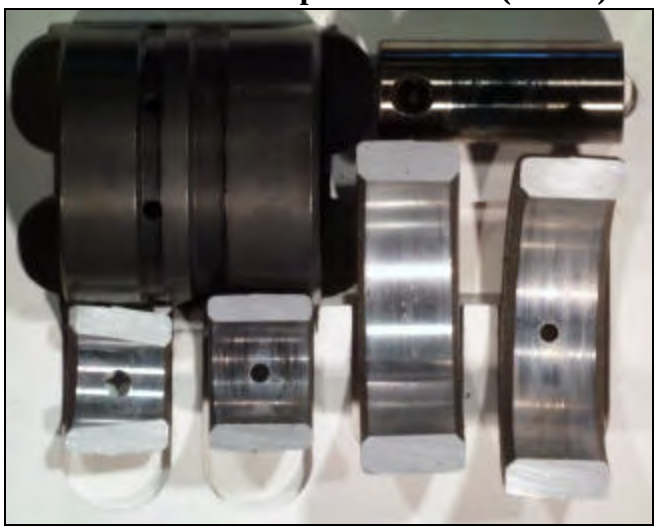
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	very slight	gray	gummy
Tip of Pin	medium	black, brown	gummy
Spring	heavy	black, gray	gummy
Spring Seat	medium	black	gummy
Ball	slight	black	gummy
Front Side	medium	gray	gummy

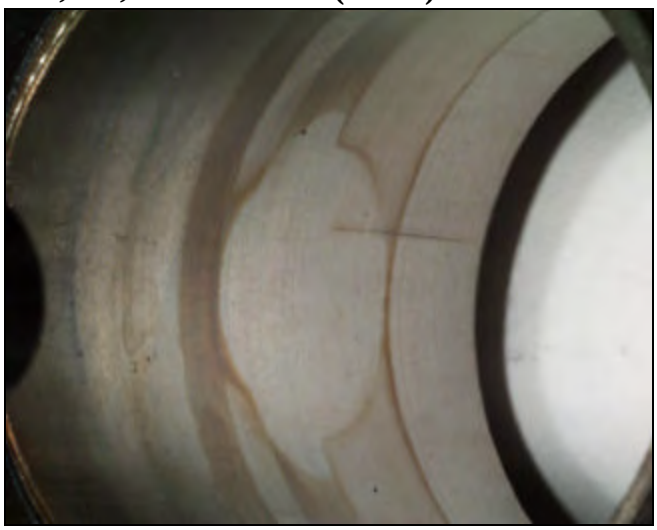
Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and Water 200 psig/40 psig

Constant Pressure Expansion Valve (macro)

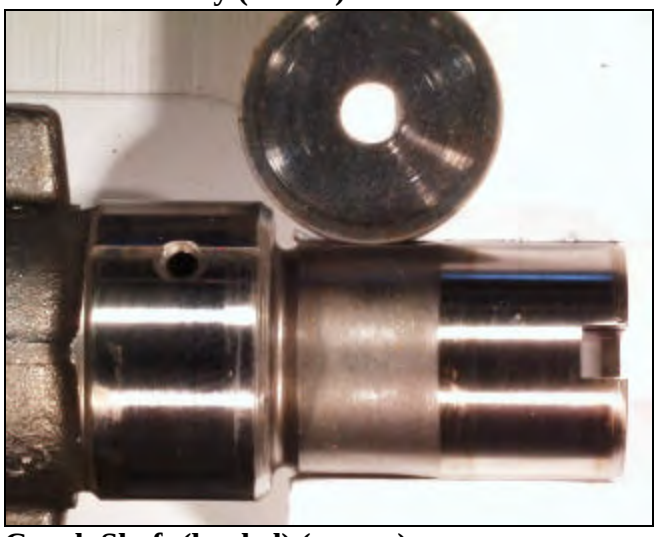
Ball, Pin, Seat of CPEV (micro)



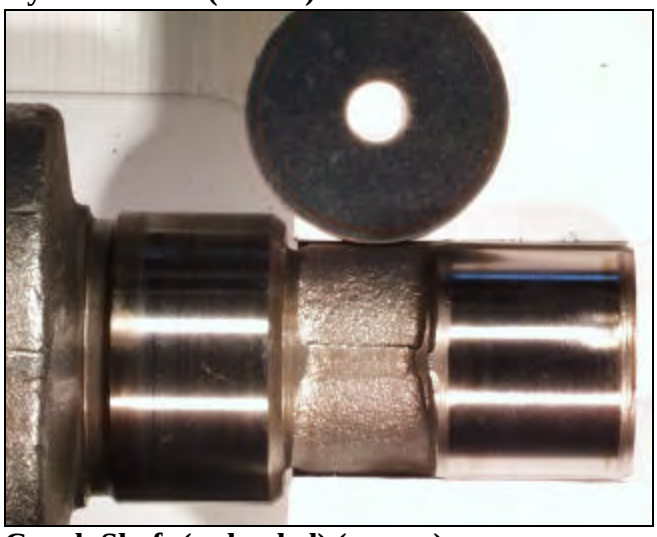
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

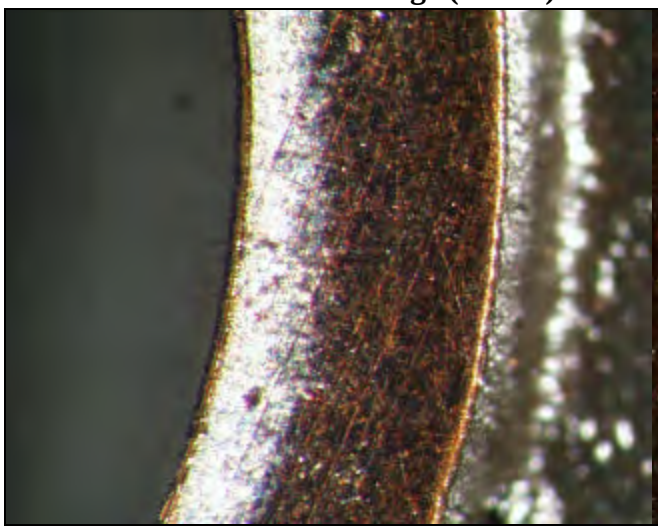


Crank Shaft (unloaded) (macro)

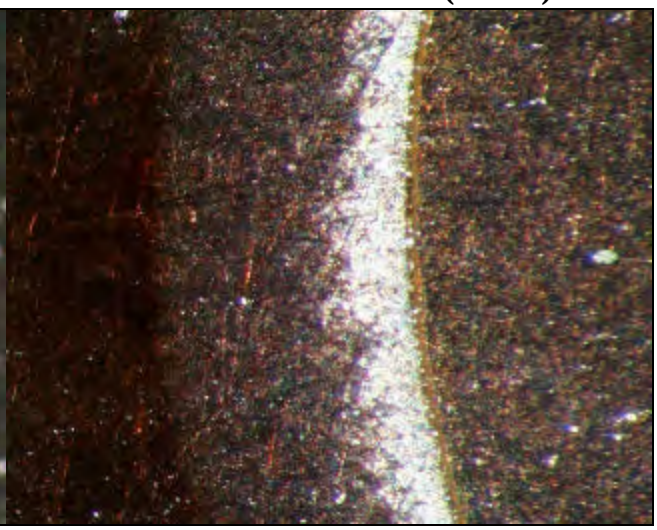
Photographic Documentation of R-407C Compressor with Contaminant Acid, Air, and Water 200 psig/40 psig

Valve Plate and Reed/Discharge (macro)

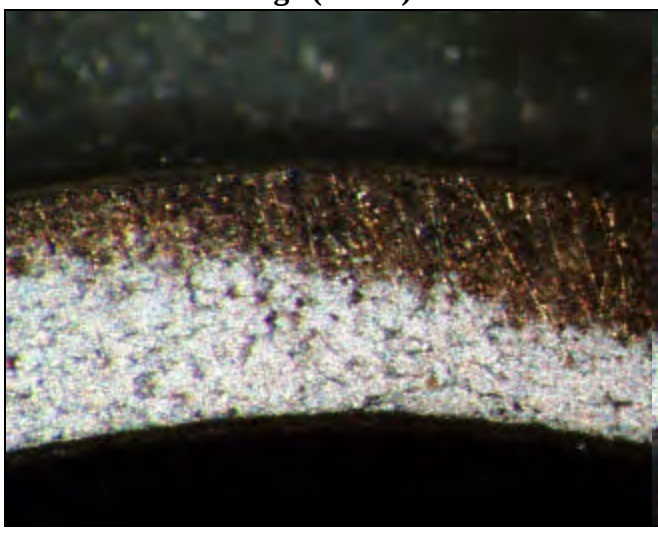
Valve Plate and Reed/Suction (macro)



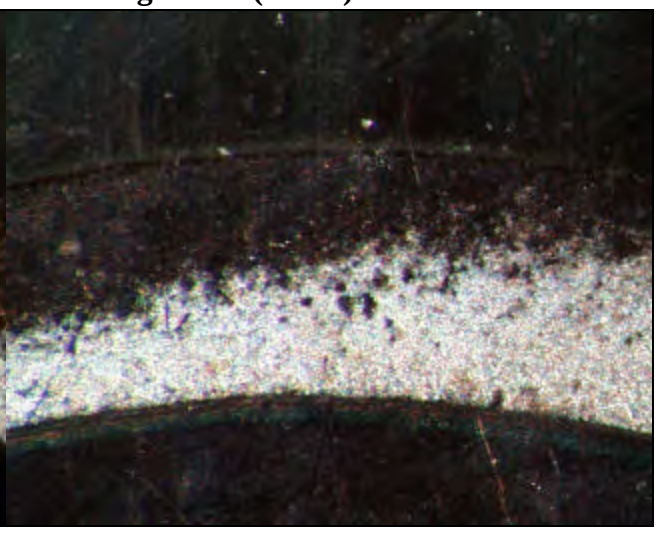
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Control Compressor

TEST HISTORY OF:

Unit Number 85
Model # RS43C1E-CAV-250 **Serial #** 96F16532
Run Time (hr.) 12021 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 3.5 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean/Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	Yes
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 6 **(3)** 6 **(4)** 6

Crank journals
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 1.2465
Unloaded 1.2465

Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance clean/Cu plating
Wear polish

Bottom washer (casting side)
Appearance clean
Wear polish

Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear
Varnish ring none
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance Cu plating
Wear polish
Dimensions **Loaded** 1.2475
Unloaded 1.2475

TEST HISTORY OF:

Unit Number 85
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.51
Water (ppm)	39
Fluoride ion (ppm)	1.2
Chloride ion (ppm)	9.3
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.050
Number of screens	2
Debris in compressor bottom (g)	0.111

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

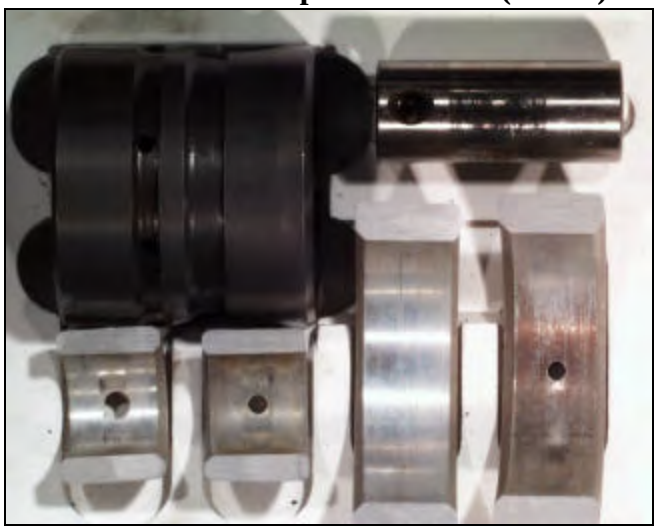
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	slight	gray	hard
Tip of Pin	heavy	black	gummy
Spring	medium	black, gray	hard
Spring Seat	medium	black	hard
Ball	medium	black	hard
Front Side	slight	black	hard

Photographic Documentation of R-22 Control Compressor
280 psig/78 psig

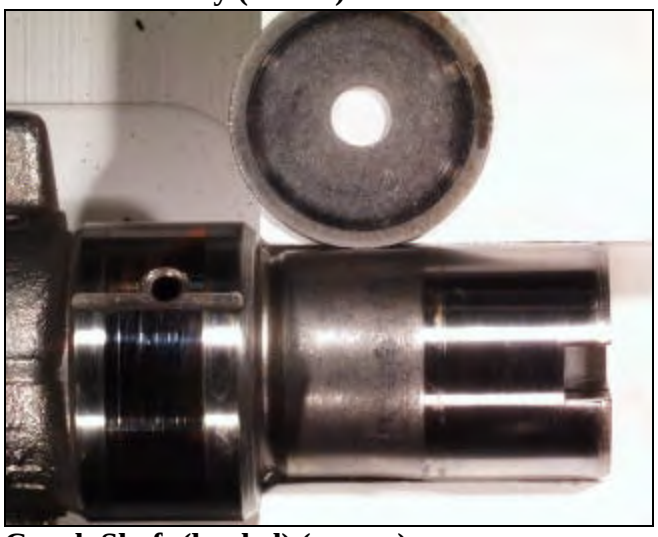
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



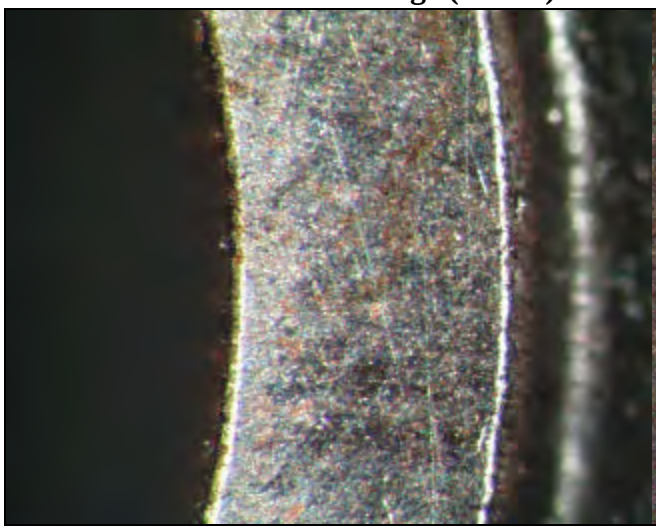
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

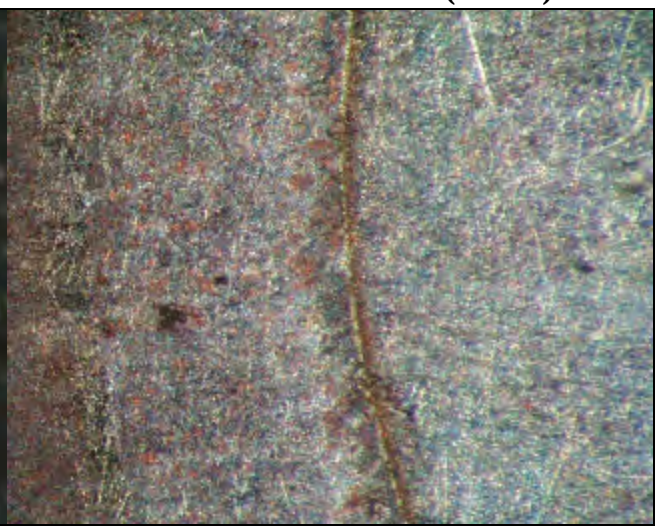
Photographic Documentation of R-22 Control Compressor
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

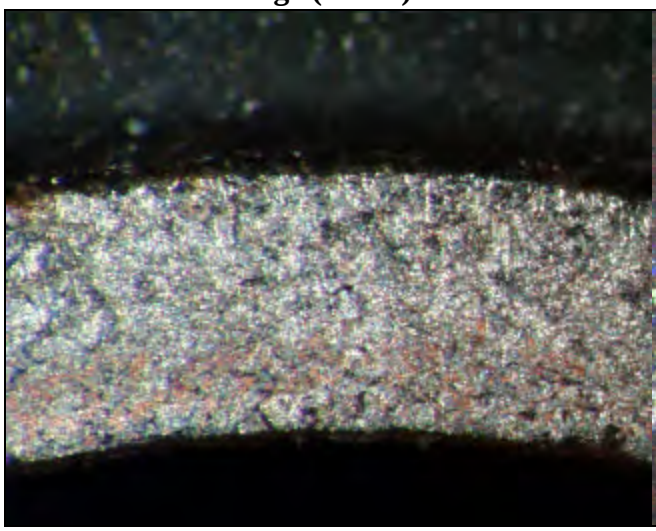
Valve Plate and Reed/Suction (macro)



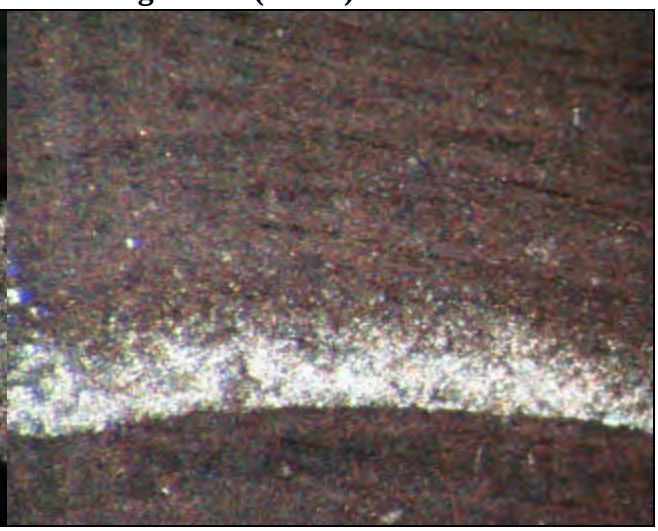
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Control Compressor

TEST HISTORY OF:

Unit Number 86
Model # RS43C1E-CAV-250 **Serial #** 96F16521
Run Time (hr.) 12005 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5.4 **(2)** 3.8 **(3)** 5.4 **(4)** 4.6
Remaining torque of stator bolts
(1) 5.8 **(2)** 5.8 **(3)** 12.5 **(4)** 5.8

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean/Cu plate
Quantity of bearing chips	heavy

Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0025
	Unloaded	1.0025
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear/Cu plating	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear/Cu plating	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2520

TEST HISTORY OF:

Unit Number 86
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/Cu	
Wear	polish	
Dimensions	**Loaded**	0.5025
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.31
Water (ppm)	32
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	8
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	1
Zinc (ppm)	3

Trash in liquid screen (g)	0.119
Number of screens	2
Debris in compressor bottom (g)	0.537

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/Cu plating

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	slight

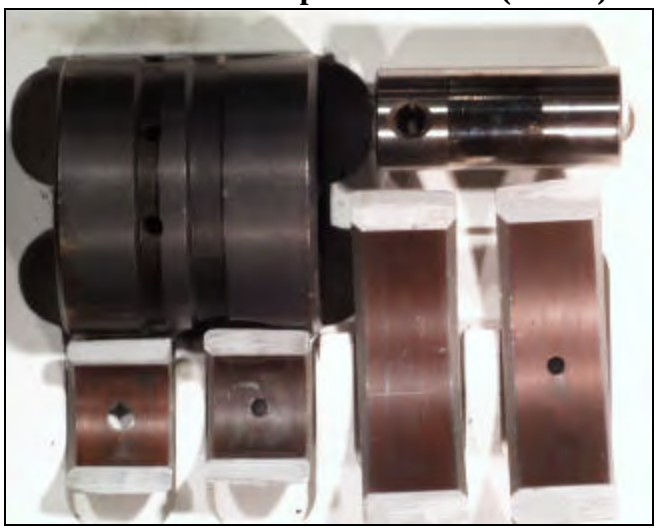
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	very slight	gray	hard
Equalizer Hole	slight	gray	hard
Tip of Pin	heavy	black	gummy
Spring	medium	black, gray	hard
Spring Seat	heavy	black	hard
Ball	heavy	black	hard
Front Side	slight	gray	hard

Photographic Documentation of R-22 Control Compressor
280 psig/78 psig

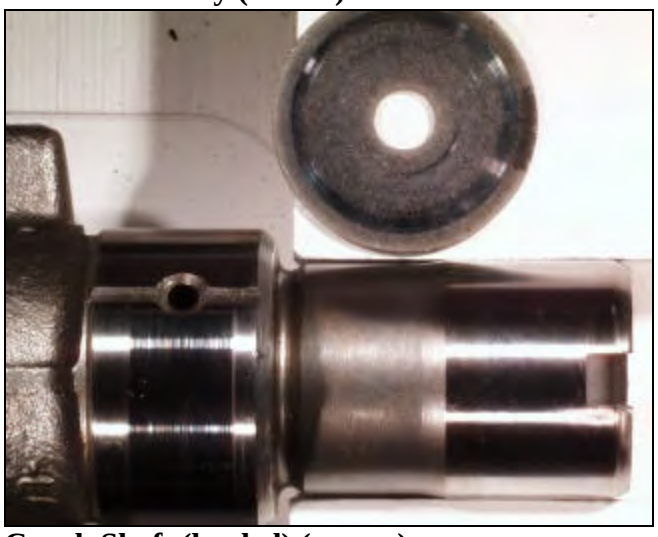
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

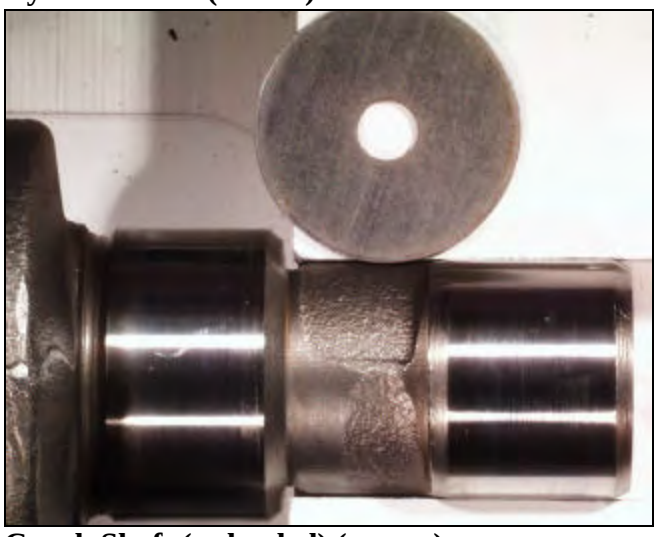


Piston Assembly (macro)

Cylinder Bore (macro)

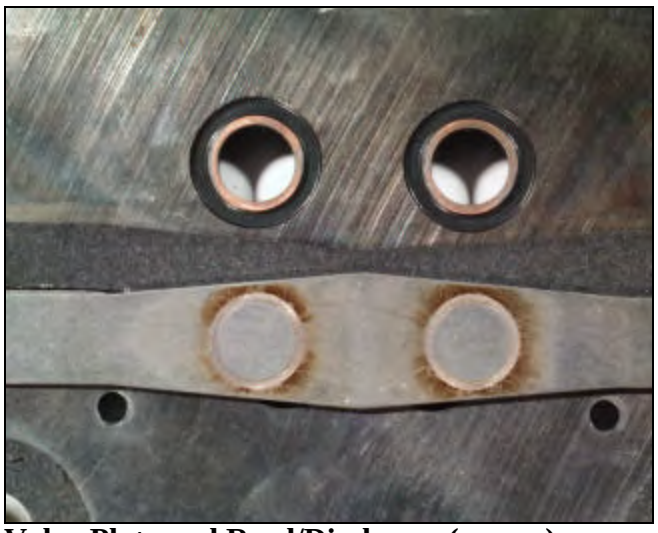


Crank Shaft (loaded) (macro)



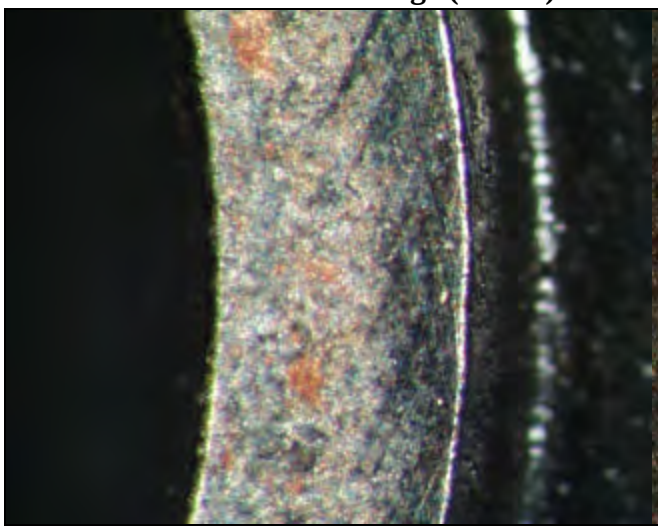
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Control Compressor
280 psig/78 psig

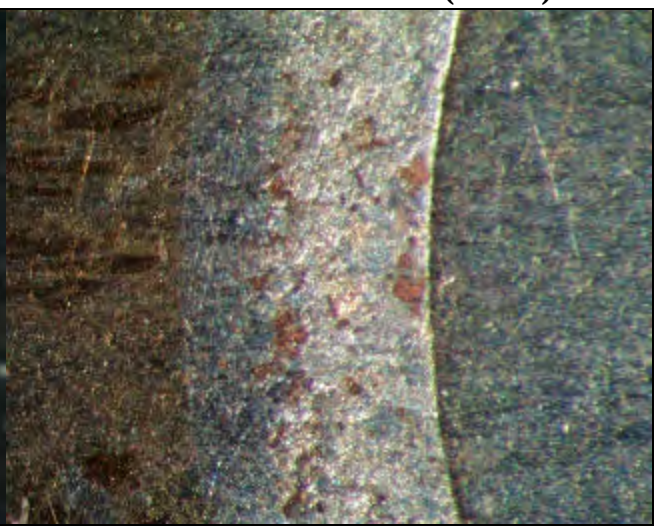


Valve Plate and Reed/Discharge (macro)

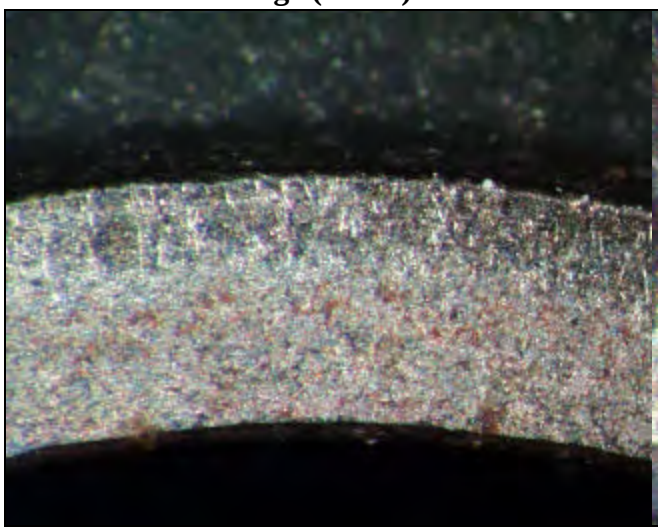
Valve Plate and Reed/Suction (macro)



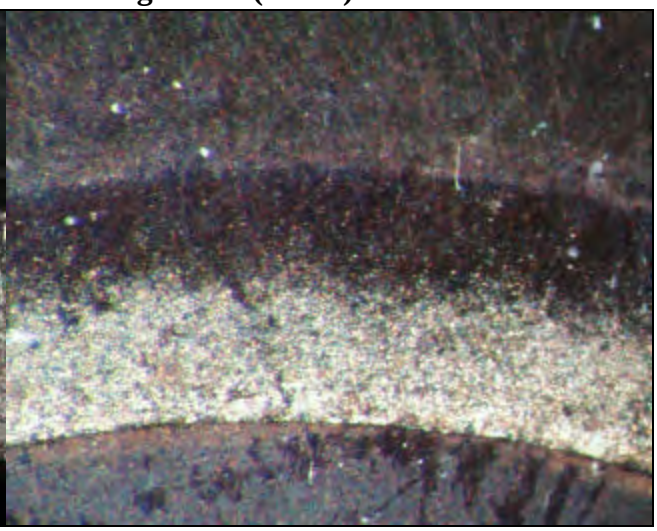
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Control Compressor

TEST HISTORY OF:

Unit Number 87
Model # RS43C1E-CAV-250 **Serial #** 96F16540
Run Time (hr.) 12017 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5.4 **(3)** 5.4 **(4)** 5

Remaining torque of stator bolts
(1) 2.1 **(2)** 2.1 **(3)** 2.1 **(4)** 6.3

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 14 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6 **(2)** 6 **(3)** 6 **(4)** 5

Crank journals		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/scored/Cu plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 87
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	26
Fluoride ion (ppm)	1.4
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	2

Trash in liquid screen (g)	0.066
Number of screens	2
Debris in compressor bottom (g)	0.504

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

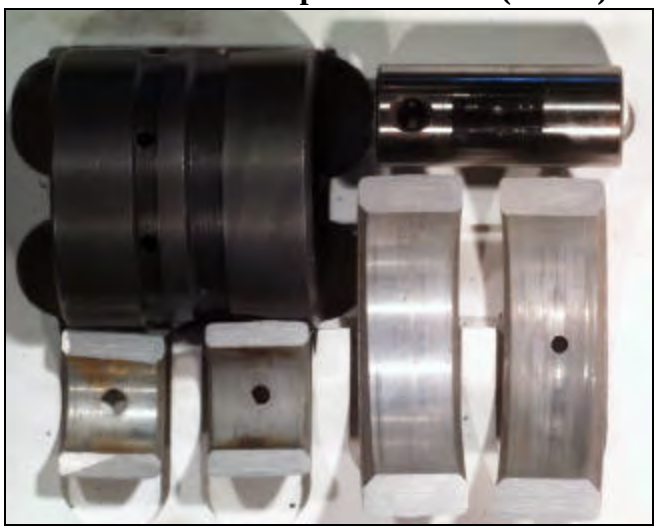
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	slight	gray	hard
Equalizer Hole	very slight	gray	hard
Tip of Pin	very heavy	black	gummy
Spring	medium	black, gray	hard
Spring Seat	slight	gray	hard
Ball	medium	black	gummy
Front Side	slight	gray	hard

Photographic Documentation of R-22 Control Compressor
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

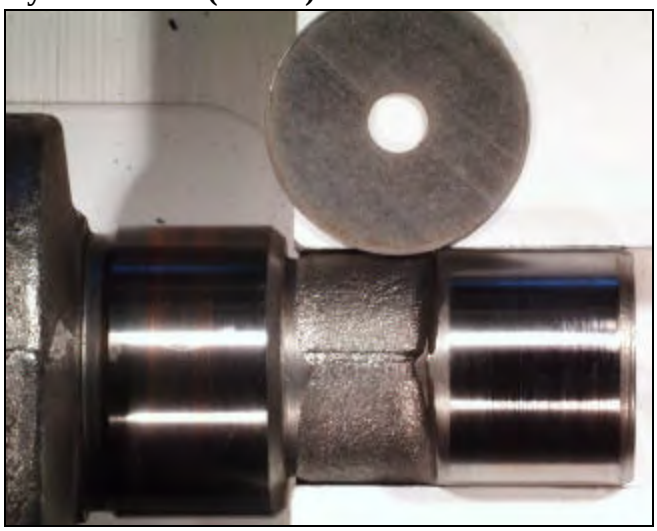
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

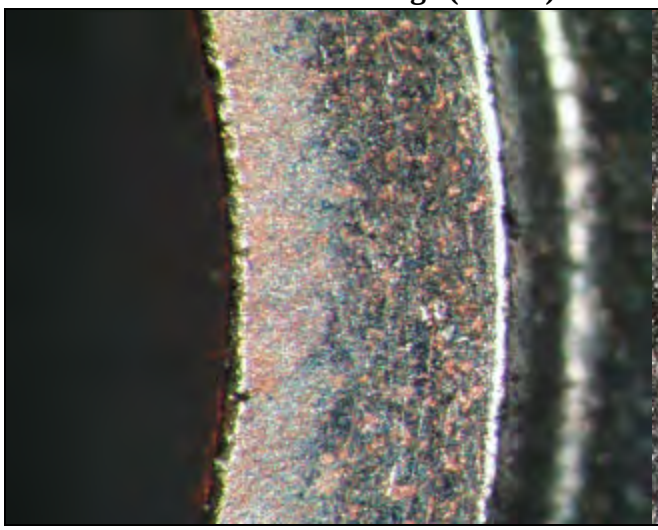


Crank Shaft (unloaded) (macro)

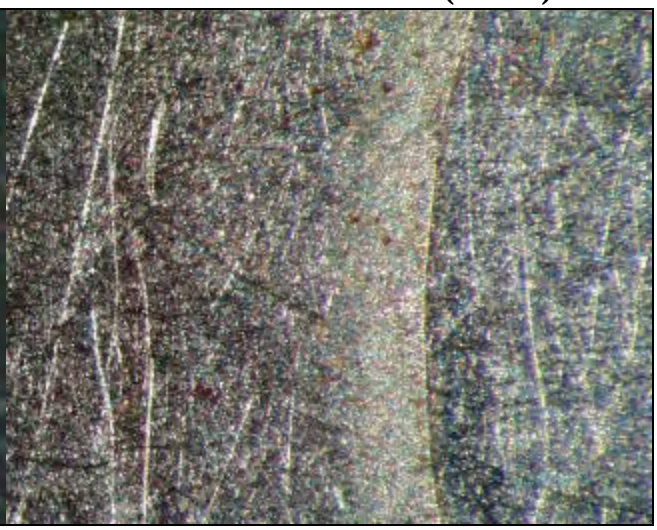
Photographic Documentation of R-22 Control Compressor
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

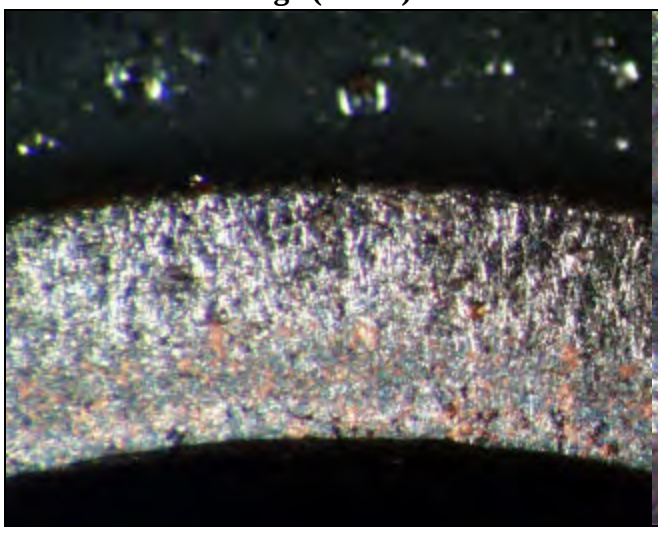
Valve Plate and Reed/Suction (macro)



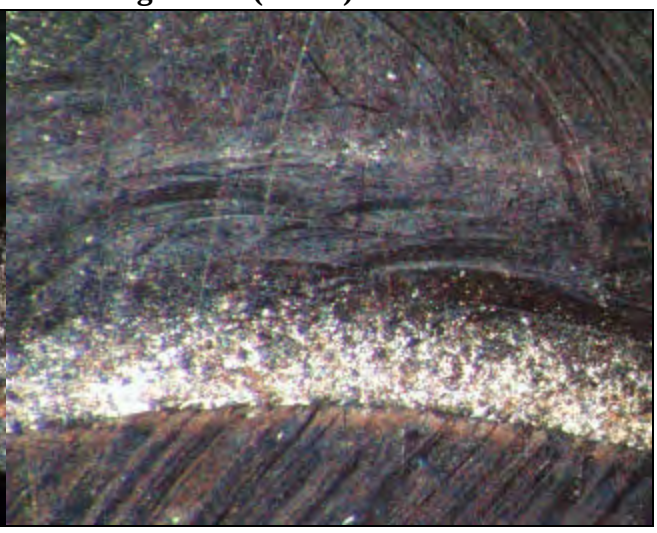
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 88
Model # RS43C1E-CAV-250 **Serial #** 96F16529
Run Time (hr.) 12006 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 5 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 10 **(4)** 9

Suction muffler appearance	rust
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	brown
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 16 **(3)** 15 **(4)** 16

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 6 **(4)** 5

Crank journals		
Appearance	clean/Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, heavy	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	varnish	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear	
Varnish ring	heavy	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3550
Connecting rod (large end)		
Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 88
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.14
Water (ppm)	34
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	9.2
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	5
Lead (ppm)	0
Silicon (ppm)	9
Tin (ppm)	1
Zinc (ppm)	15

Trash in liquid screen (g)	0.061
Number of screens	1
Debris in compressor bottom (g)	0.358

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

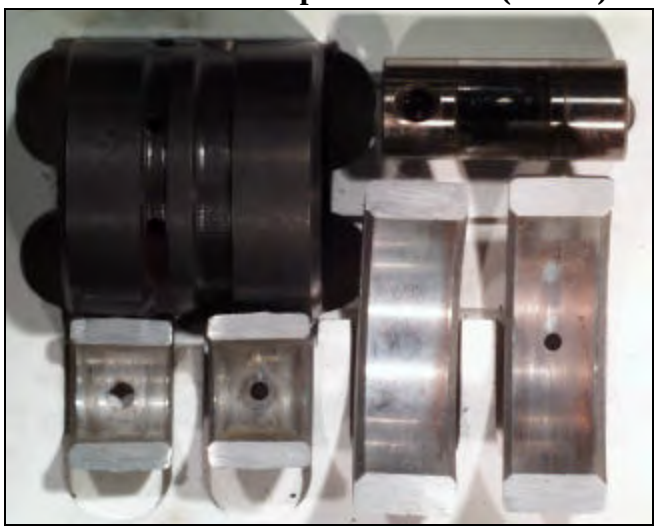
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	heavy	black	gummy
Front Side	slight	black	hard

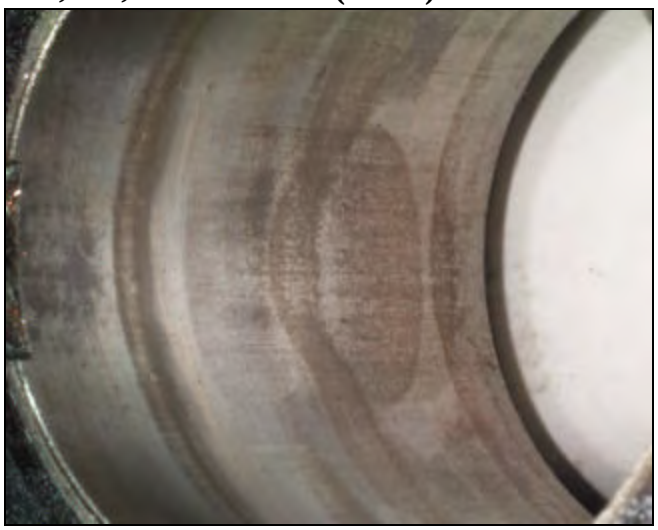
Photographic Documentation of R-22 Compressor with Contaminant Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

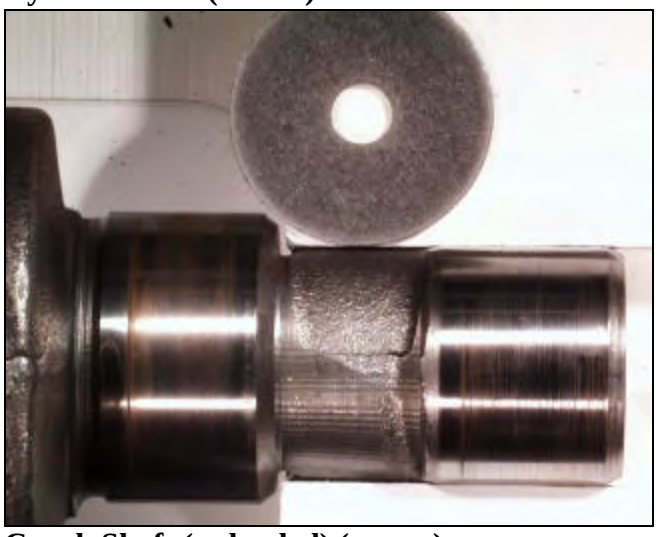


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

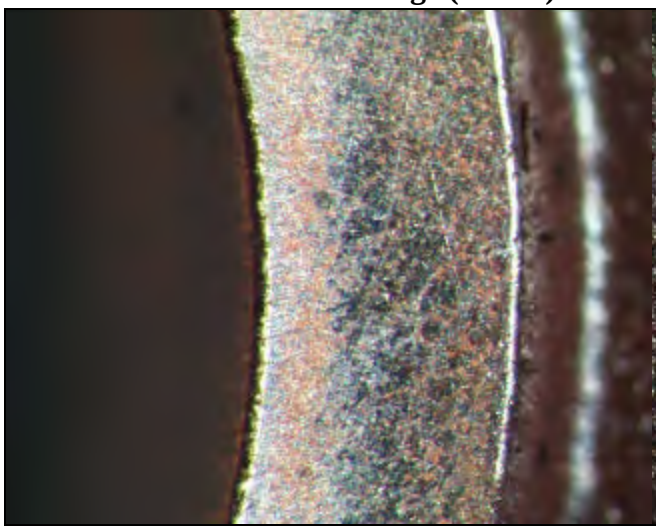


Crank Shaft (unloaded) (macro)

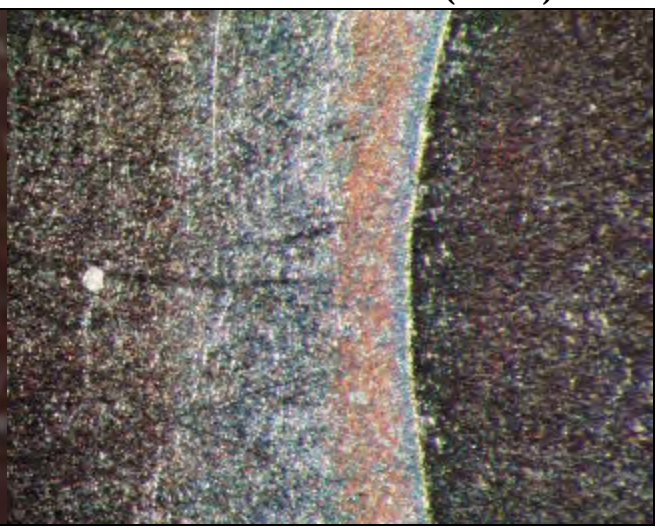
Photographic Documentation of R-22 Compressor with Contaminant Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

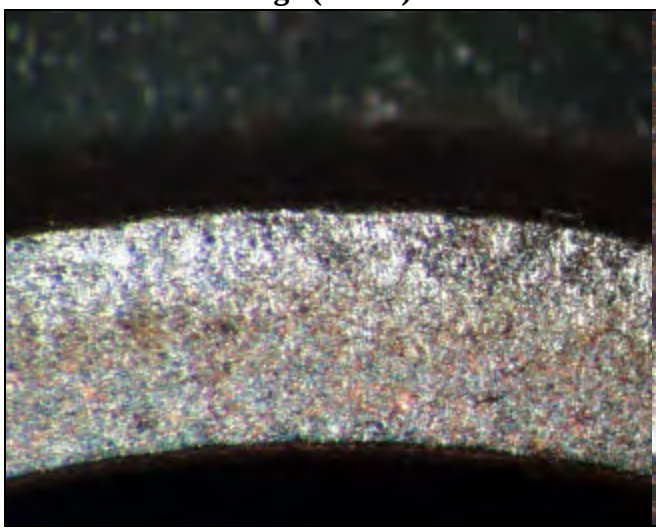
Valve Plate and Reed/Suction (macro)



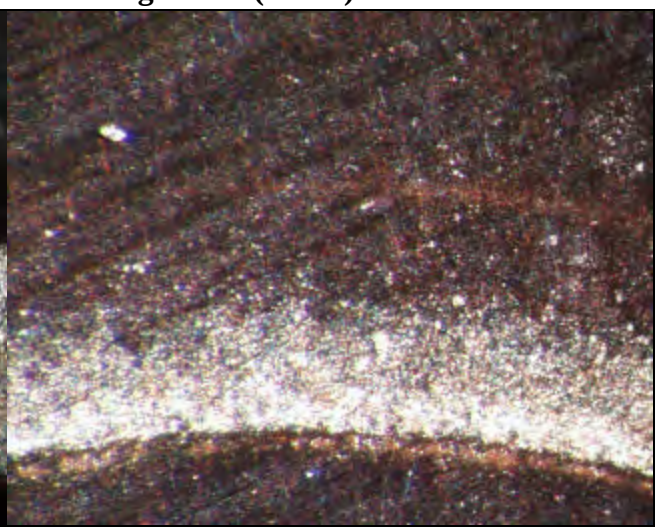
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 89
Model # RS43C1E-CAV-250 **Serial #** 96F16522
Run Time (hr.) 12011 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 10 **(4)** 10

Suction muffler appearance	rust
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 17 **(4)** 17

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9975
	Unloaded	0.9975
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	scored	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear/Cu plating	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	rust	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 89
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	18
Fluoride ion (ppm)	1.5
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.059
Number of screens	1
Debris in compressor bottom (g)	0.487

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

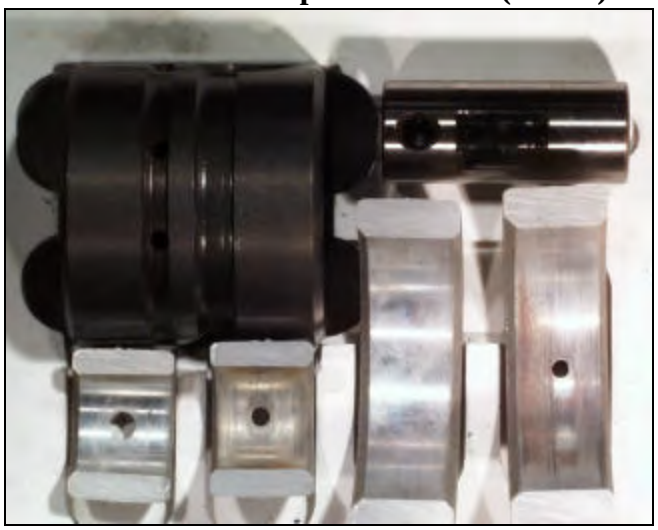
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black, brown	hard, gummy
Spring Seat	medium	black	gummy
Ball	medium	black	hard
Front Side	medium	black	hard

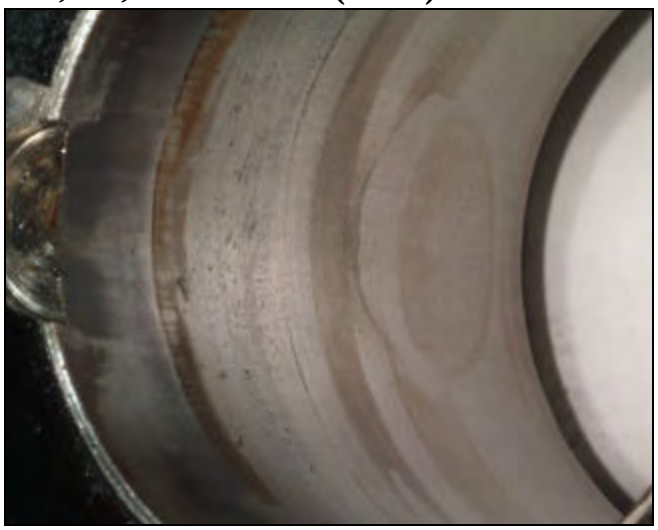
Photographic Documentation of R-22 Compressor with Contaminant Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

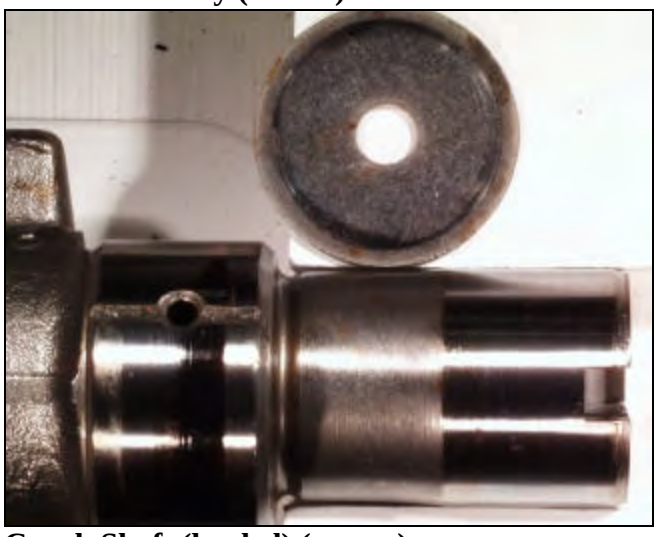
Ball, Pin, Seat of CPEV (micro)



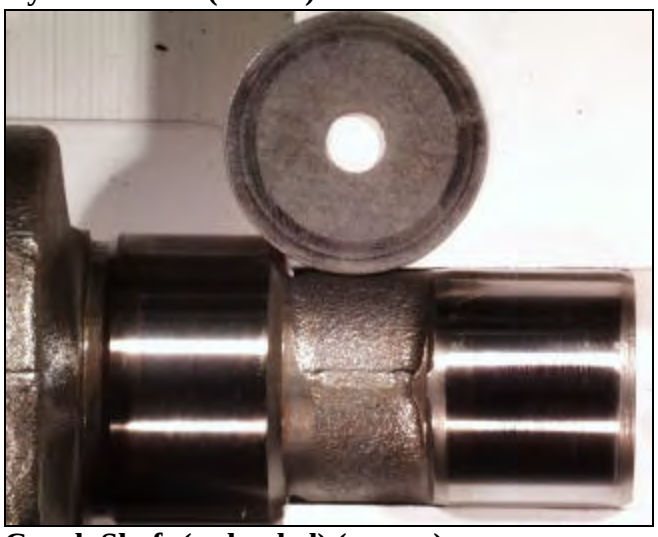
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

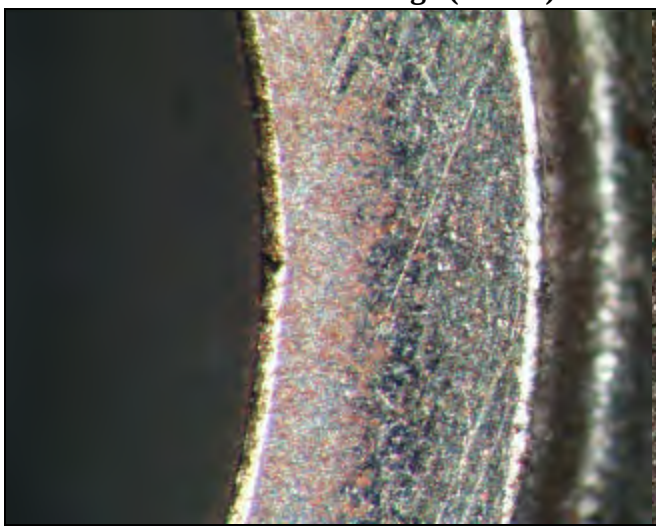


Crank Shaft (unloaded) (macro)

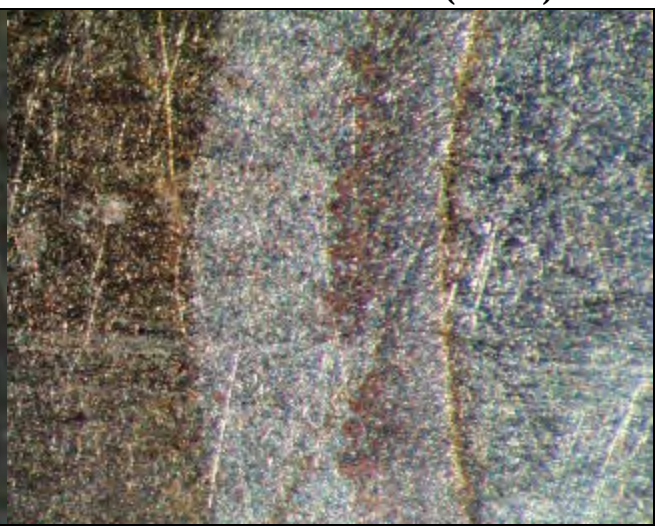
Photographic Documentation of R-22 Compressor with Contaminant Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

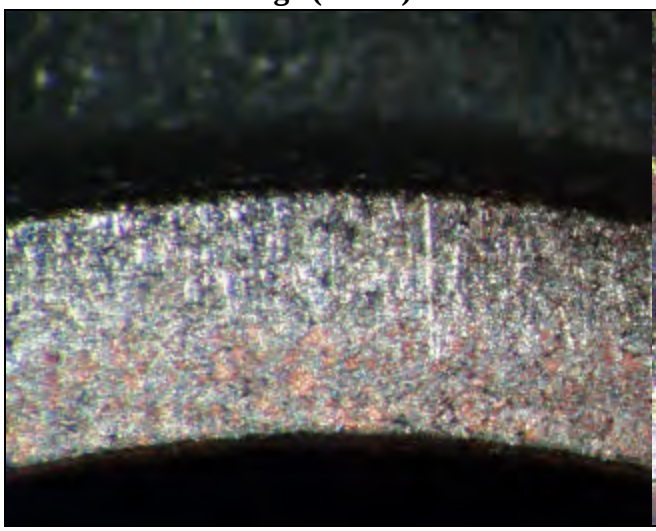
Valve Plate and Reed/Suction (macro)



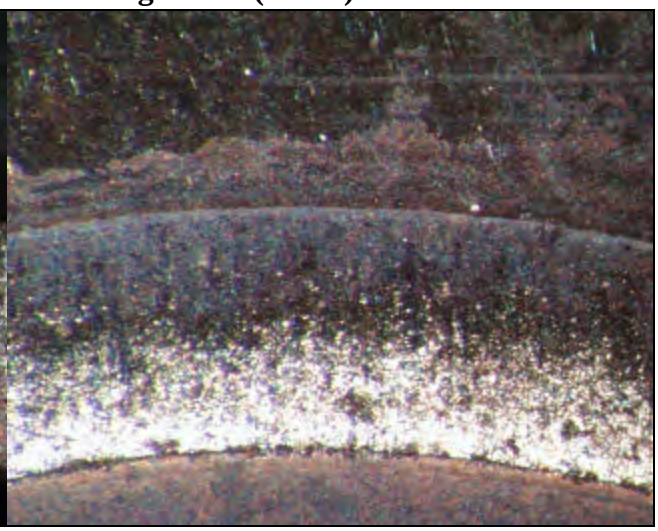
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 90
Model # RS43C1E-CAV-250 **Serial #** 96F16536
Run Time (hr.) 12031 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 280
Suction Pressure (psig) 78
Discharge Temp (°F) 143
Return Gas Temp (°F) 60
SumpTemp (°F) 98

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 10 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean/stator top green
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 20 **(3)** 20 **(4)** 17.5
Head gasket brittle? no/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 5 **(2)** 6 **(3)** 6 **(4)** 5

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980
Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear polish
Bottom washer (casting side)
Appearance scored
Wear slight
Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0035
Unloaded 1.0035
Shaft in cage bearing
Appearance clean
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear/rust
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 90
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	2
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.114
Number of screens	2
Debris in compressor bottom (g)	0.379

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

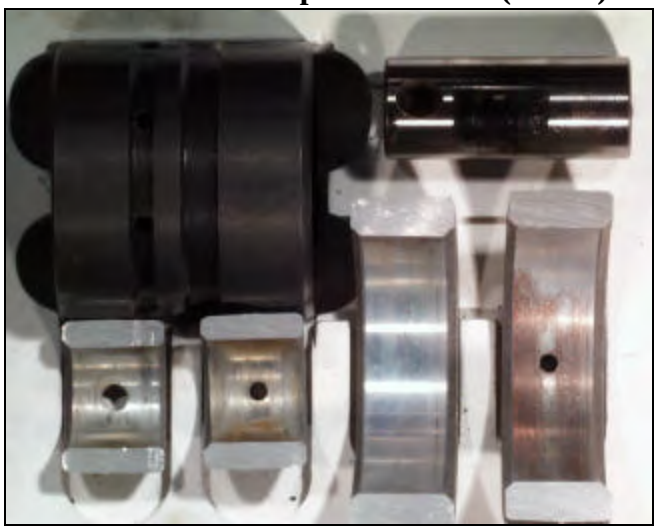
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	black	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	medium	black	hard
Spring Seat	slight	black	hard
Ball	medium	black, brassy	hard
Front Side	medium	black	hard

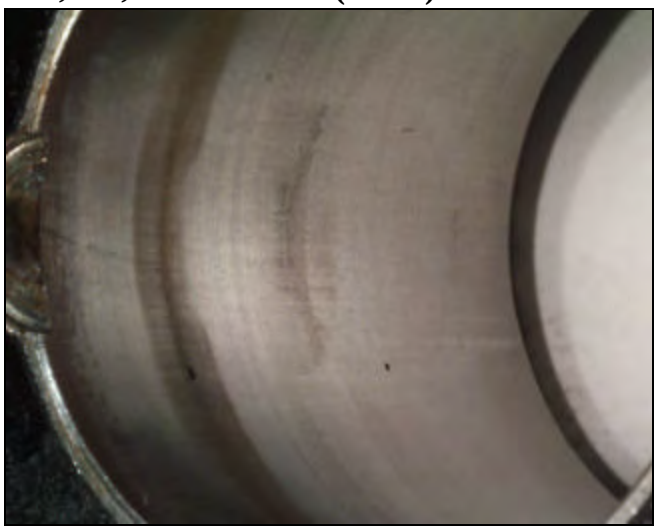
Photographic Documentation of R-22 Compressor with Contaminant Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

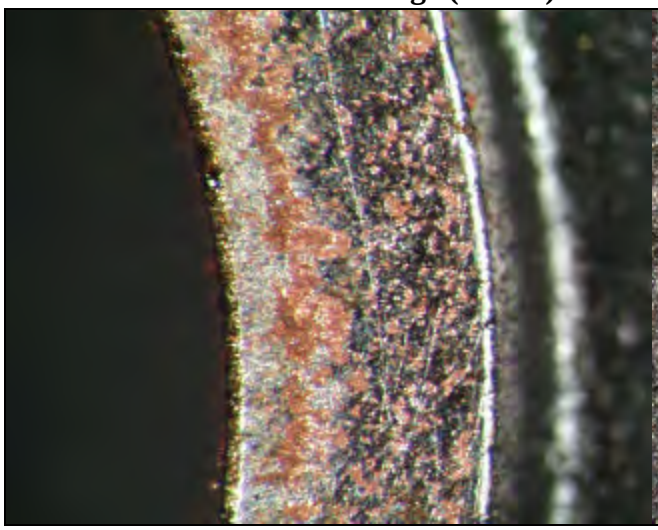
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

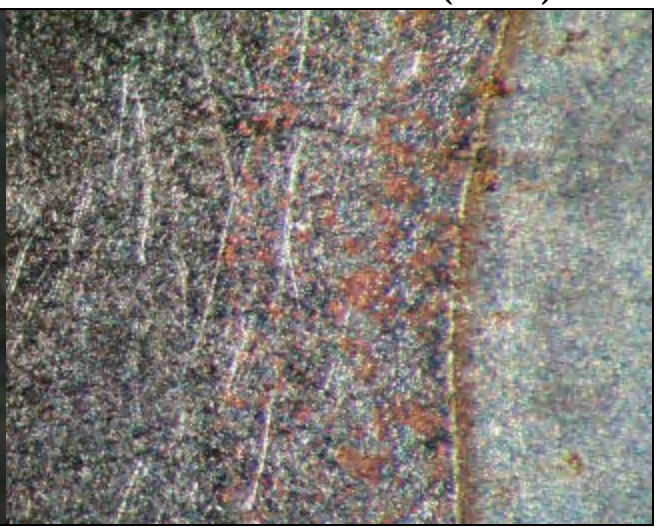
Photographic Documentation of R-22 Compressor with Contaminant Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

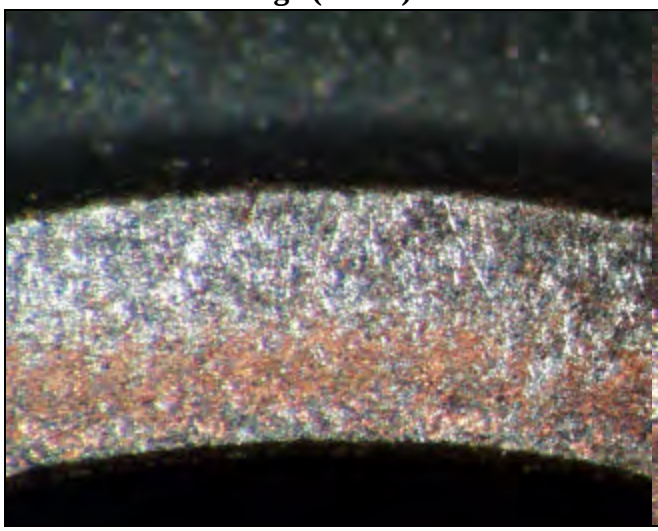
Valve Plate and Reed/Suction (macro)



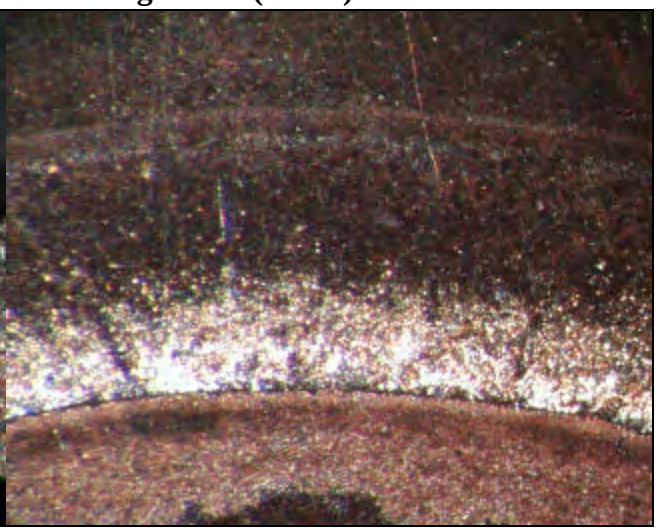
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 91
Model # RS43C1E-CAV-250 **Serial #** 96F16520
Run Time (hr.) 12036 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 12.5 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 17 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 7 **(2)** 6 **(3)** 6 **(4)** 6

Crank journals		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating/corrosion	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean/Cu plating	
Wear	polish	
Lower bronze bearings		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean/Cu plating/corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear/Cu plating	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 91
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.15
Water (ppm)	1
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	2
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	8
Zinc (ppm)	2

Trash in liquid screen (g)	0.031
Number of screens	1
Debris in compressor bottom (g)	0.586

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	very slight

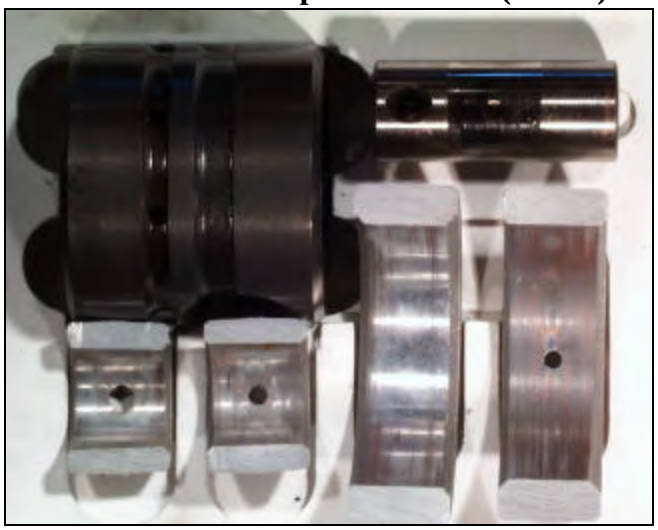
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	hard
Spring Seat	medium	black	hard
Ball	medium	black	hard
Front Side	heavy	black	hard

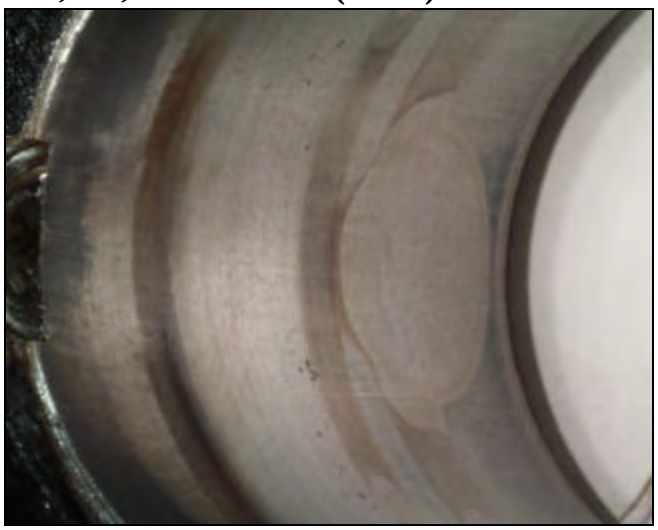
Photographic Documentation of R-22 Compressor with Contaminant Acid
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

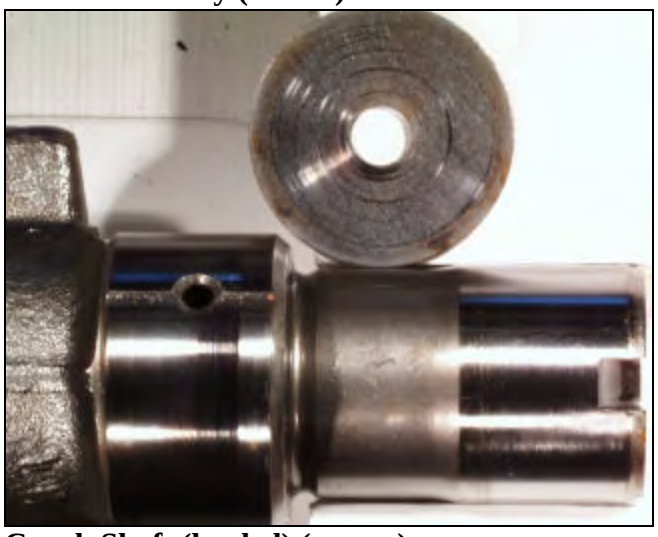
Ball, Pin, Seat of CPEV (micro)



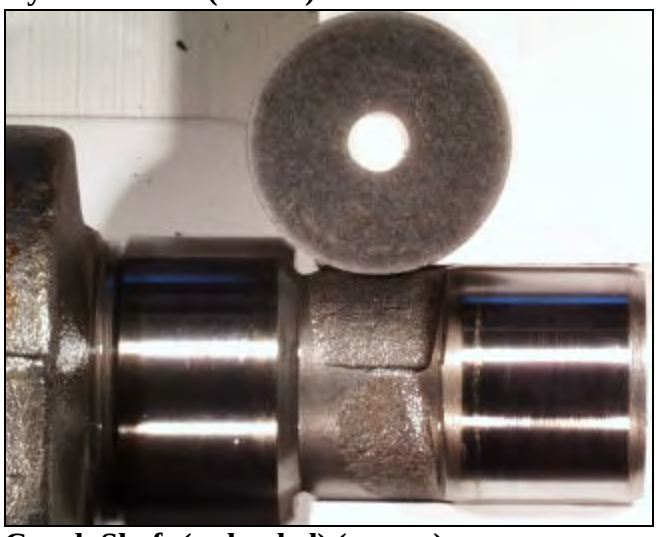
Piston Assembly (macro)



Cylinder Bore (macro)



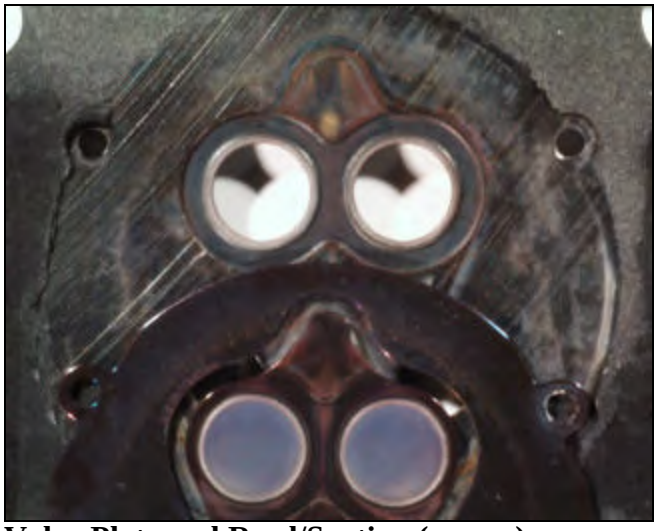
Crank Shaft (loaded) (macro)



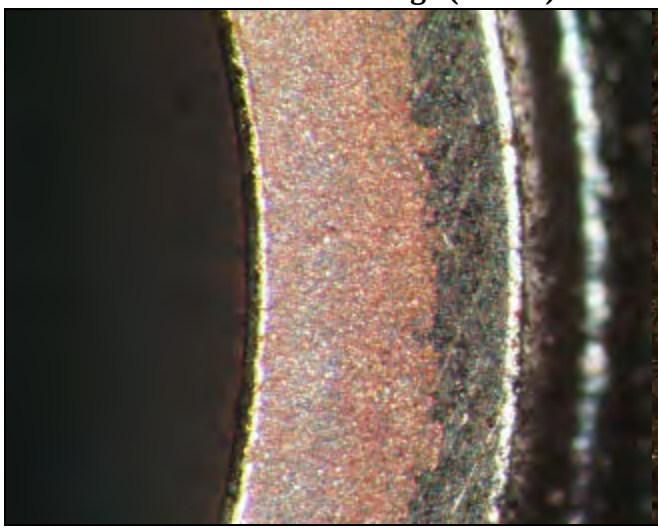
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid
280 psig/78 psig

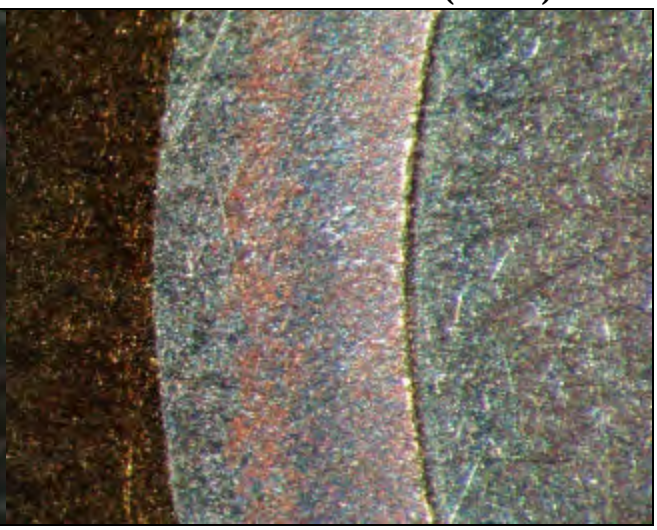
Valve Plate and Reed/Discharge (macro)



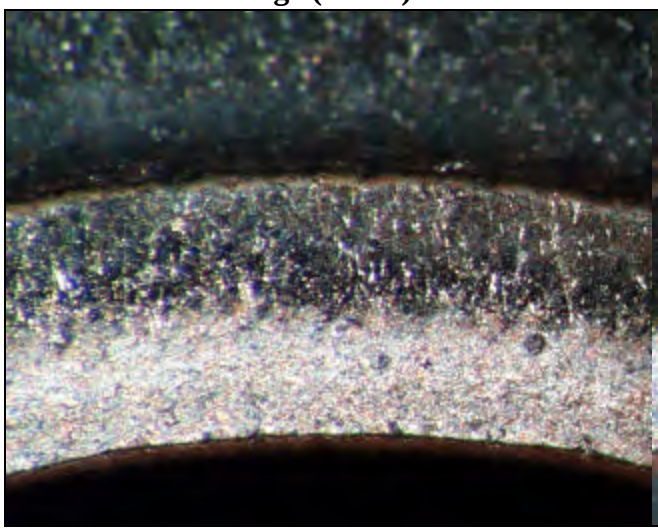
Valve Plate and Reed/Suction (macro)



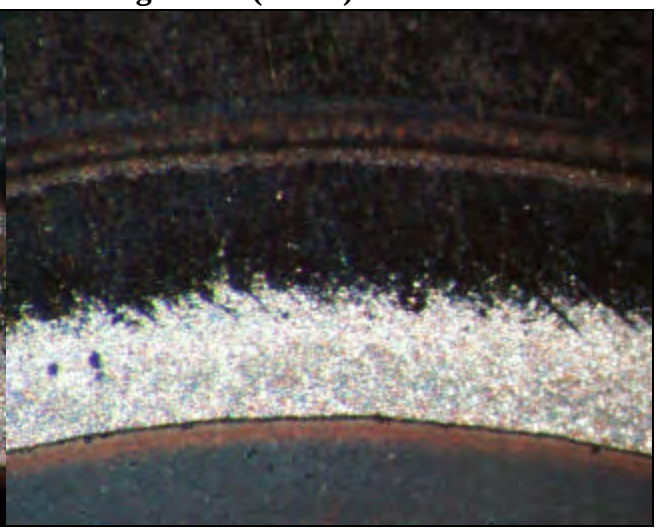
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 92
Model # RS43C1E-CAV-250 **Serial #** 96F16524
Run Time (hr.) 12020 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 15 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray, soot
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	medium

Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 17 **(4)** 17

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 7 **(4)** 5

Crank journals
Appearance clean/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance scored/Cu plating/wear metals
Wear slight

Bottom washer (casting side)
Appearance Cu plating
Wear slight

Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance clean/Cu plating/corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance low wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 92
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.14
Water (ppm)	25
Fluoride ion (ppm)	0.93
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	6
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	6
Zinc (ppm)	23

Trash in liquid screen (g)	0.003
Number of screens	1
Debris in compressor bottom (g)	0.122

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

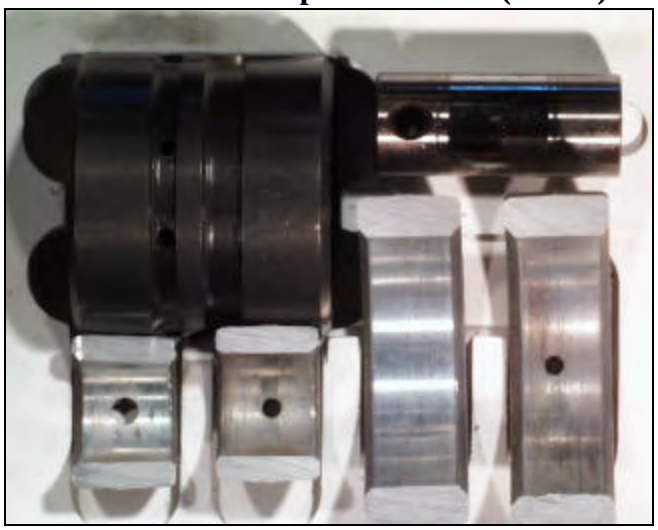
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	hard
Ball	medium	black, brown	hard
Front Side	slight	black	hard

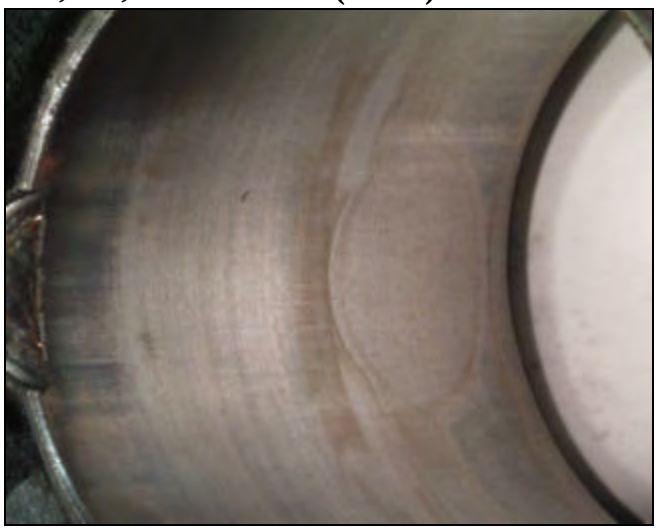
Photographic Documentation of R-22 Compressor with Contaminant Acid
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

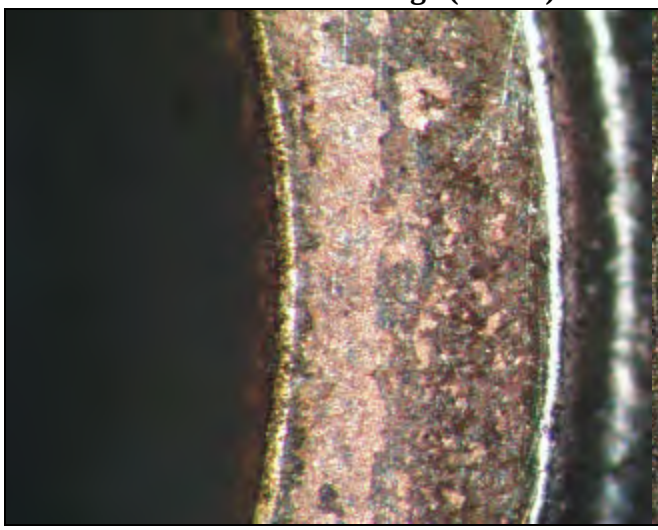
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

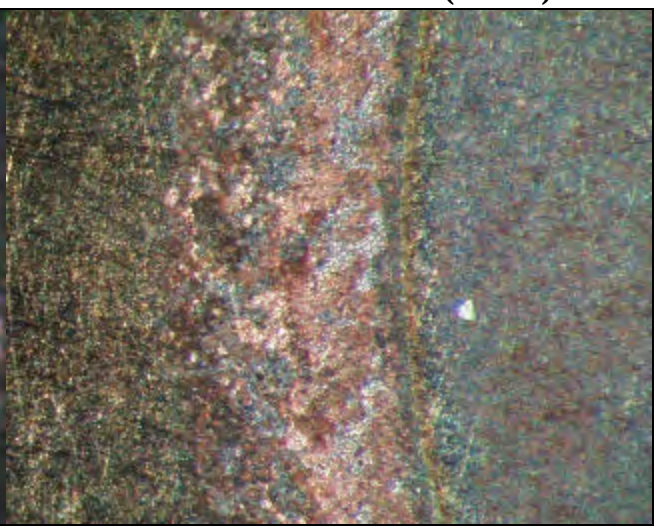
Photographic Documentation of R-22 Compressor with Contaminant Acid
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

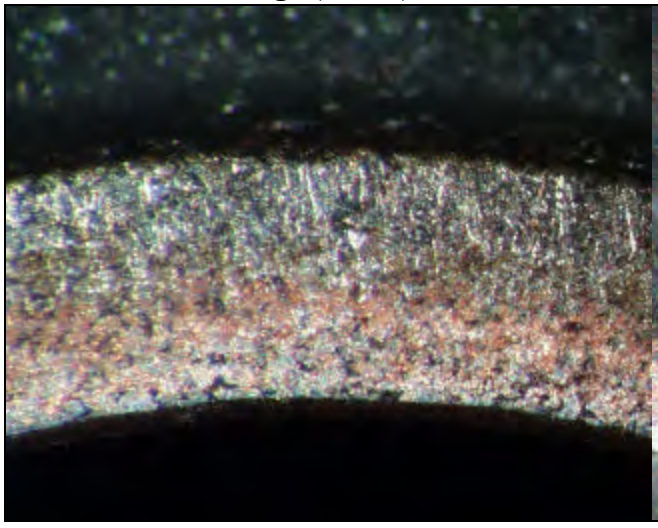
Valve Plate and Reed/Suction (macro)



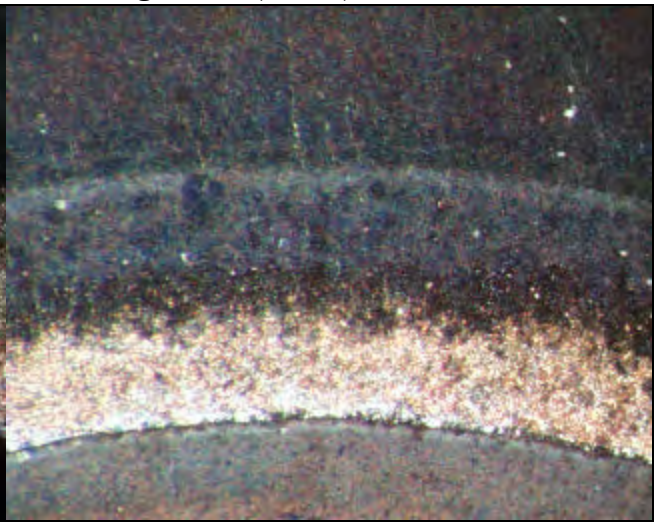
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 93
Model # RS43C1E-CAV-250 **Serial #** 96F16518
Run Time (hr.) 12029 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 12.5 **(2)** 10 **(3)** 10 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	brown
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 17.5 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	Cu plate
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 7 **(4)** 5

Crank journals

Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470

Lower crank bearing journal

Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990

Bottom thrust washer (crank side)

Appearance	scored/Cu plating/corrosion
Wear	polish

Bottom washer (casting side)

Appearance	clean/Cu plating
Wear	polish

Lower bronze bearings

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035

Shaft in cage bearing

Appearance	clean/Cu plating/corrosion
Wear	polish

Piston top appearance clean

Piston skirt

Appearance	no wear/Cu plating	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740

Cylinder bore

Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760

Connecting rod (large end)

Appearance	scored/Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 93
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion/Cu	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.13
Water (ppm)	37
Fluoride ion (ppm)	0.98
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	4
Lead (ppm)	0
Silicon (ppm)	5
Tin (ppm)	0
Zinc (ppm)	7

Trash in liquid screen (g)	0.071
Number of screens	1
Debris in compressor bottom (g)	0.042

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

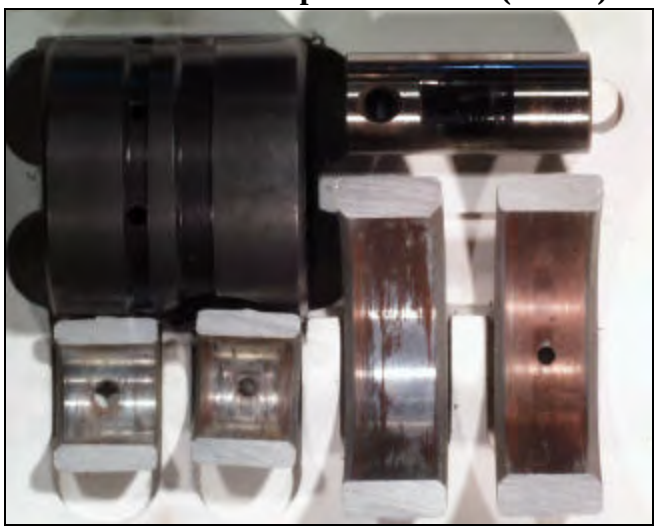
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	heavy	black	gummy
Front Side	heavy	black	hard

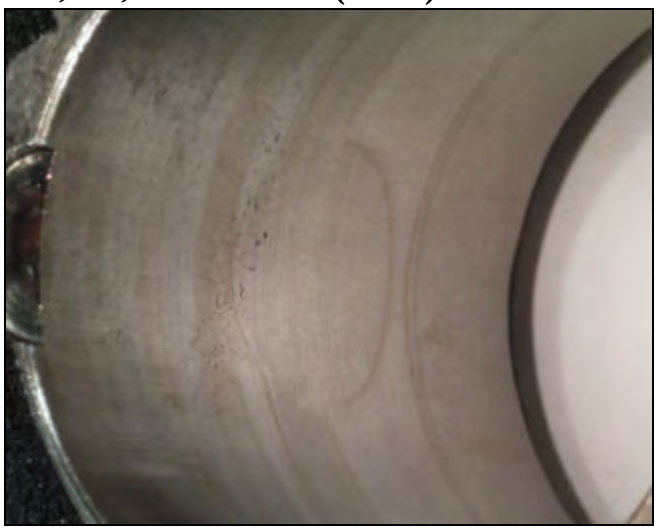
Photographic Documentation of R-22 Compressor with Contaminant Air
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

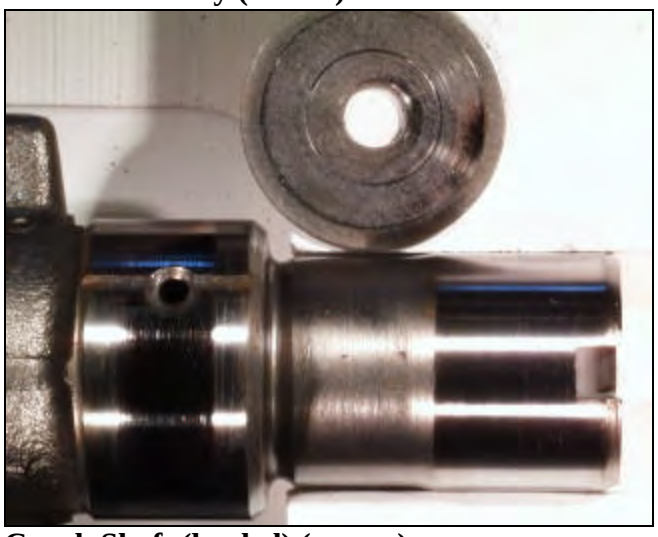
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



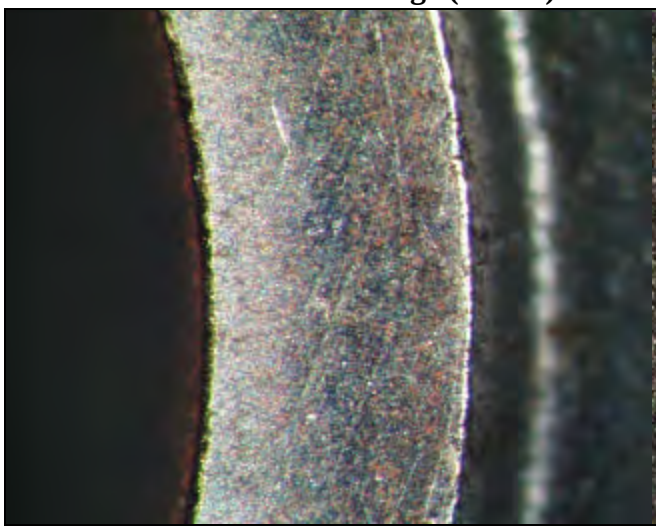
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

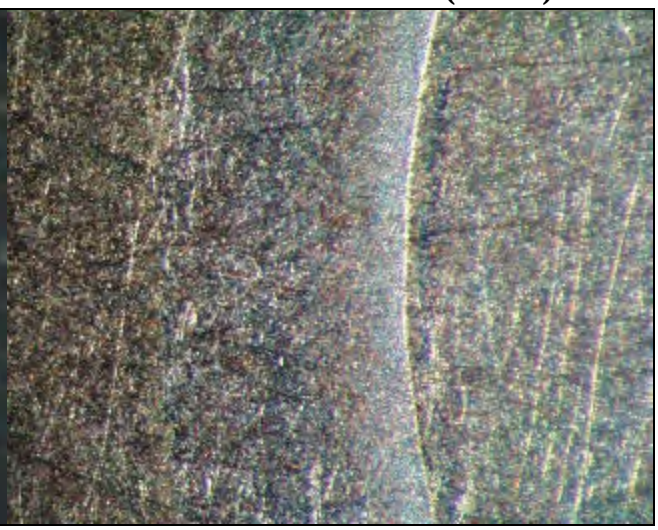
Photographic Documentation of R-22 Compressor with Contaminant Air
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

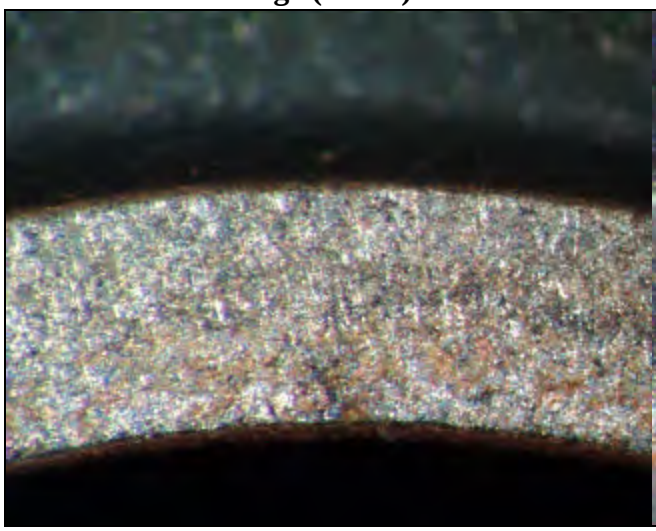
Valve Plate and Reed/Suction (macro)



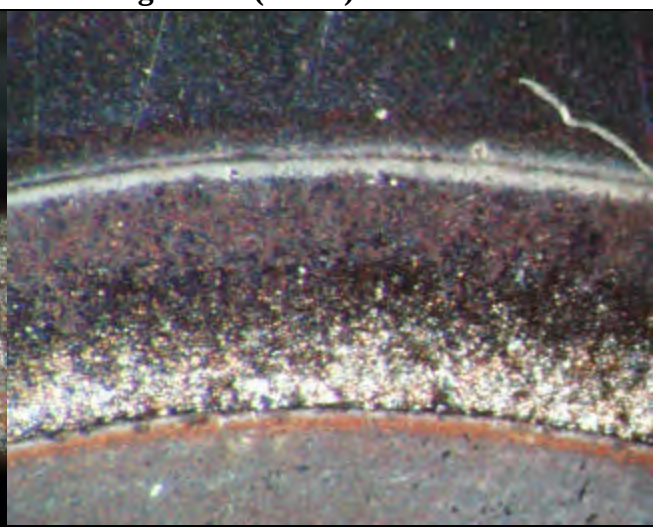
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 94
Model # RS43C1E-CAV-250 **Serial #** 96F16526
Run Time (hr.) 12000 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 5 **(2)** 4 **(3)** 6 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 11 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 16 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 6 **(3)** 5 **(4)** 6

Crank journals
Appearance clean/Cu plating
Wear polish, medium
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean
Wear polish, slight
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance corrosion
Wear polish, medium

Bottom washer (casting side)
Appearance clean
Wear polish, slight

Lower bronze bearings
Appearance clean
Wear polish, slight
Dimensions **Loaded** 1.0005
Unloaded 1.0005

Shaft in cage bearing
Appearance clean
Wear polish, slight

Piston top appearance varnish

Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3720
Unloaded 1.3720

Cylinder bore
Appearance low wear
Varnish ring medium
Dimensions **Loaded** 1.3745
Unloaded 1.3745

Connecting rod (large end)
Appearance none
Wear polish, slight
Dimensions **Loaded** 1.2495
Unloaded 1.2495

TEST HISTORY OF:

Unit Number 94
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/Cu	
Wear	polish	
Dimensions	**Loaded**	0.4995
	Unloaded	0.4995

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.18
Water (ppm)	37
Fluoride ion (ppm)	0.93
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	4
Lead (ppm)	0
Silicon (ppm)	8
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.026
Number of screens	1
Debris in compressor bottom (g)	0.256

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	slight

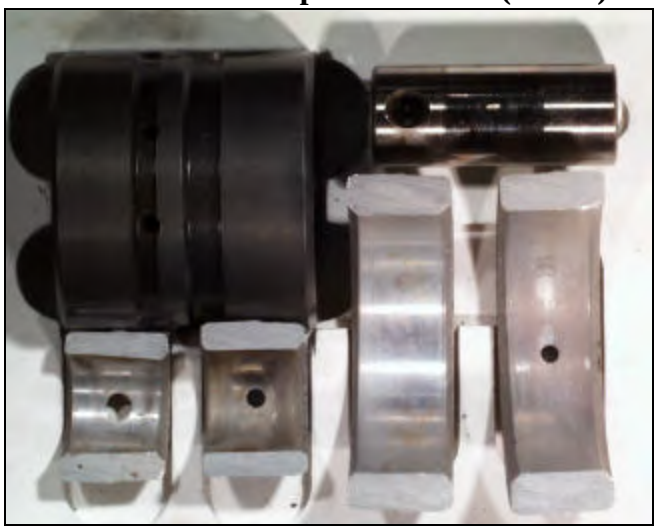
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	slight	gray	hard
Spring Seat	very slight	black	hard
Ball	medium	black	gummy
Front Side	very slight	black	hard

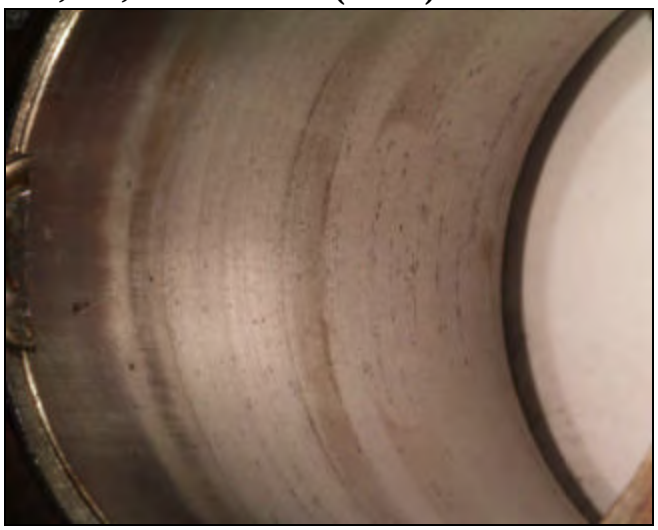
Photographic Documentation of R-22 Compressor with Contaminant Air
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

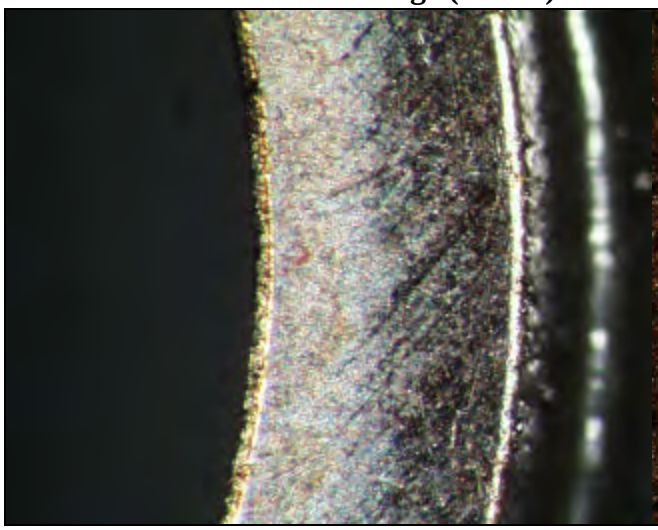
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

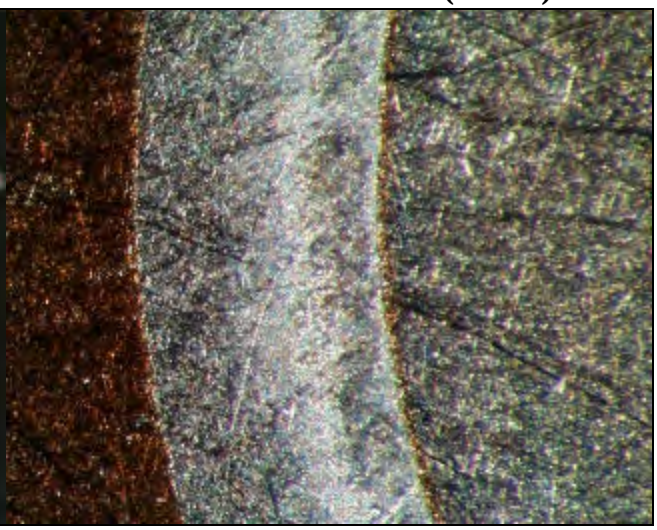
Photographic Documentation of R-22 Compressor with Contaminant Air
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

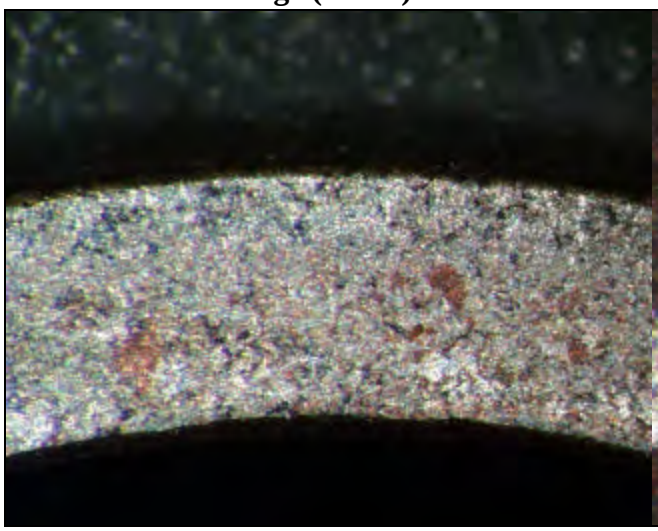
Valve Plate and Reed/Suction (macro)



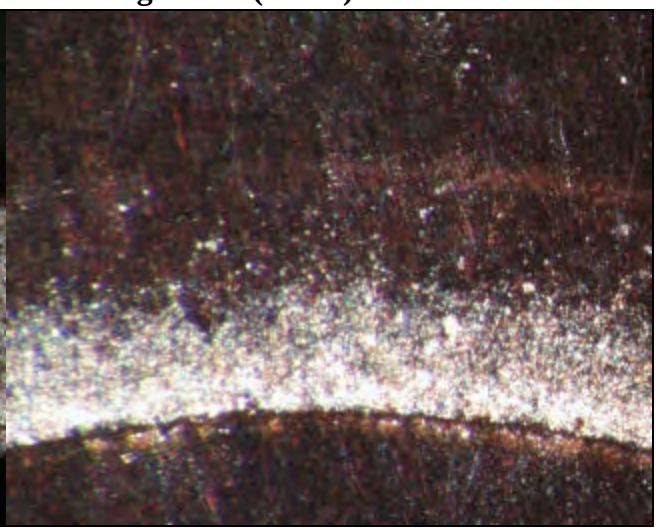
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 95
Model # RS43C1E-CAV-250 **Serial #** 96F16541
Run Time (hr.) 12007 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 280
Suction Pressure (psig) 78
Discharge Temp (°F) 143
Return Gas Temp (°F) 60
SumpTemp (°F) 98

Hi-Pot pass
High-low leak fail
Top shell appearance clean
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance bright
Remaining torque of discharge muffler
(1) 1 **(2)** 1 **(3)** 1 **(4)** 2.5
Remaining torque of stator bolts
(1) 15 **(2)** 15 **(3)** 10 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean/stator top green
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance Cu plate
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 17 **(4)** 15
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 7 **(4)** 7

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/Cu plating/wear metals
Wear polish
Bottom washer (casting side)
Appearance scored/Cu plating
Wear polish
Lower bronze bearings
Appearance clean/corrosion
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance clean
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear/Cu plating
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 95
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.26
Water (ppm)	56
Fluoride ion (ppm)	0.99
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	2
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	7
Zinc (ppm)	3

Trash in liquid screen (g)	0.084
Number of screens	2
Debris in compressor bottom (g)	0.930

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

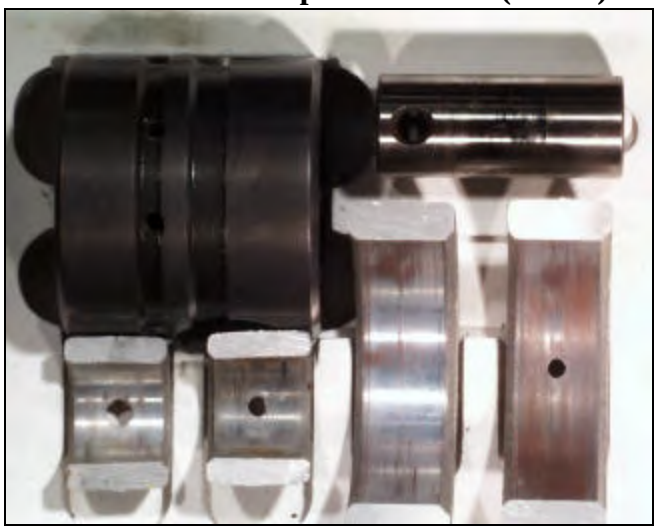
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

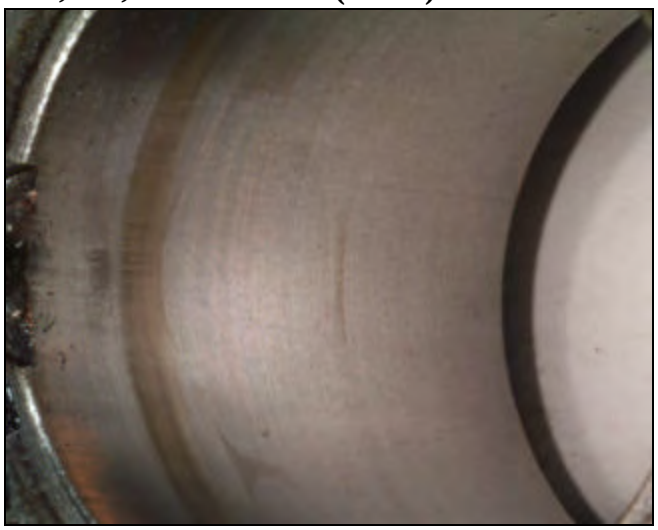
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

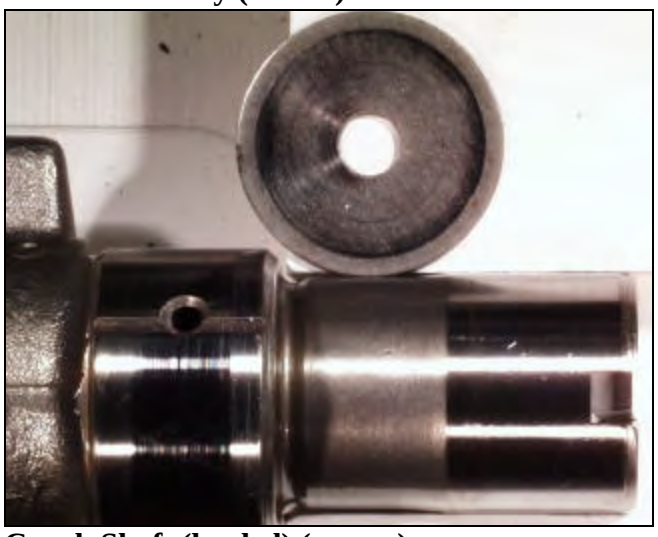
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



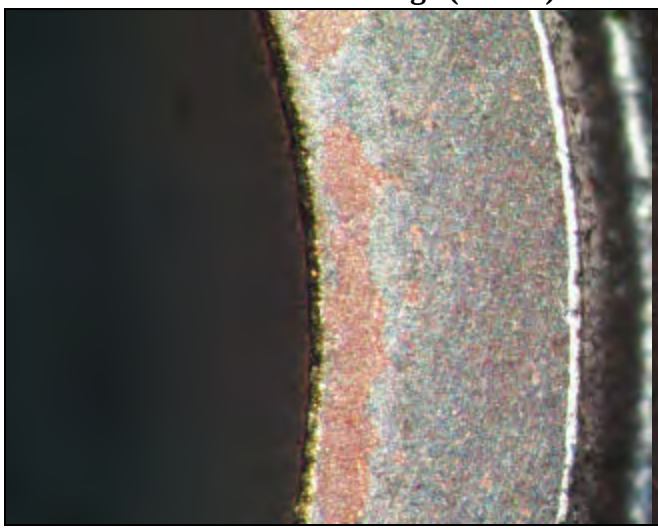
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

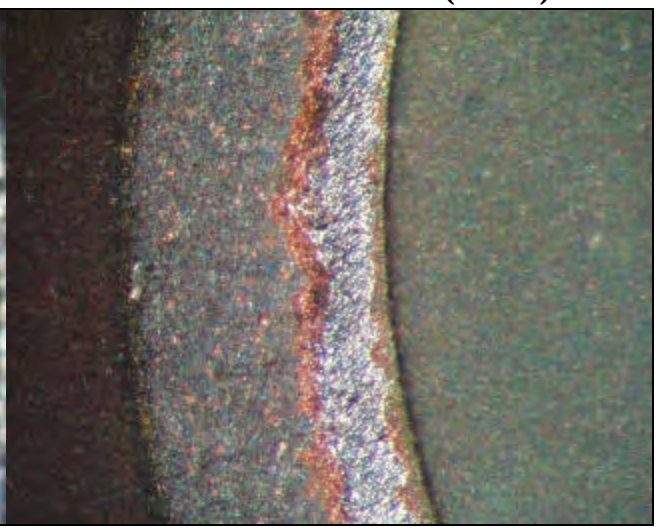
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

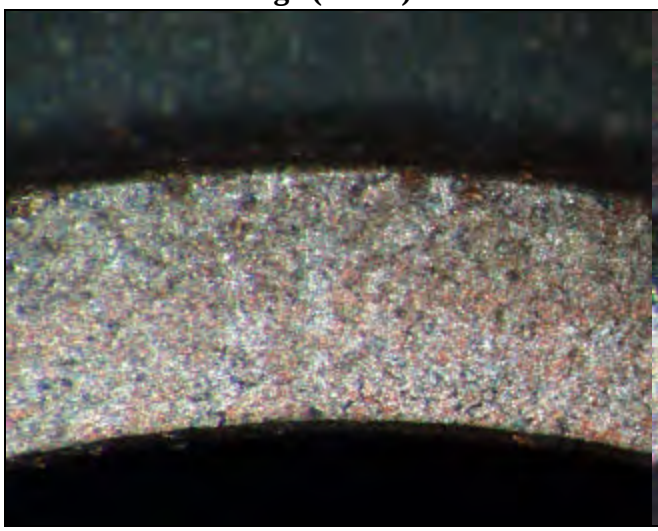
Valve Plate and Reed/Suction (macro)



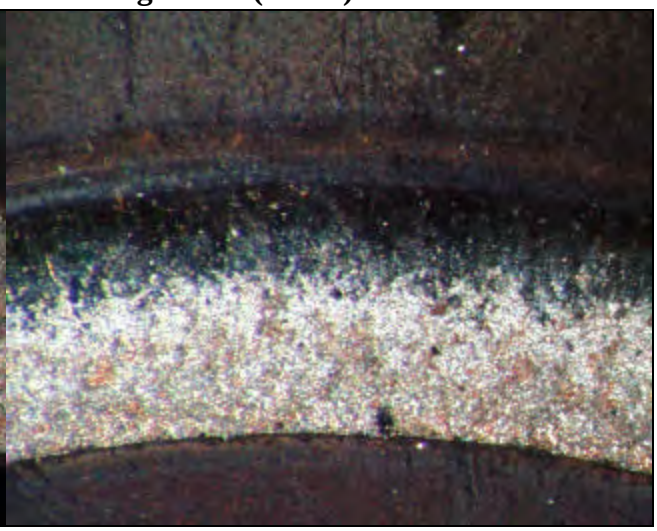
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 96
Model # RS43C1E-CAV-250 **Serial #** 96F16528
Run Time (hr.) 12039 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 280
Suction Pressure (psig) 78
Discharge Temp (°F) 143
Return Gas Temp (°F) 60
SumpTemp (°F) 98

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 2 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 10 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 18 **(2)** 17.5 **(3)** 15 **(4)** 17
Head gasket brittle? no/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean/green
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 7 **(4)** 6

Crank journals
Appearance scored
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980
Bottom thrust washer (crank side)
Appearance scored/corrosion/wear metals
Wear polish
Bottom washer (casting side)
Appearance scored
Wear slight
Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0035
Unloaded 1.0035
Shaft in cage bearing
Appearance clean
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 96
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	57
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	10
Aluminum (ppm)	0
Copper (ppm)	11
Iron (ppm)	13
Lead (ppm)	3
Silicon (ppm)	10
Tin (ppm)	4
Zinc (ppm)	42

Trash in liquid screen (g)	0.038
Number of screens	2
Debris in compressor bottom (g)	0.754

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

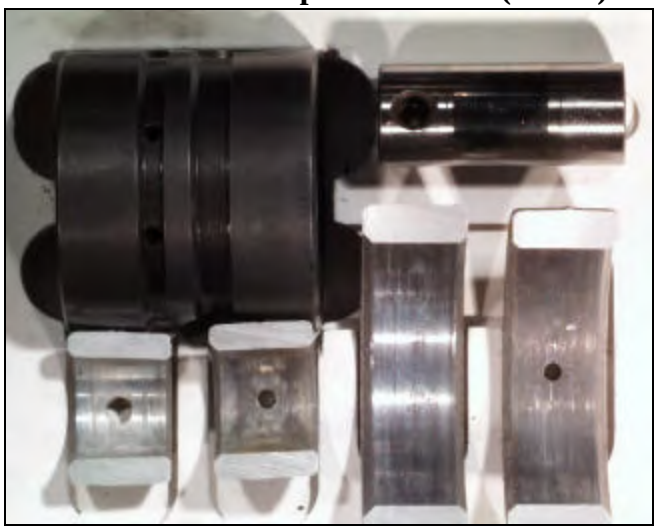
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	slight	black	gummy

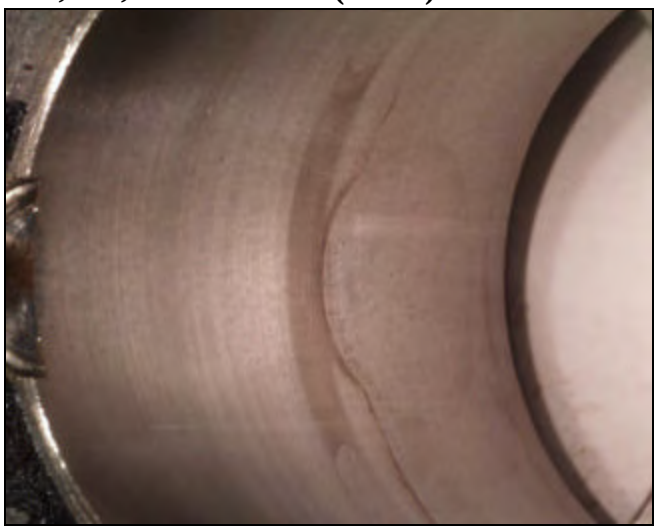
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

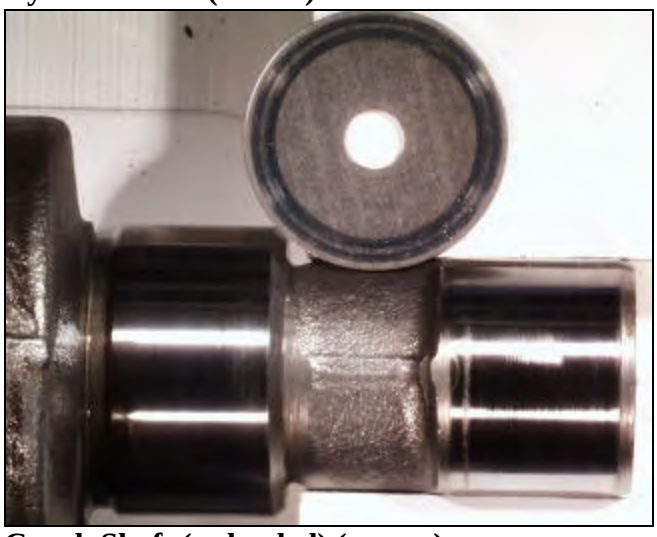


Piston Assembly (macro)



Cylinder Bore (macro)

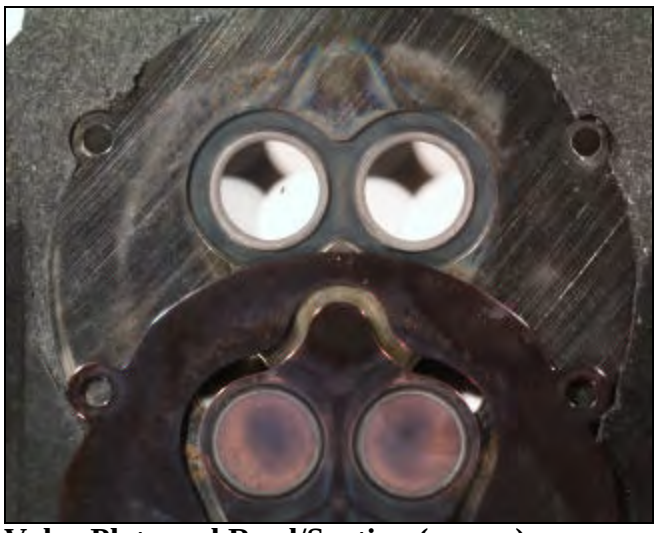
Crank Shaft (loaded) (macro)



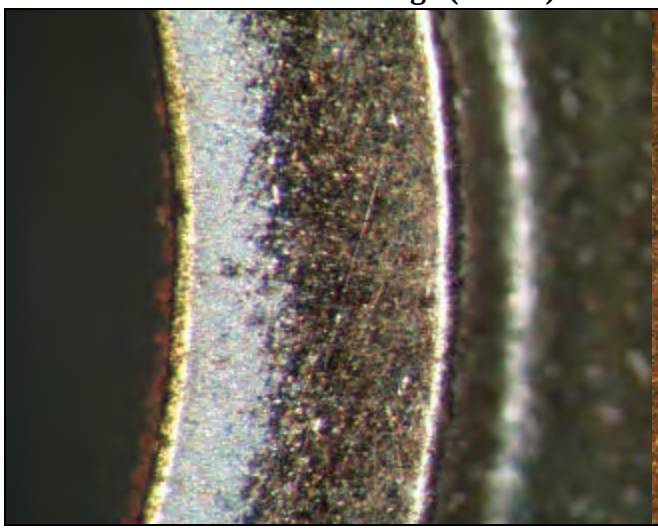
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
280 psig/78 psig

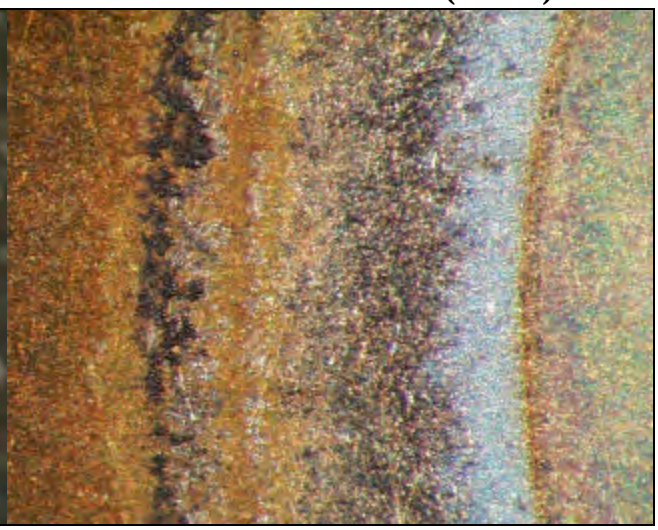
Valve Plate and Reed/Discharge (macro)



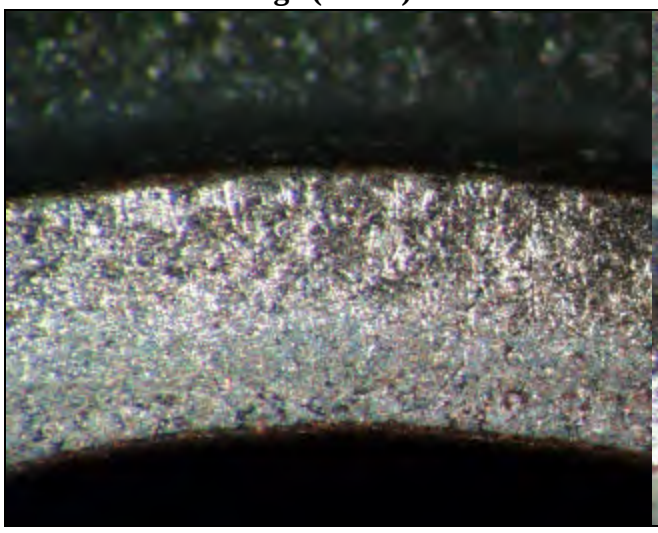
Valve Plate and Reed/Suction (macro)



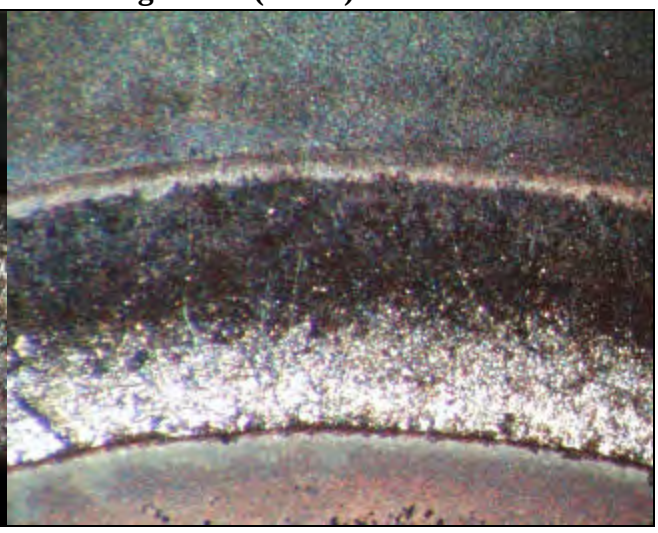
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 97
Model # RS43C1E-CAV-250 **Serial #** 96F16517
Run Time (hr.) 12005 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 5 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 12 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	Yes
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 16 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 4 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	1.2475
	Unloaded	1.2475
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	Cu plating/corrosion	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	corrosion	
Wear	slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	varnish	
Piston skirt		
Appearance	low wear/Cu plating	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear/Cu plating	
Varnish ring	medium	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 97
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5000
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	32
Fluoride ion (ppm)	1.0
Chloride ion (ppm)	9.7
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	5
Lead (ppm)	2
Silicon (ppm)	6
Tin (ppm)	2
Zinc (ppm)	16

Trash in liquid screen (g)	0.002
Number of screens	2
Debris in compressor bottom (g)	0.499

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

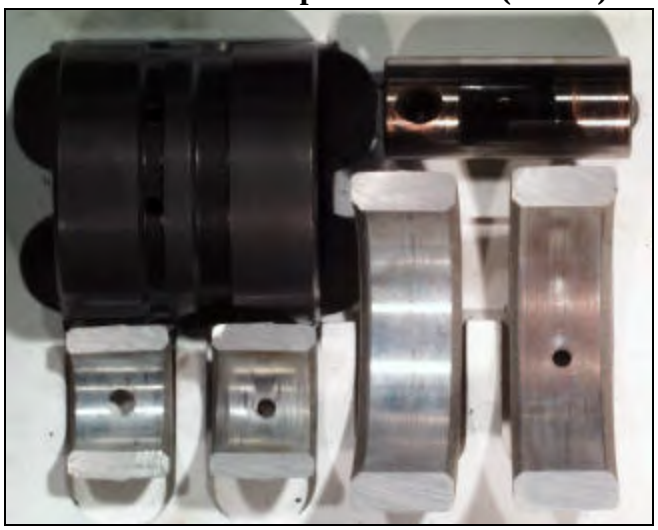
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	slight	black	gummy

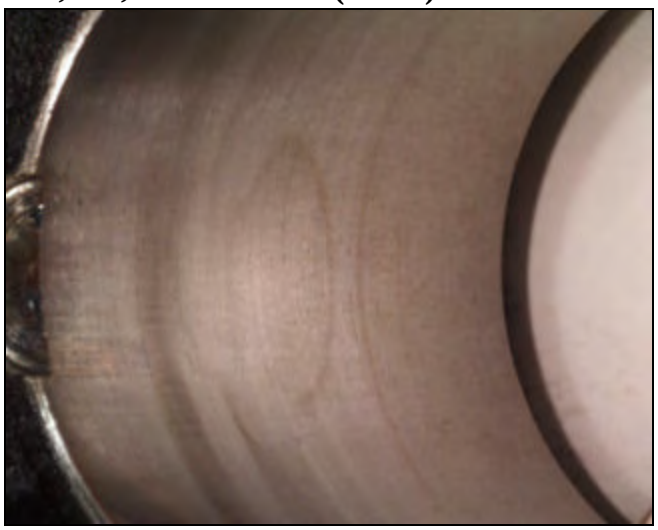
Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

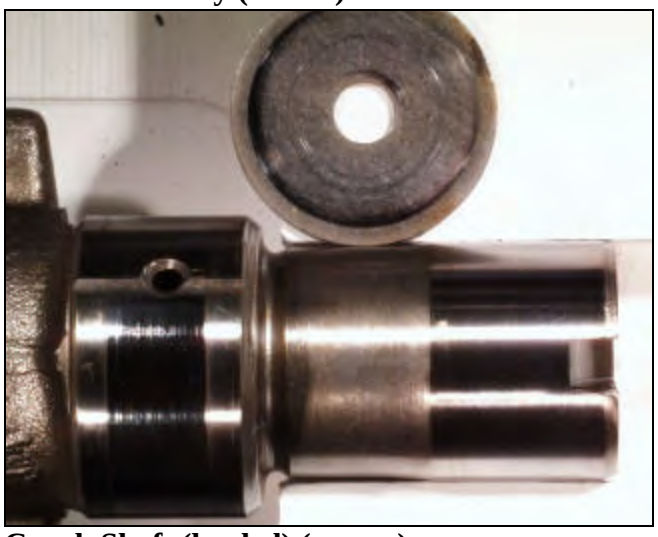
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



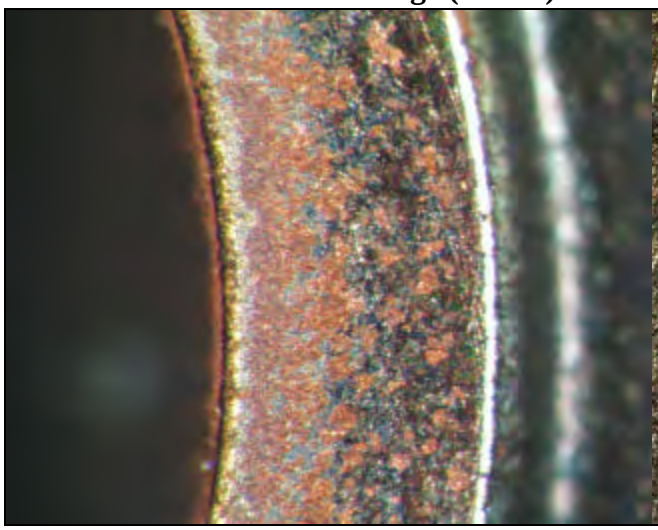
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

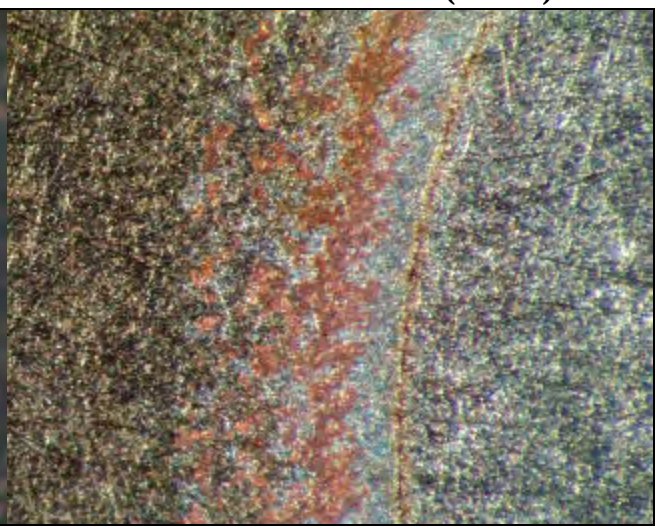
Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

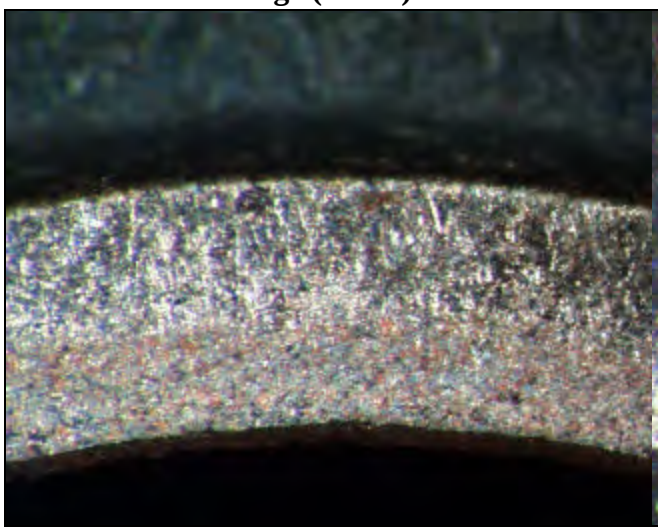
Valve Plate and Reed/Suction (macro)



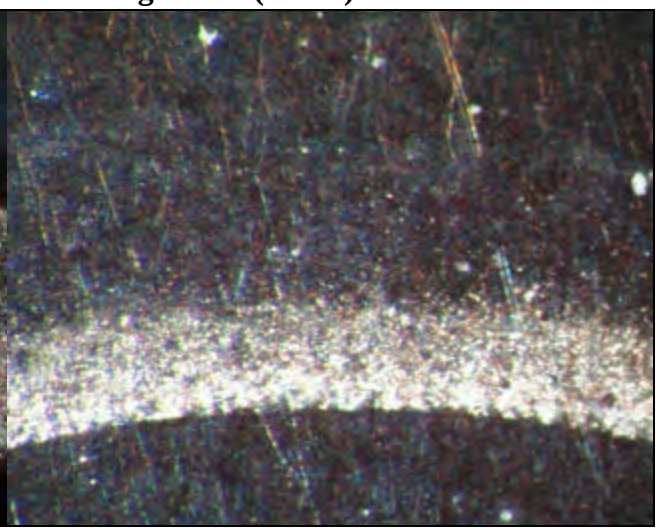
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 98
Model # RS43C1E-CAV-250 **Serial #** 96F16525
Run Time (hr.) 12004 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black/gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 5
Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 10 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17 **(2)** 16 **(3)** 16 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean/Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995
Bottom thrust washer (crank side)		
Appearance	Cu plating/corrosion	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, medium	
Lower bronze bearings		
Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	varnish	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 98
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5000
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.23
Water (ppm)	21
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	5
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	24

Trash in liquid screen (g)	0.076
Number of screens	1
Debris in compressor bottom (g)	0.477

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

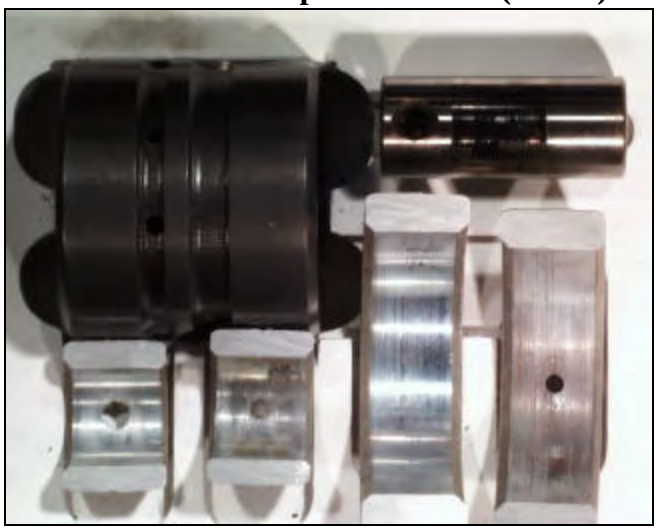
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	slight	gray	hard
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	slight	black	gummy

Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

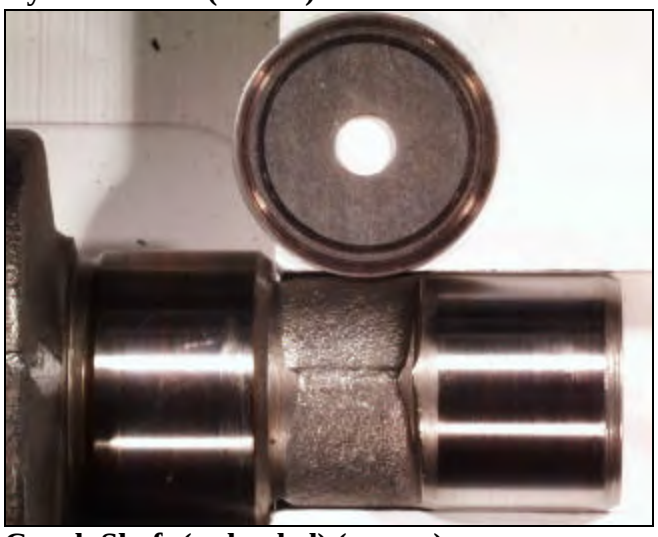
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

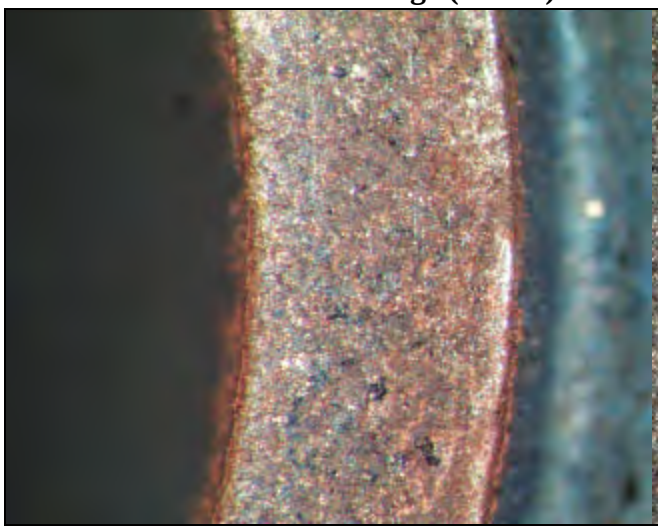


Crank Shaft (unloaded) (macro)

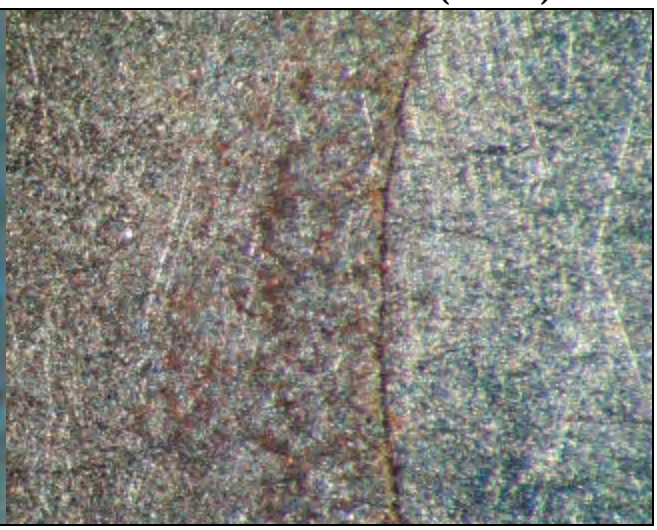
Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

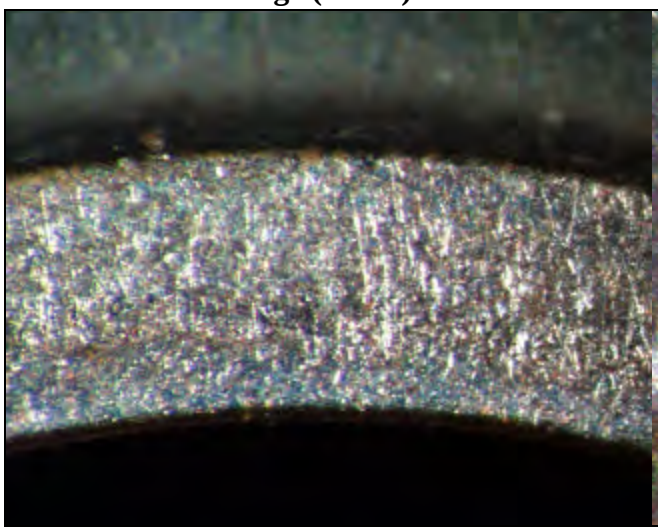
Valve Plate and Reed/Suction (macro)



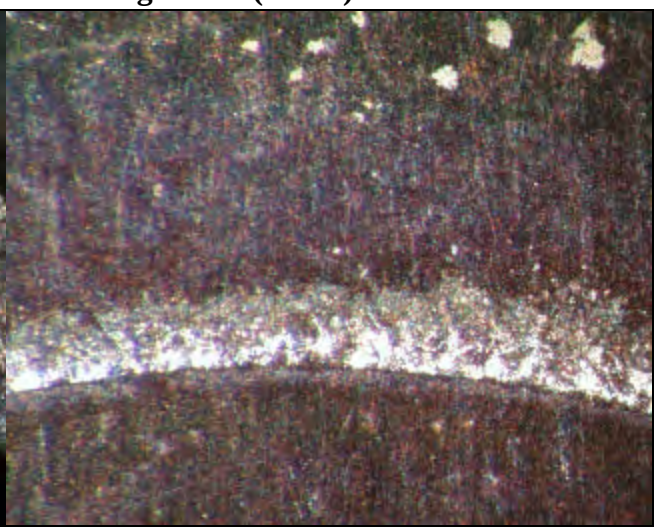
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 99
Model # RS43C1E-CAV-250 **Serial #** 96F16474
Run Time (hr.) 12007 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 16 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	varnish	
Piston skirt		
Appearance	low wear/Cu plating	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	none	
Wear	polish, medium	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 99
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/Cu	
Wear	polish, slight	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	49
Fluoride ion (ppm)	1.2
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.016
Number of screens	3
Debris in compressor bottom (g)	0.381

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	very slight

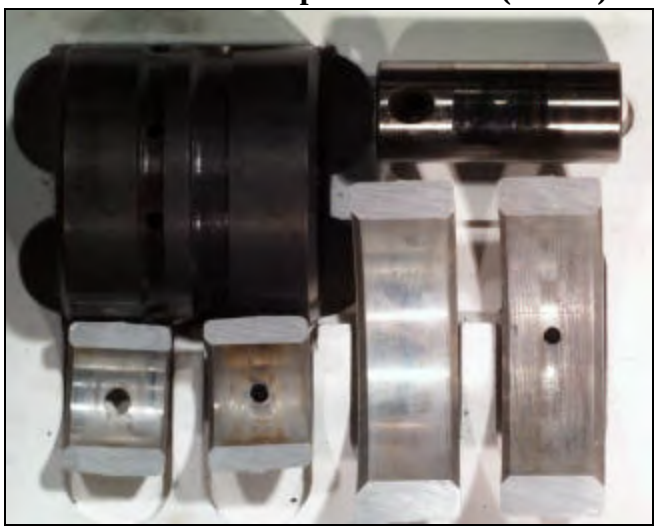
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	medium	black	hard
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

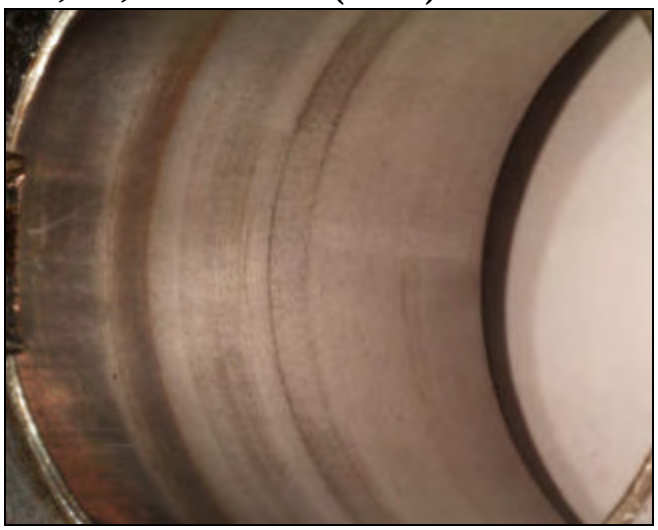
Photographic Documentation of R-22 Compressor with Contaminant Air and Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

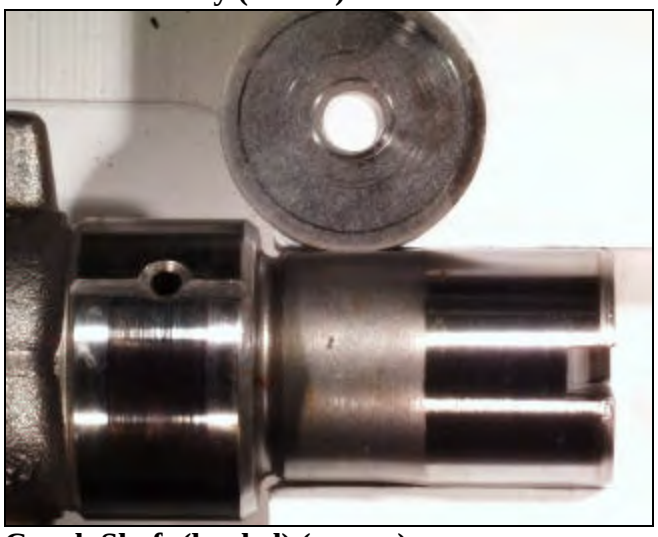
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)



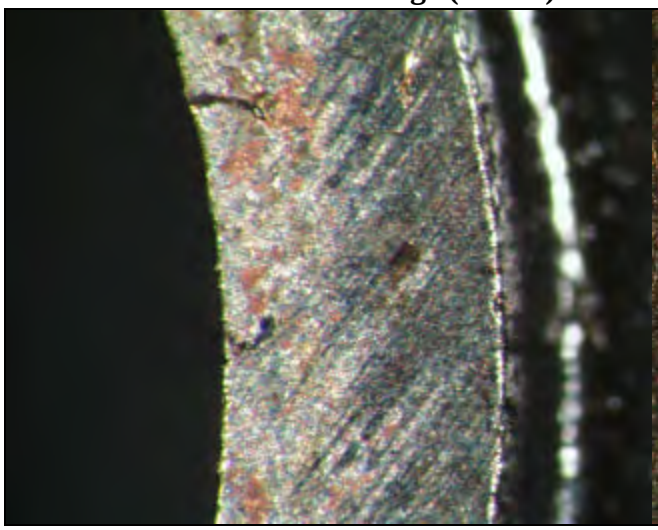
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

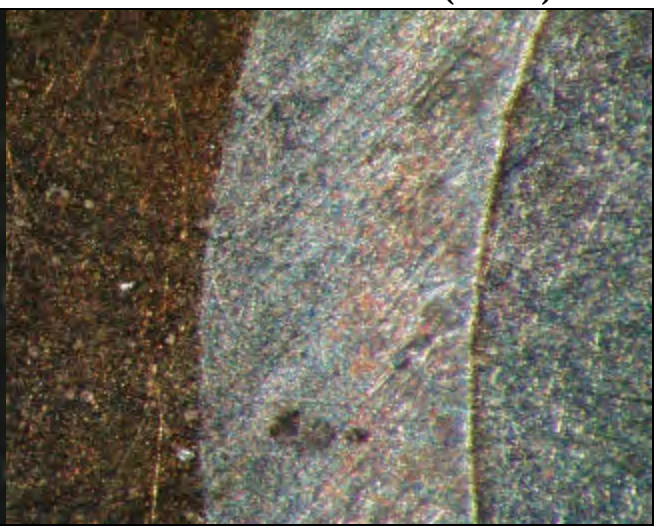
Photographic Documentation of R-22 Compressor with Contaminant Air and Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

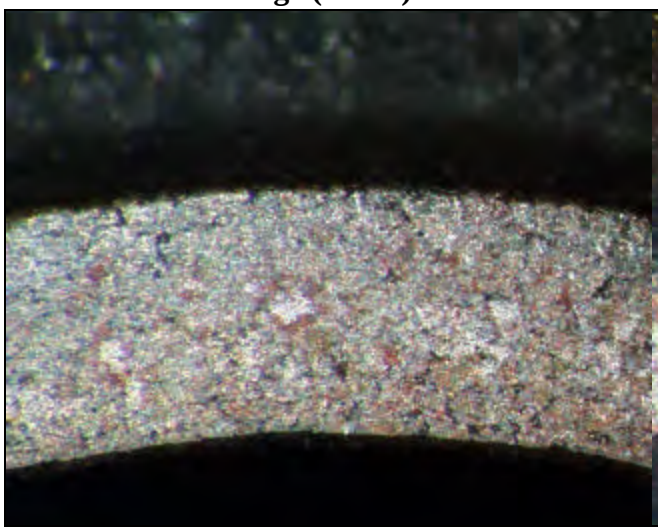
Valve Plate and Reed/Suction (macro)



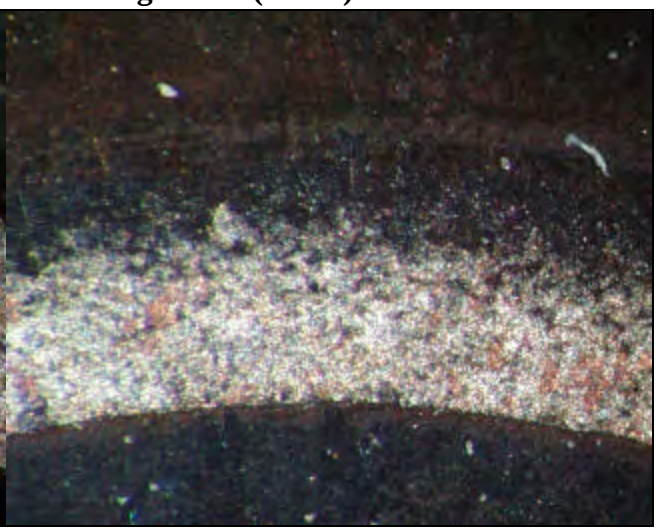
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 100
Model # RS43C1E-CAV-250 **Serial #** 96F16480
Run Time (hr.) 12003 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 6 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 10 **(2)** 9 **(3)** 9 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 16 **(3)** 16 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	0.9900
	Unloaded	0.9900
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/Cu plating	
Dimensions	**Loaded**	1.3735
	Unloaded	1.3735
Cylinder bore		
Appearance	low wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3755
Connecting rod (large end)		
Appearance	corrosion	
Wear	polish, medium	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 100
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	0.5000
	Unloaded	0.5000

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.13
Water (ppm)	20
Fluoride ion (ppm)	0.92
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	2

Trash in liquid screen (g)	0.034
Number of screens	2
Debris in compressor bottom (g)	0.814

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	very slight

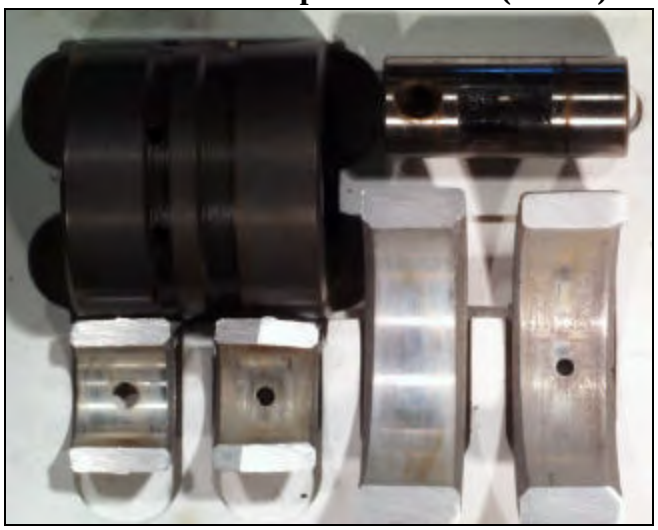
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	medium	black	gummy
Spring Seat	slight	black	gummy
Ball	heavy	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-22 Compressor with Contaminant Air and Water
280 psig/78 psig

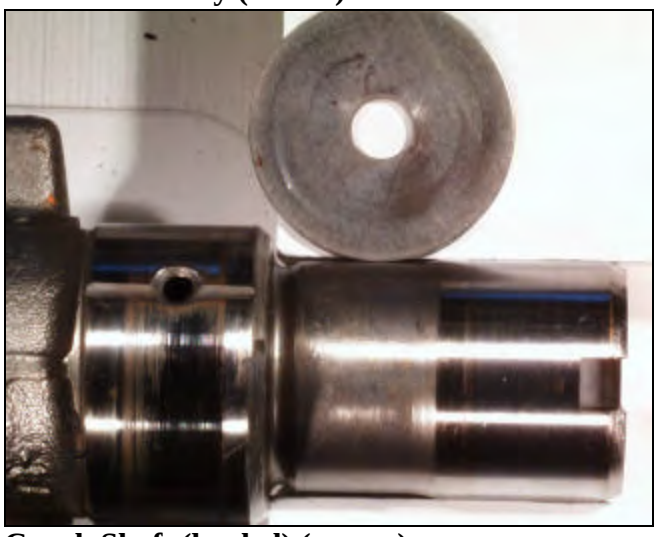
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



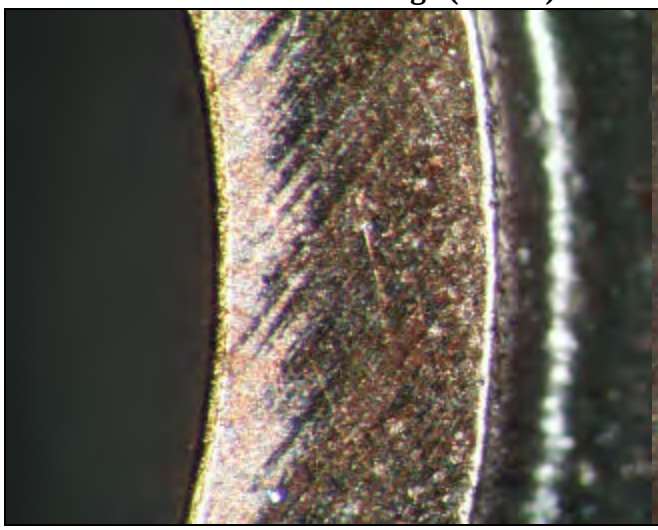
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

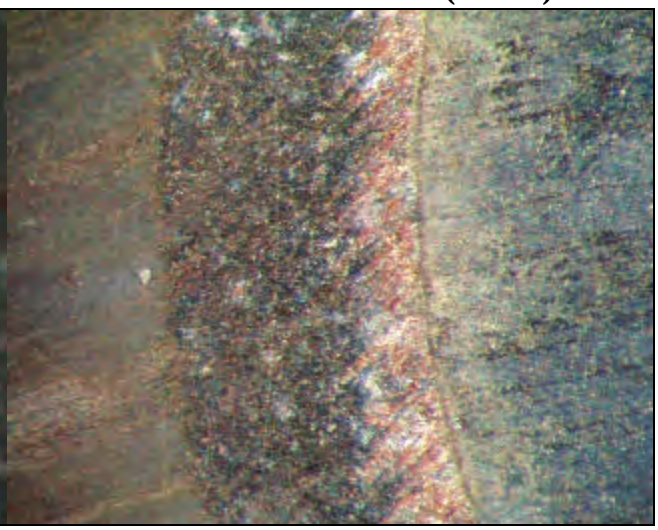
Photographic Documentation of R-22 Compressor with Contaminant Air and Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

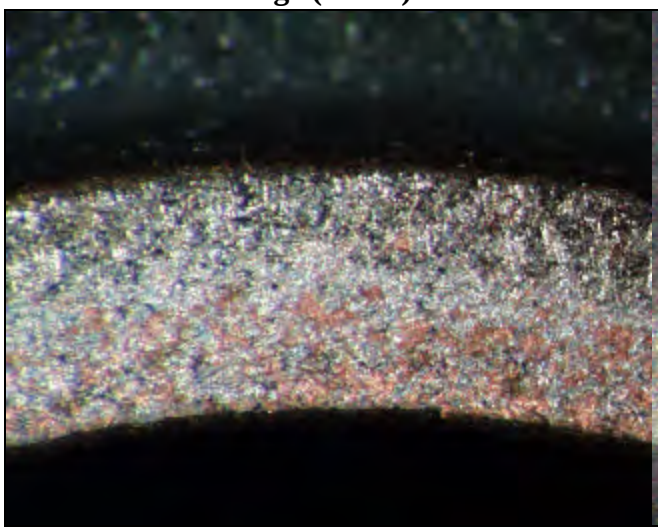
Valve Plate and Reed/Suction (macro)



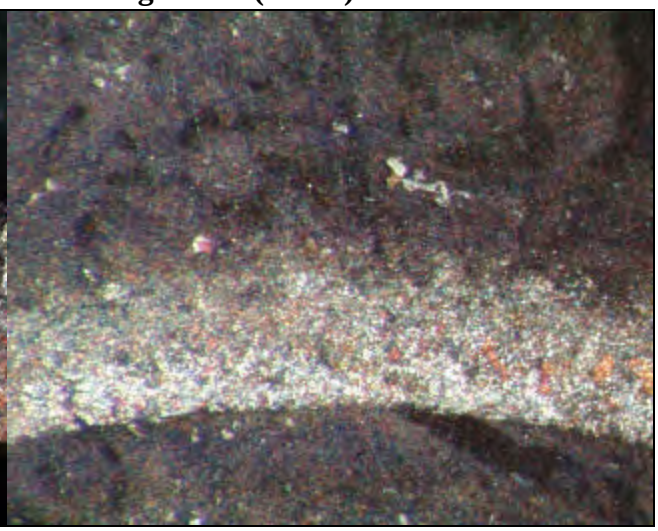
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 101
Model # RS43C1E-CAV-250 **Serial #** 96F16470
Run Time (hr.) 12068 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 5

Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	brown
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 14 **(3)** 14 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 9 **(2)** 10 **(3)** 8 **(4)** 9

Crank journals		
Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	1.2445
	Unloaded	1.2445
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9960
	Unloaded	0.9960
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	corrosion	
Wear	polish, medium	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0010
Shaft in cage bearing		
Appearance	Cu plating	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3700
	Unloaded	1.3700
Cylinder bore		
Appearance	low wear	
Varnish ring	medium	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Connecting rod (large end)		
Appearance	scored/Cu plating	
Wear	medium	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2490

TEST HISTORY OF:

Unit Number 101
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.10
Water (ppm)	26
Fluoride ion (ppm)	0.91
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	3
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	25

Trash in liquid screen (g)	0.047
Number of screens	1
Debris in compressor bottom (g)	0.738

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	none

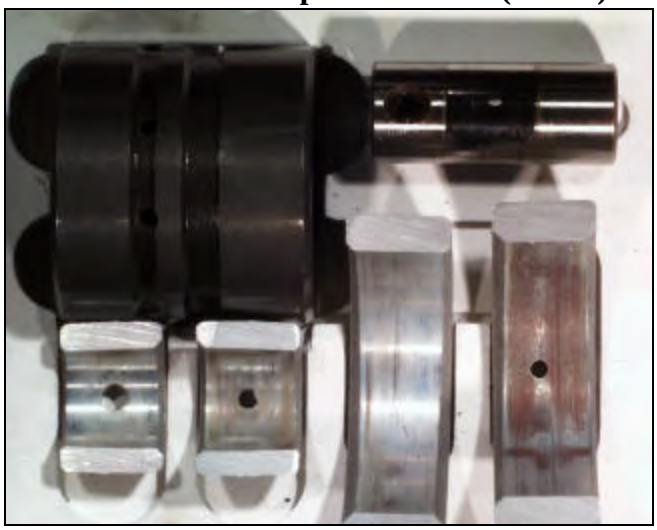
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

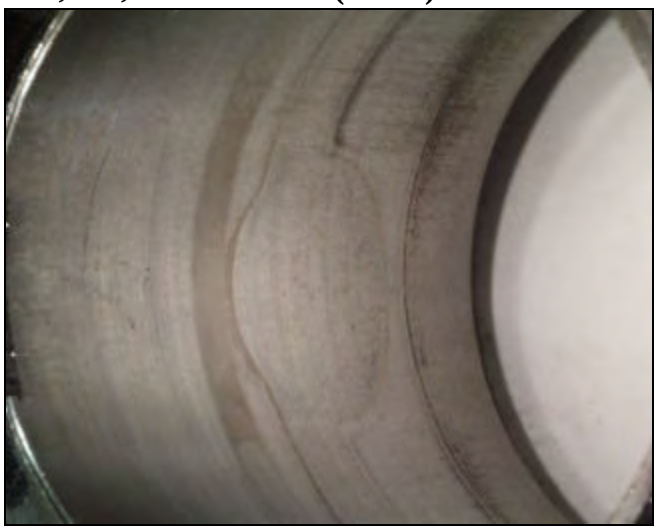
Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water 280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

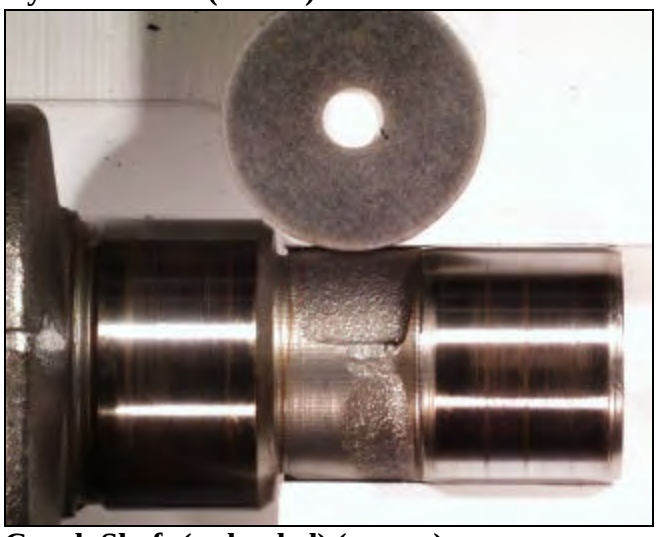


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

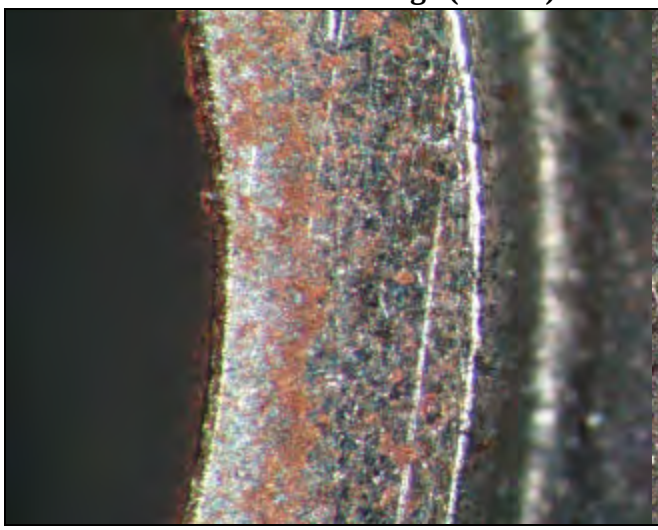


Crank Shaft (unloaded) (macro)

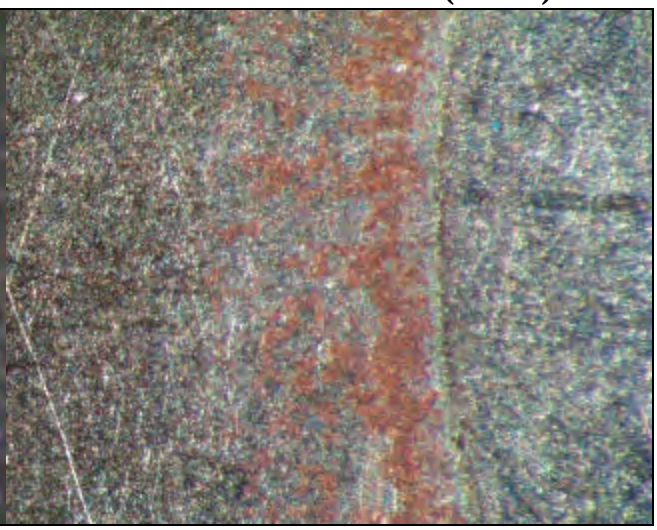
Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
280 psig/78 psig

Valve Plate and Reed/Discharge (macro)

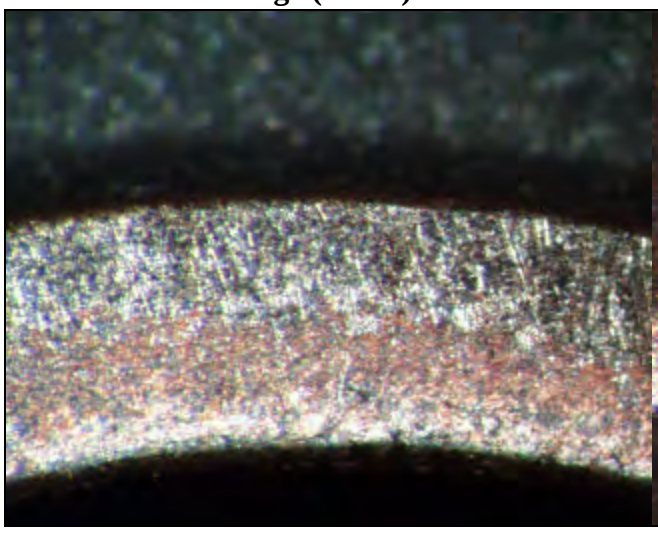
Valve Plate and Reed/Suction (macro)



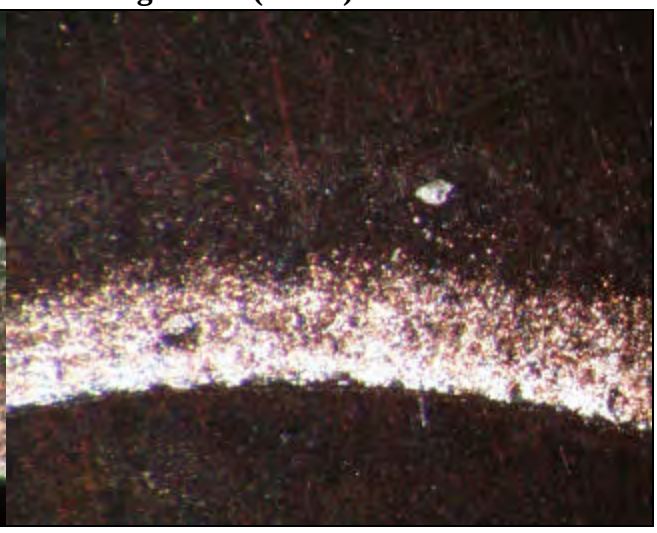
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 102
Model # RS43C1E-CAV-250 **Serial #** 96F16473
Run Time (hr.) 12007 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	280
Suction Pressure (psig)	78
Discharge Temp (°F)	143
Return Gas Temp (°F)	60
SumpTemp (°F)	98
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 4 **(4)** 5
Remaining torque of stator bolts
(1) 9 **(2)** 10 **(3)** 10 **(4)** 9

Suction muffler appearance	rust
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals
Appearance clean
Wear polish, medium
Dimensions **Loaded** 1.2465
Unloaded 1.2465

Lower crank bearing journal
Appearance clean
Wear polish, slight
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance Cu plating
Wear polish, medium

Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish, slight

Lower bronze bearings
Appearance clean/corrosion
Wear polish, slight
Dimensions **Loaded** 1.0015
Unloaded 1.0015

Shaft in cage bearing
Appearance clean
Wear polish, slight

Piston top appearance clean

Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3725
Unloaded 1.3730

Cylinder bore
Appearance low wear/scored
Varnish ring slight
Dimensions **Loaded** 1.3735
Unloaded 1.3735

Connecting rod (large end)
Appearance scored
Wear polish, medium
Dimensions **Loaded** 1.2500
Unloaded 1.2500

TEST HISTORY OF:

Unit Number 102
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.4995
	Unloaded	0.4995

Piston pin washers appearance
no wear

Piston pin

Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	26
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	3
Lead (ppm)	0
Silicon (ppm)	5
Tin (ppm)	1
Zinc (ppm)	13

Trash in liquid screen (g)	0.023
Number of screens	1
Debris in compressor bottom (g)	0.431

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
280 psig/78 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

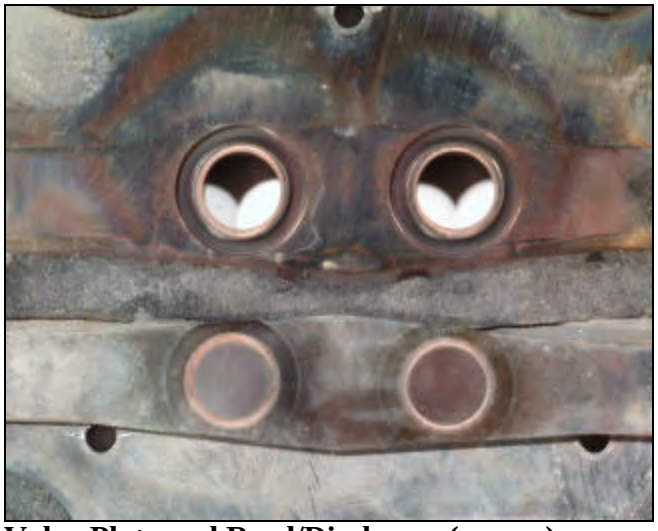
Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

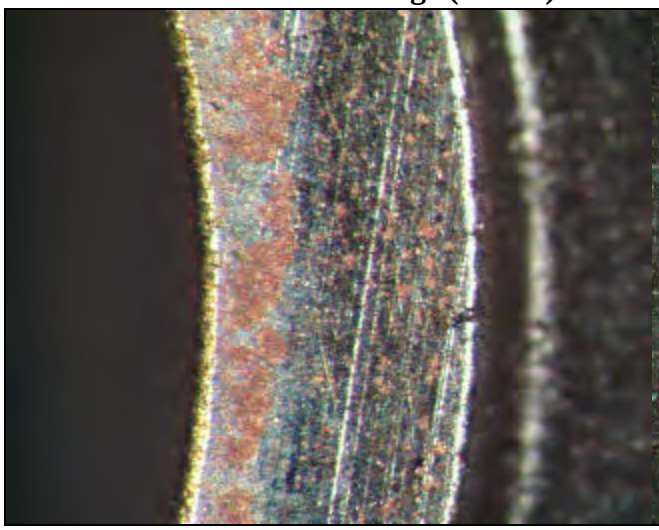
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
280 psig/78 psig

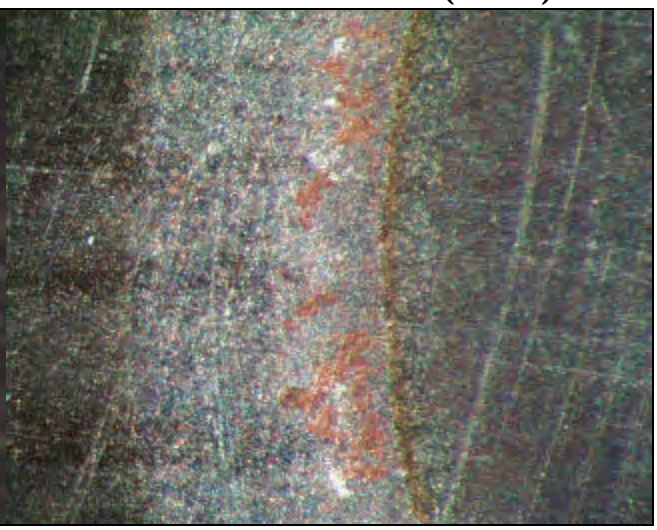


Valve Plate and Reed/Discharge (macro)

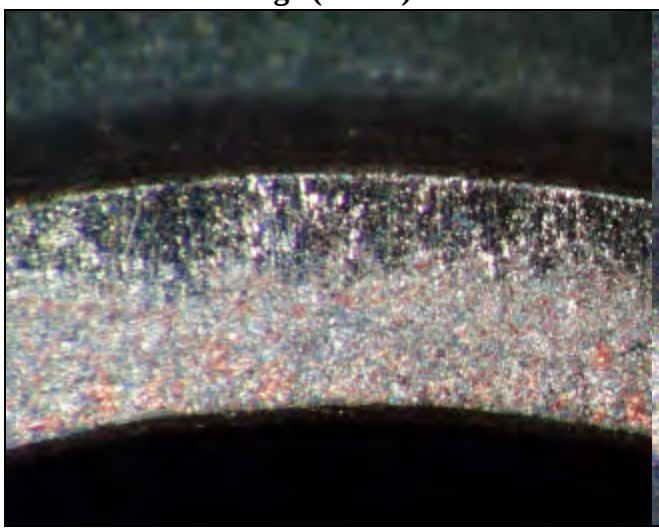
Valve Plate and Reed/Suction (macro)



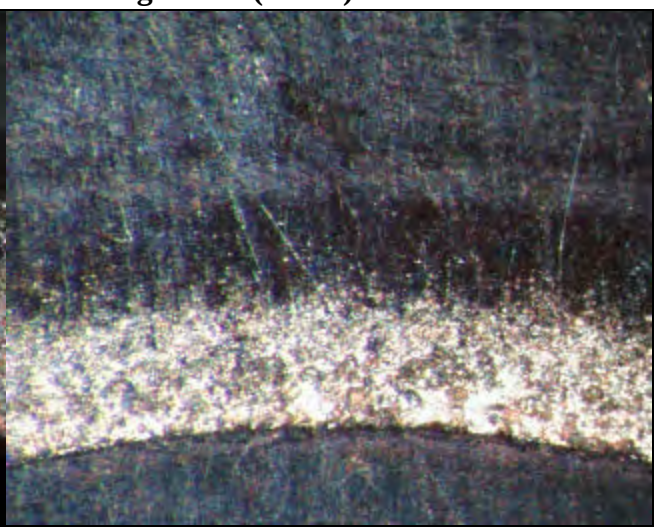
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Control Compressor

TEST HISTORY OF:

Unit Number 103
Model # RS43C1E-CAV-250 **Serial #** 96F16543
Run Time (hr.) 12021 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2.5 **(2)** 1.7 **(3)** 2 **(4)** 2

Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 3 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/bronze plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 103
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/bronze plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.04
Water (ppm)	19
Fluoride ion (ppm)	0.92
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.022
Number of screens	1
Debris in compressor bottom (g)	0.499

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

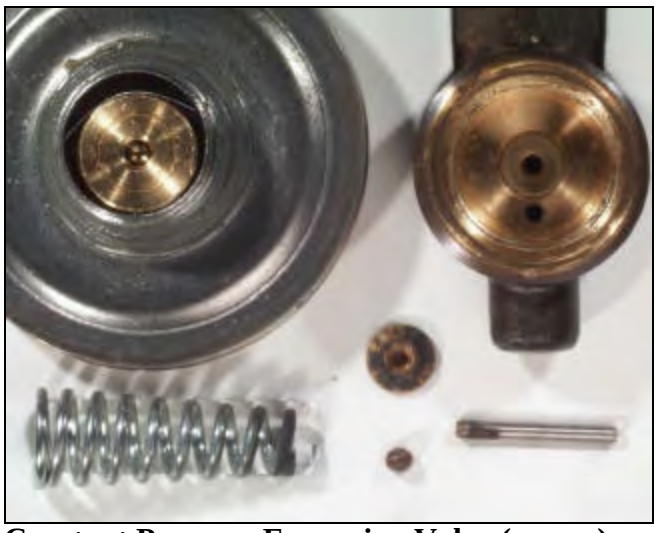
Discharge reed

Condition	good
Appearance	Cu plating
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

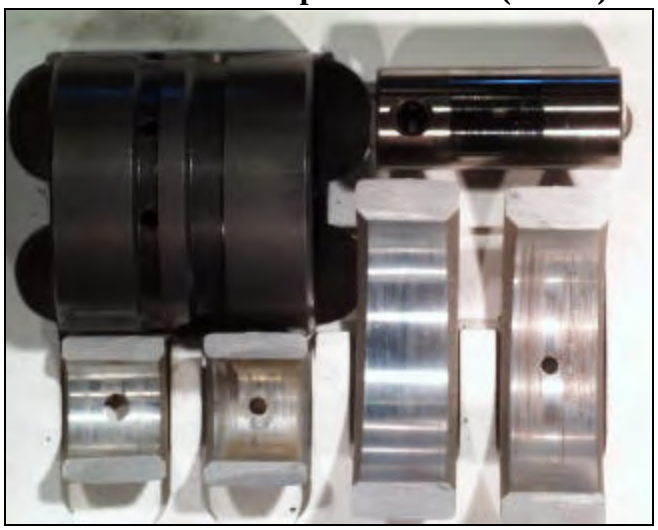
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	very slight	gray	hard
Tip of Pin	medium	black	hard
Spring	medium	black, gray	hard
Spring Seat	heavy	black	hard
Ball	heavy	black	gummy
Front Side	slight	black	hard

Photographic Documentation of R-22 Control Compressor
175 psig/32 psig



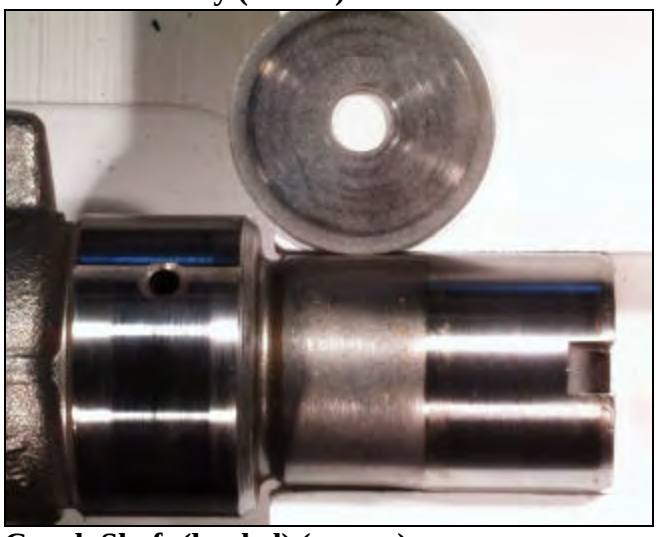
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

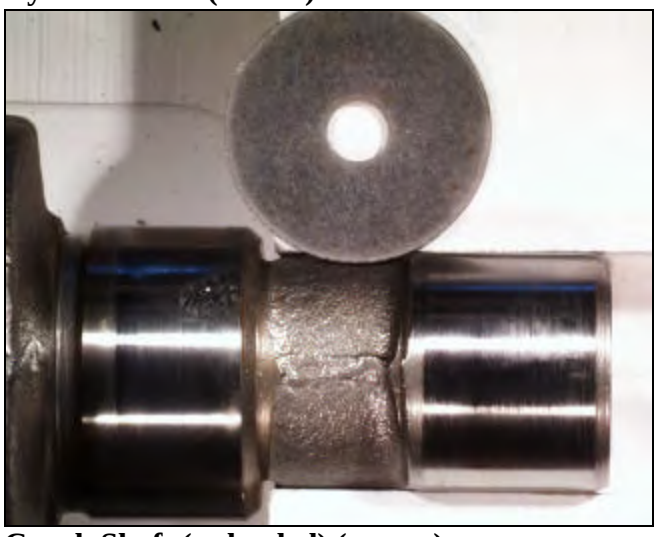


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

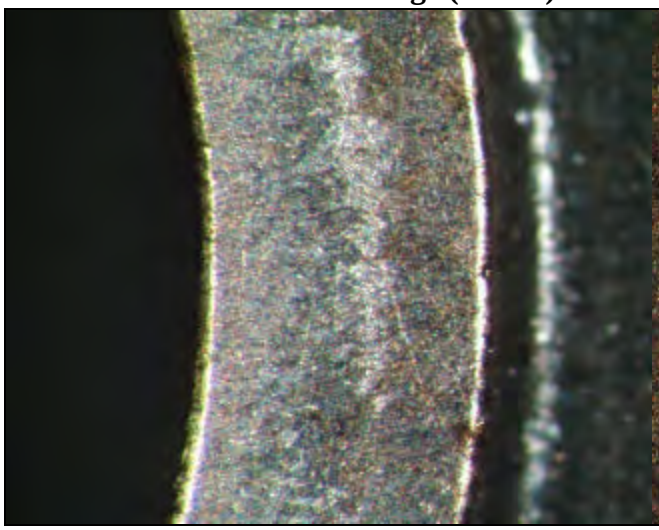


Crank Shaft (unloaded) (macro)

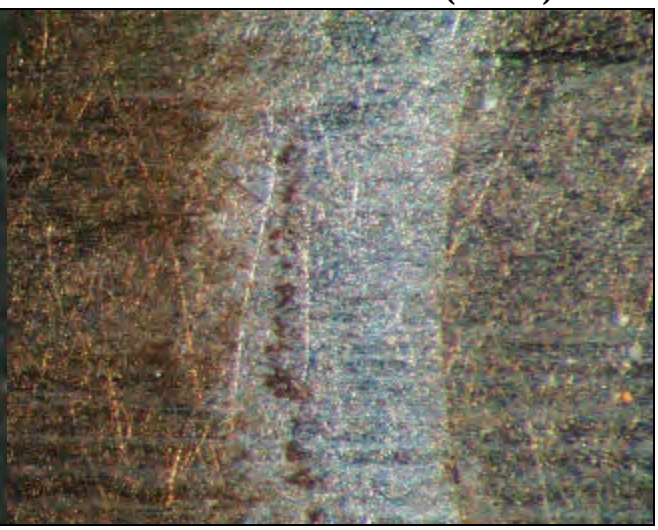
Photographic Documentation of R-22 Control Compressor
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

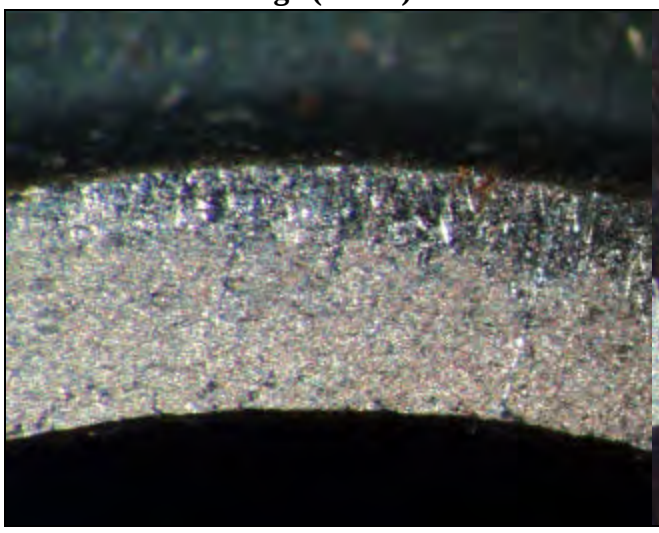
Valve Plate and Reed/Suction (macro)



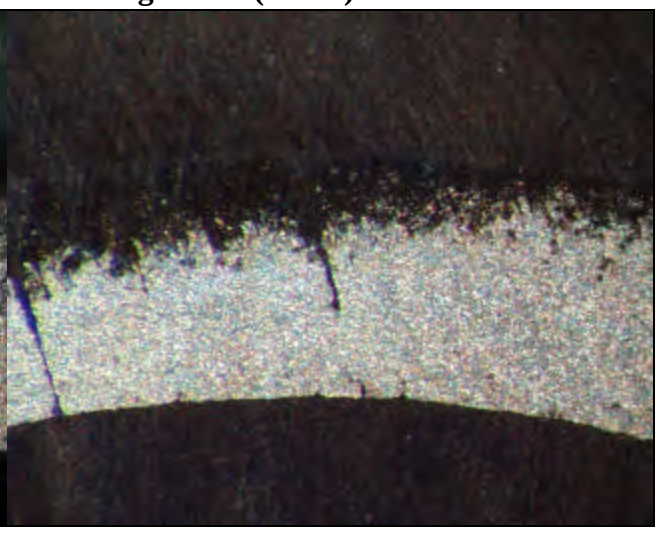
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Control Compressor

TEST HISTORY OF:

Unit Number 104
Model # RS43C1E-CAV-250 **Serial #** 96F16475
Run Time (hr.) 12026 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 2.9 **(2)** 2.5 **(3)** 1.7 **(4)** 2.1

Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 14 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 4 **(4)** 5

Crank journals
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 0.9985
Unloaded 0.9985

Bottom thrust washer (crank side)
Appearance clean/Cu plating
Wear polish

Bottom washer (casting side)
Appearance clean
Wear polish

Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance low wear/Cu plating
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored
Wear polish
Dimensions **Loaded** 1.2505
Unloaded 1.2505

TEST HISTORY OF:

Unit Number 104
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.04
Water (ppm)	15
Fluoride ion (ppm)	0.78
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.028
Number of screens	1
Debris in compressor bottom (g)	0.584

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

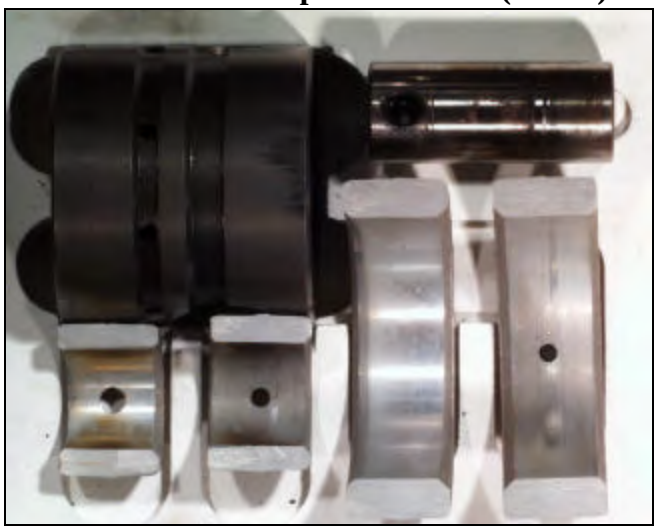
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	very slight	brown	hard
Equalizer Hole	very slight	gray	hard
Tip of Pin	medium	black	hard
Spring	medium	black, gray	hard
Spring Seat	heavy	black	hard
Ball	heavy	black	hard
Front Side	heavy	black	hard

Photographic Documentation of R-22 Control Compressor
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

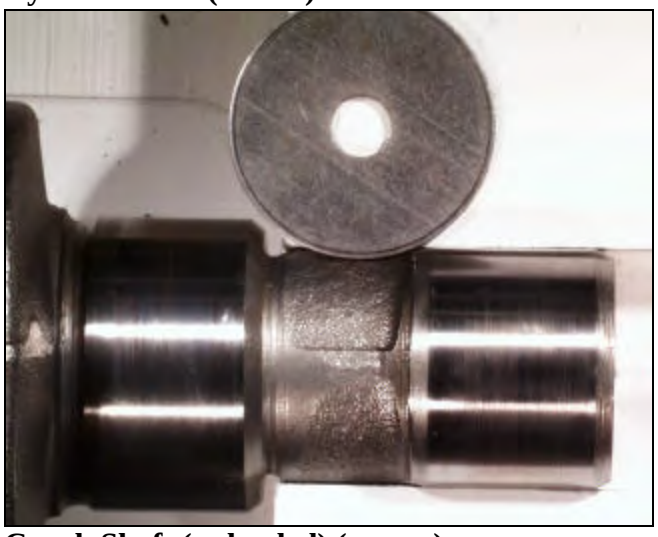
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

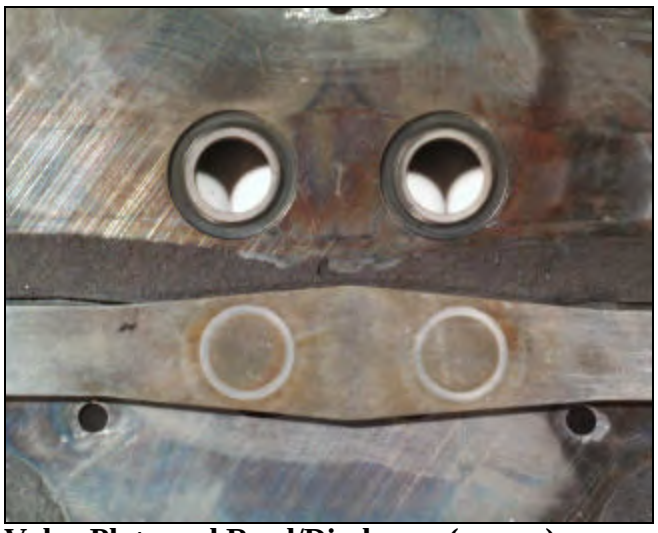
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



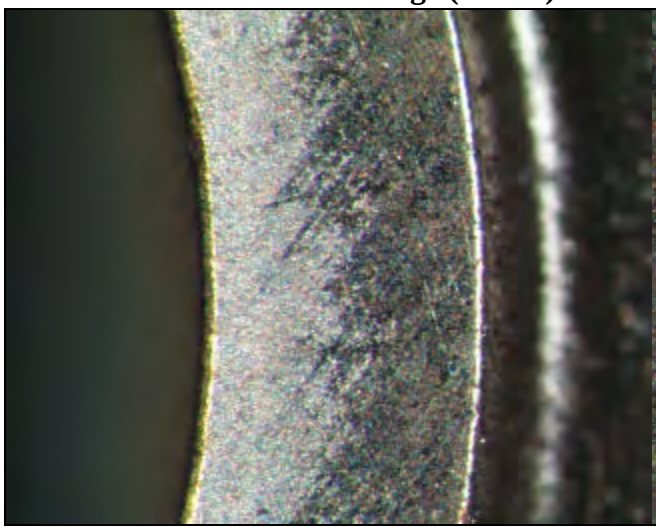
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Control Compressor
175 psig/32 psig



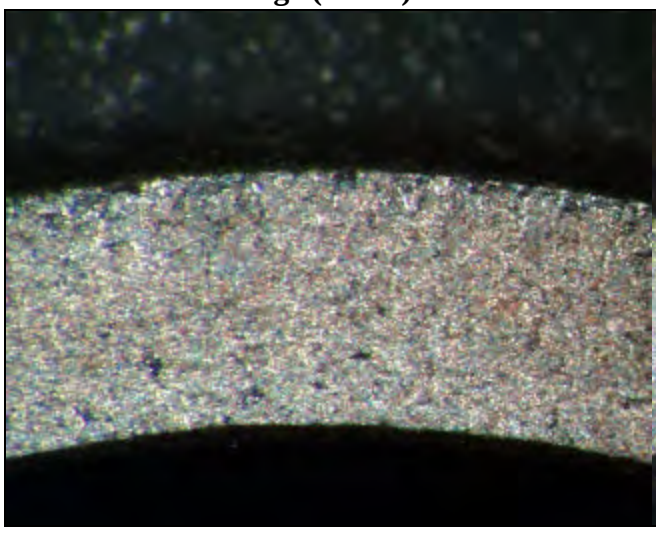
Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)



Valve Plate/Discharge (micro)

Discharge Reed (micro)



Valve Plate/Suction (micro)

Suction Reed (micro)

Report for R-22 Control Compressor

TEST HISTORY OF:

Unit Number 105
Model # RS43C1E-CAV-250 **Serial #** 96F16450
Run Time (hr.) 12017 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	black/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 2.1 **(2)** 2.1 **(3)** 2.1 **(4)** 2.1
Remaining torque of stator bolts
(1) 11.7 **(2)** 11.7 **(3)** 11.7 **(4)** 11.7

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean/Cu plate
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 105
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.15
Water (ppm)	14
Fluoride ion (ppm)	0.85
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.059
Number of screens	1
Debris in compressor bottom (g)	0.304

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

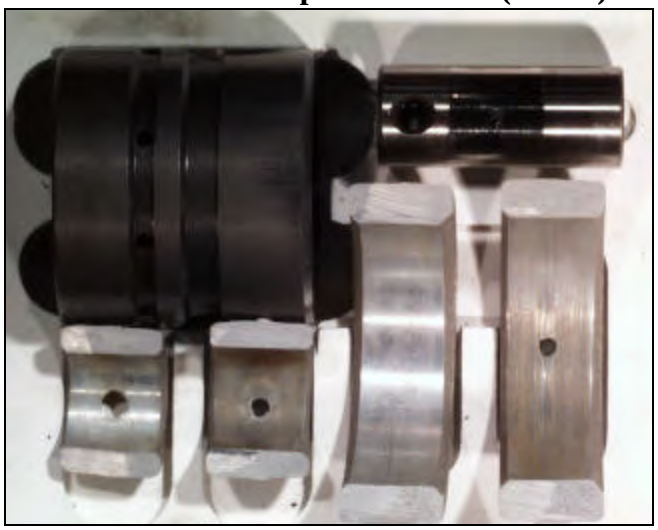
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	very slight	black	gummy
Tip of Pin	medium	black	gummy
Spring	medium	gray	hard
Spring Seat	medium	black	hard
Ball	medium	black	gummy
Front Side	very slight	gray	hard

Photographic Documentation of R-22 Control Compressor
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

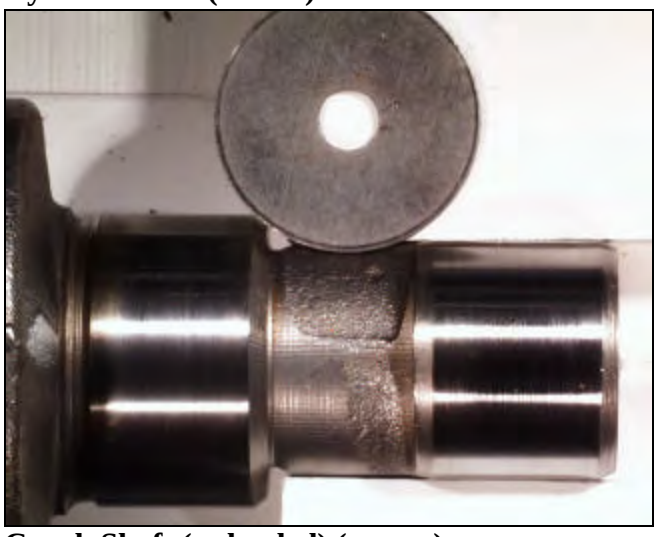
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

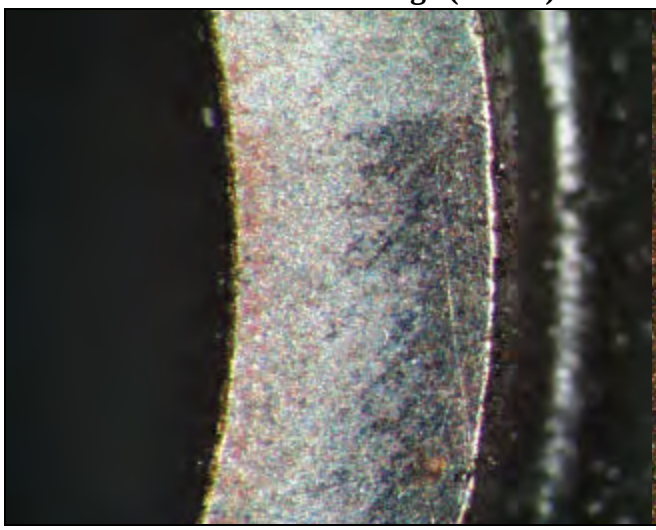


Crank Shaft (unloaded) (macro)

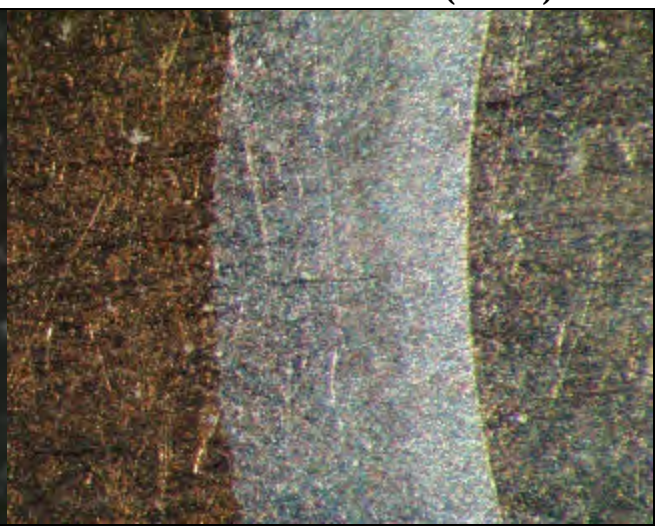
Photographic Documentation of R-22 Control Compressor
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

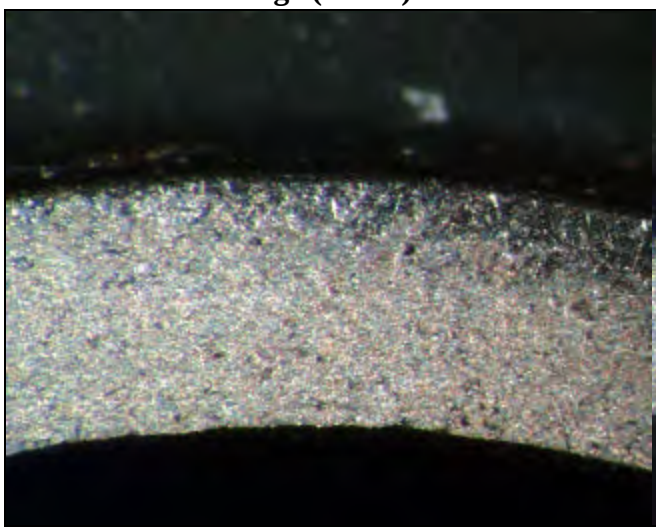
Valve Plate and Reed/Suction (macro)



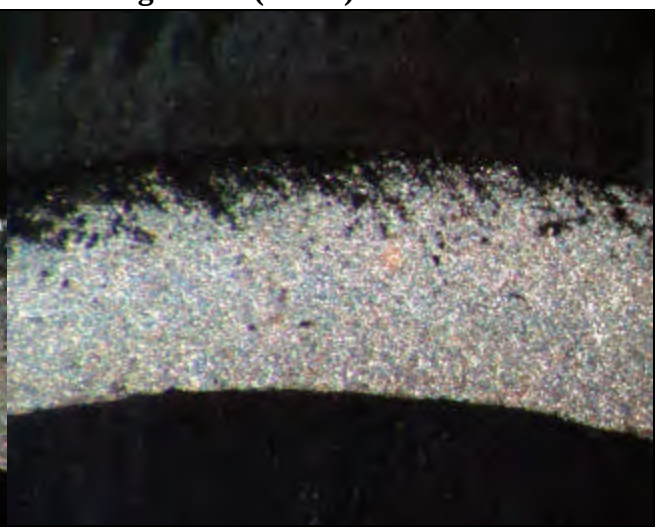
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 106
Model # RS43C1E-CAV-250 **Serial #** 96F16544
Run Time (hr.) 12015 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 4 **(4)** 3

Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 9 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17 **(2)** 16 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals		
Appearance	clean/Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0015
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3750
	Unloaded	1.3750
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 106
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.4995
	Unloaded	0.4995

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	14
Fluoride ion (ppm)	0.87
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.004
Number of screens	1
Debris in compressor bottom (g)	0.293

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

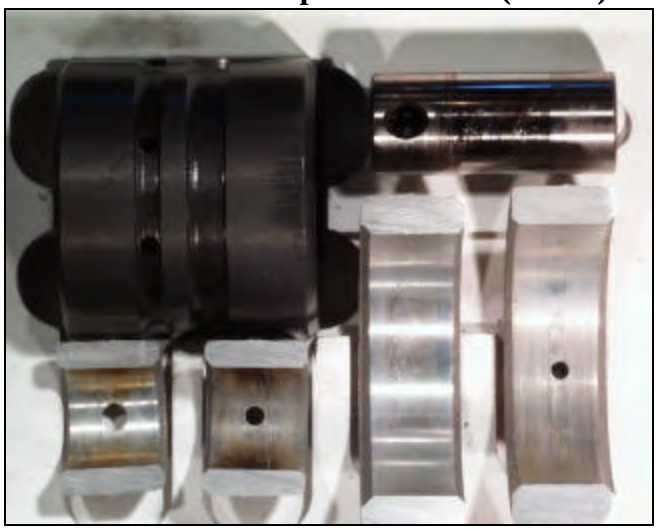
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	medium	black	gummy
Spring Seat	slight	gray	hard
Ball	medium	black	gummy
Front Side	heavy	black	gummy

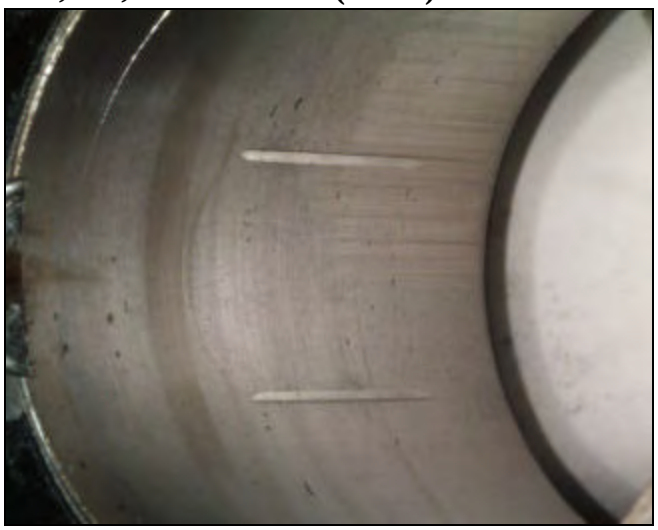
Photographic Documentation of R-22 Compressor with Contaminant Water
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

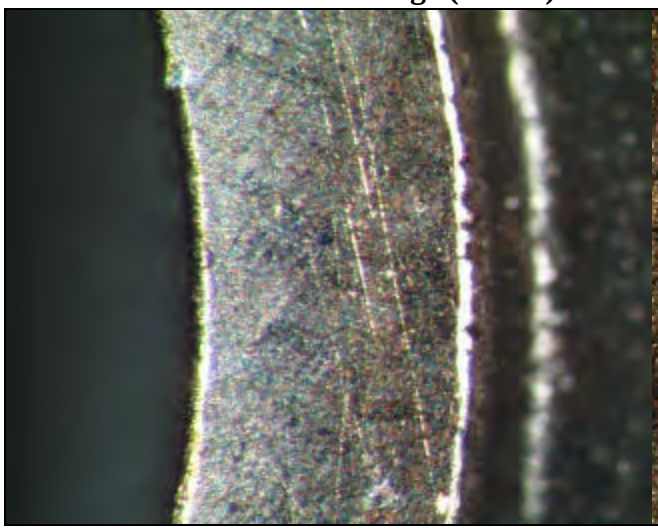
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

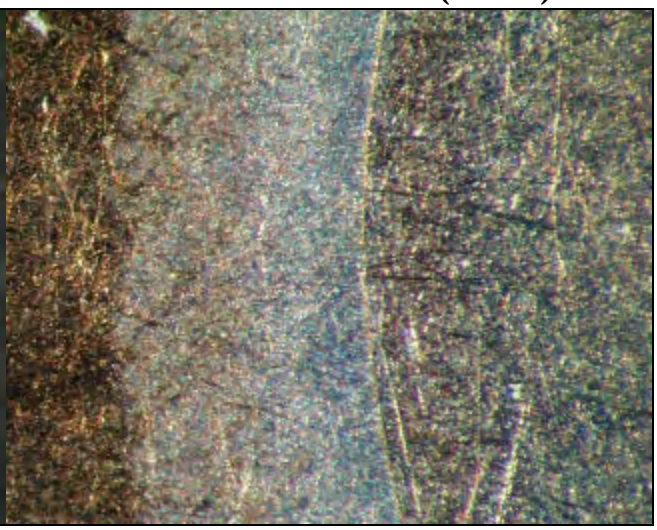
Photographic Documentation of R-22 Compressor with Contaminant Water
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

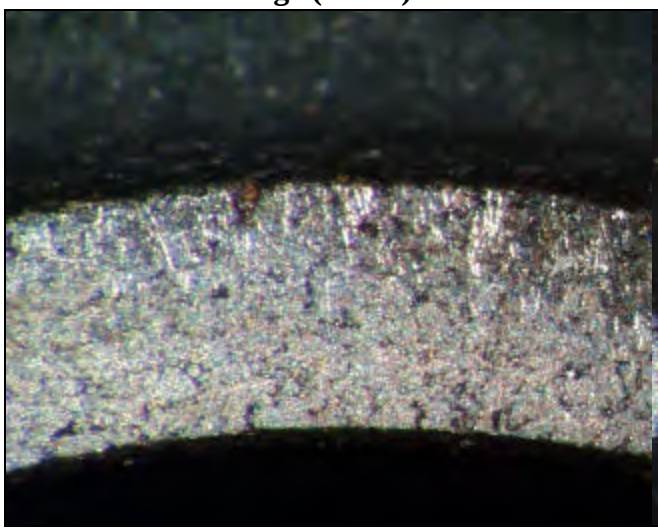
Valve Plate and Reed/Suction (macro)



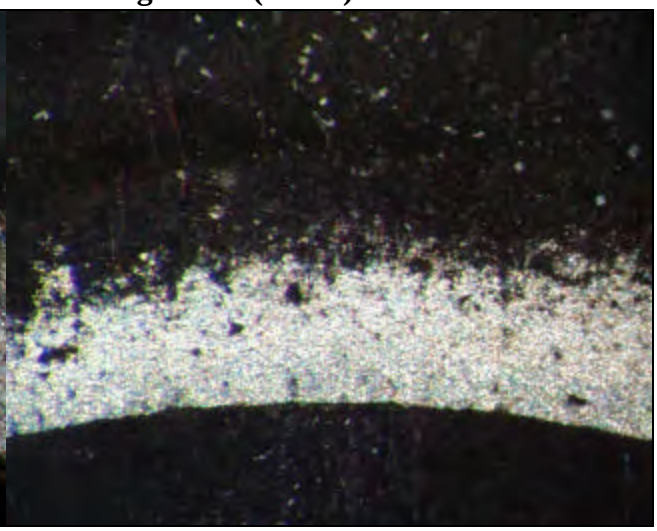
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 107
Model # RS43C1E-CAV-250 **Serial #** 96F16451
Run Time (hr.) 12003 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2 **(2)** 3 **(3)** 2 **(4)** 2

Remaining torque of stator bolts
(1) 9 **(2)** 8 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean/Cu plate
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 16 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 4 **(4)** 5

Crank journals

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460

Lower crank bearing journal

Appearance	Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985

Bottom thrust washer (crank side)

Appearance	Cu plating	
Wear	polish, medium	

Bottom washer (casting side)

Appearance	corrosion	
Wear	polish, slight	

Lower bronze bearings

Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030

Shaft in cage bearing

Appearance	clean
Wear	polish, slight

Piston top appearance clean

Piston skirt

Appearance	low wear/scored	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720

Cylinder bore

Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3755

Connecting rod (large end)

Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.2490
	Unloaded	1.2490

TEST HISTORY OF:

Unit Number 107
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish, medium	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	36
Fluoride ion (ppm)	0.85
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.031
Number of screens	1
Debris in compressor bottom (g)	0.354

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

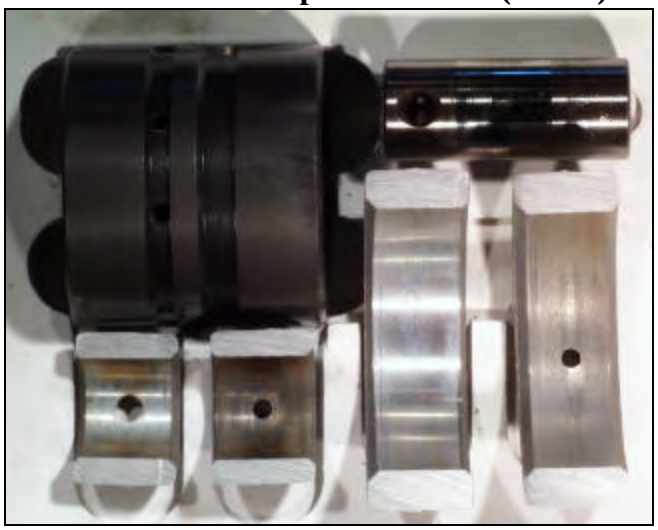
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	water	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	medium	black	gummy
Spring Seat	slight	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	hard

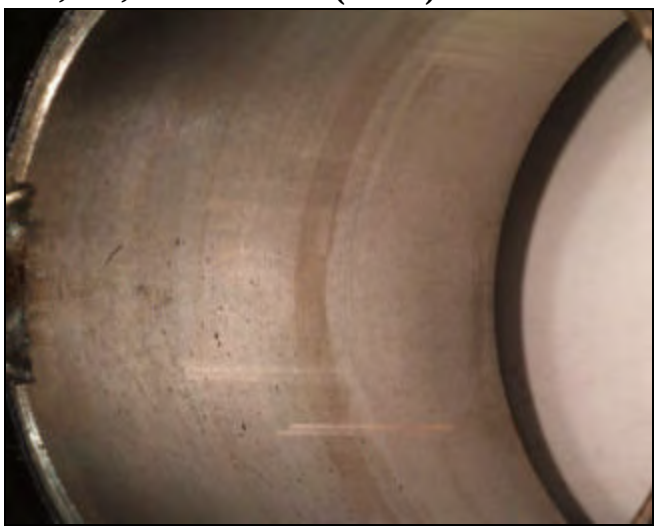
Photographic Documentation of R-22 Compressor with Contaminant Water
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

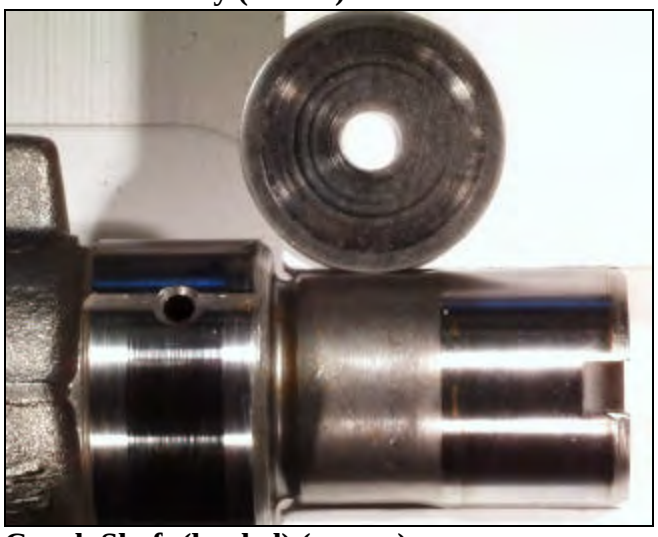
Ball, Pin, Seat of CPEV (micro)



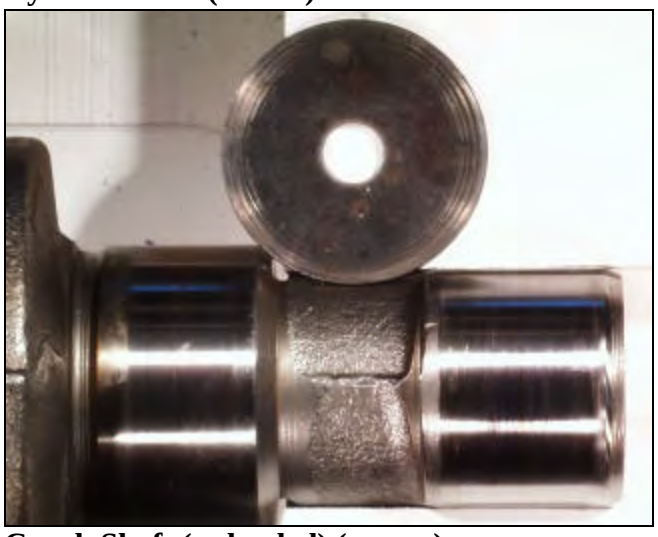
Piston Assembly (macro)



Cylinder Bore (macro)

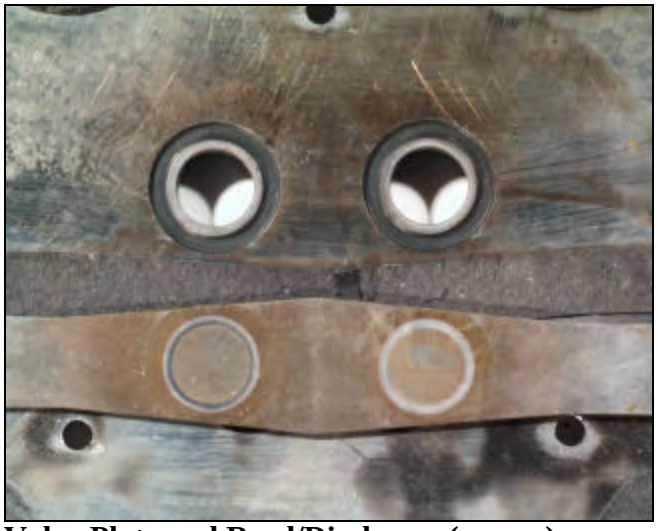


Crank Shaft (loaded) (macro)



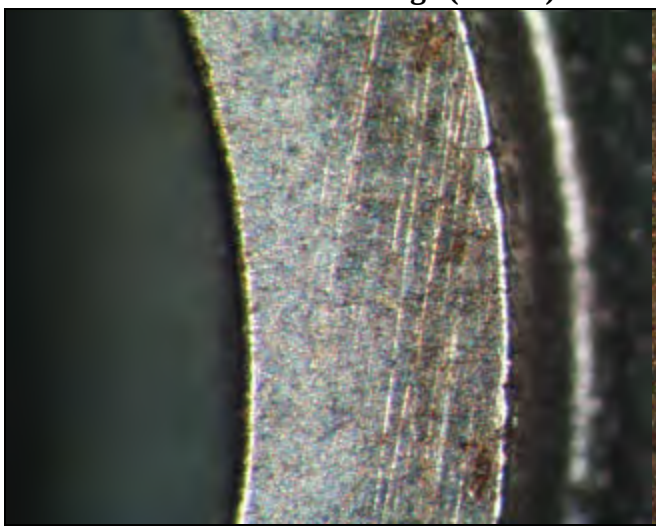
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Water
175 psig/32 psig

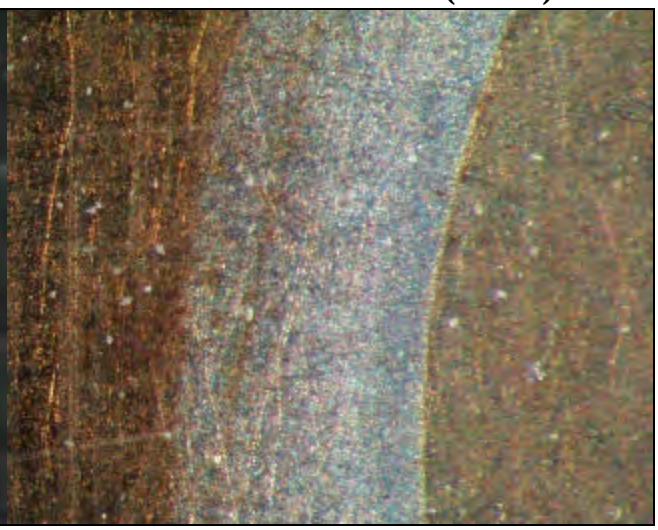


Valve Plate and Reed/Discharge (macro)

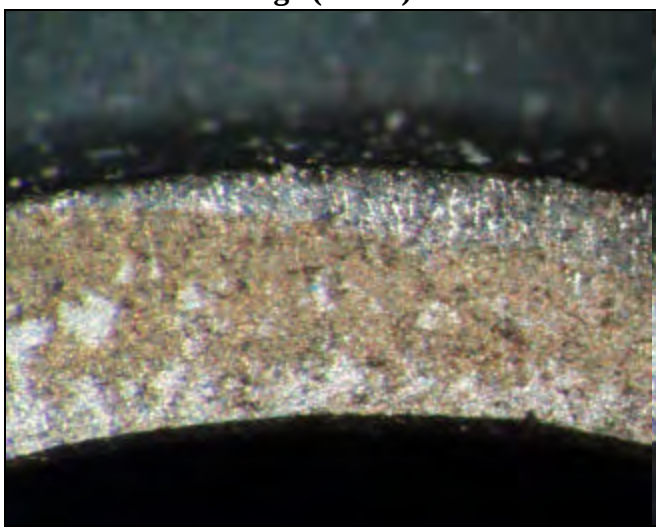
Valve Plate and Reed/Suction (macro)



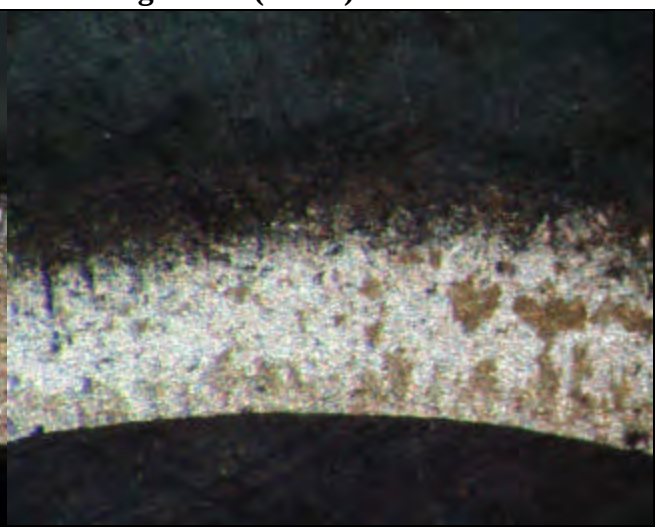
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 108
Model # RS43C1E-CAV-250 **Serial #** 96F16458
Run Time (hr.) 12021 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	gray
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2 **(2)** 3 **(3)** 2 **(4)** 2

Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 14 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 4 **(4)** 5

Crank journals		
Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.9975
	Unloaded	0.9975
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0005
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear/scored	
Dimensions	**Loaded**	1.3725
	Unloaded	1.3725
Cylinder bore		
Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3745
	Unloaded	1.3745
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	medium	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 108
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish, medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	21
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.599

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

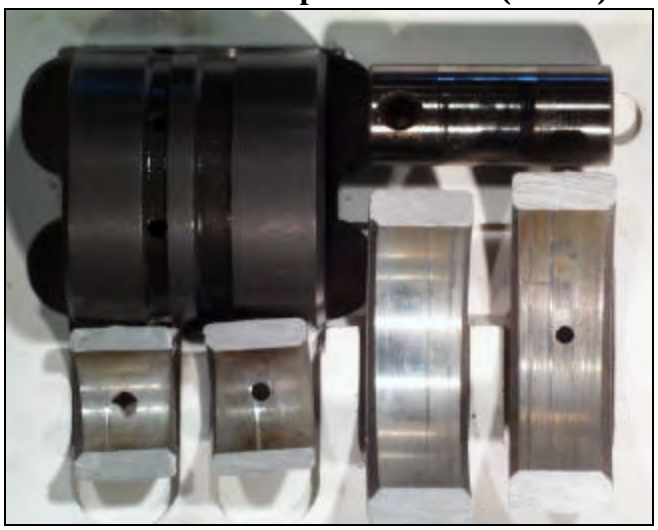
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	slight	black	gummy
Spring Seat	slight	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	hard

Photographic Documentation of R-22 Compressor with Contaminant Water
175 psig/32 psig

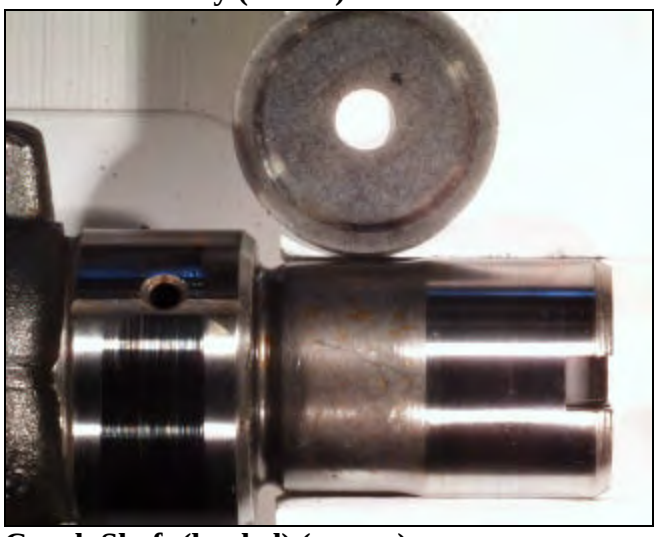
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

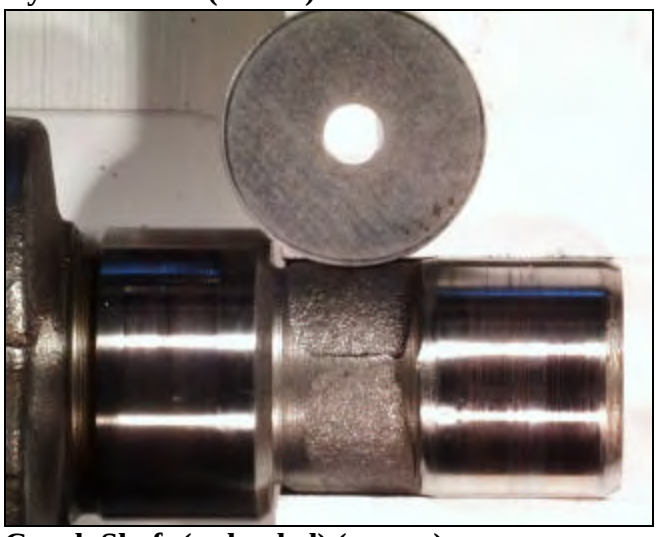


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

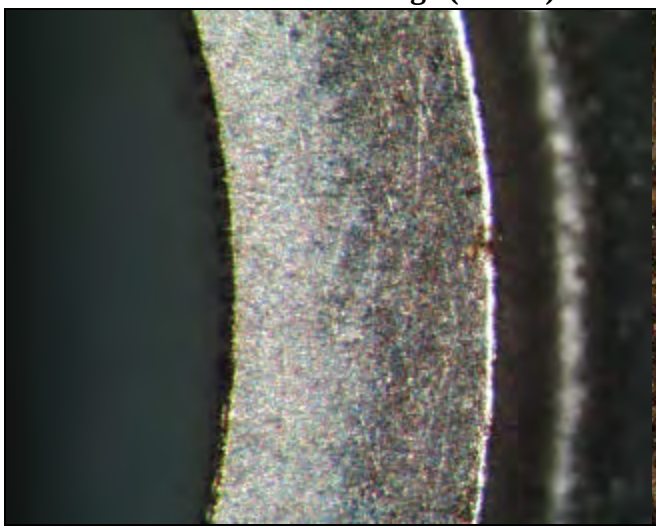


Crank Shaft (unloaded) (macro)

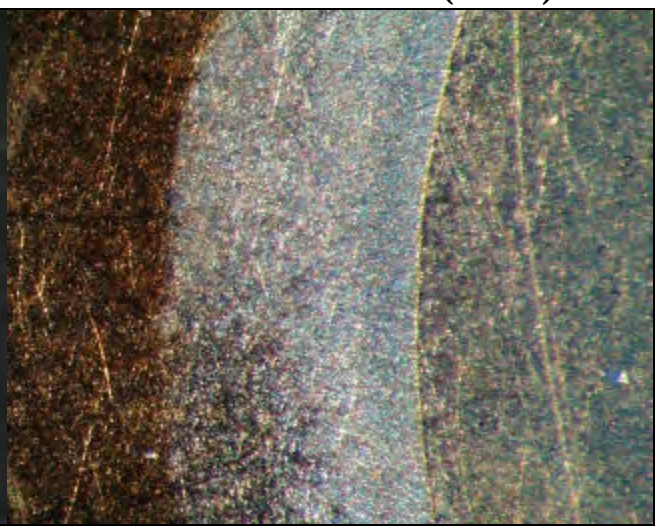
Photographic Documentation of R-22 Compressor with Contaminant Water
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

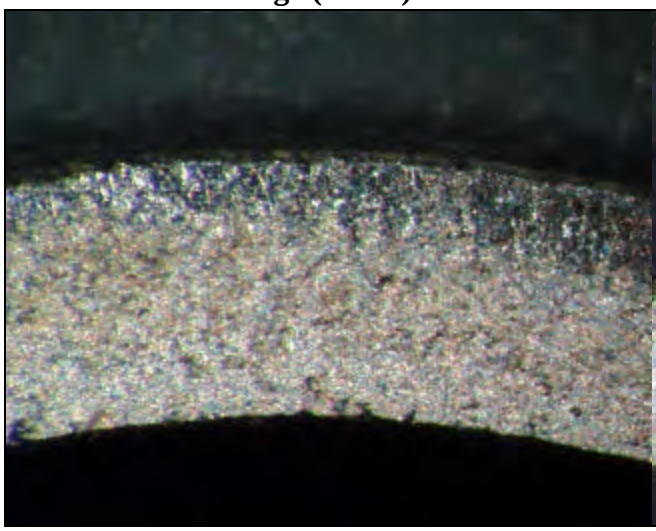
Valve Plate and Reed/Suction (macro)



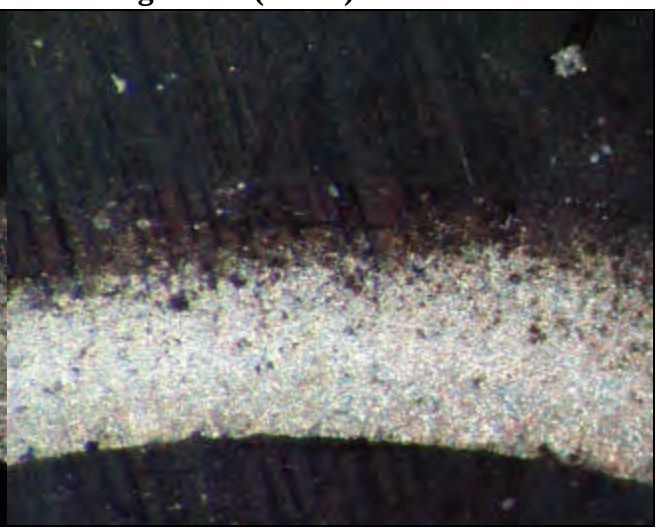
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 109
Model # RS43C1E-CAV-250 **Serial #** 96F16446
Run Time (hr.) 12001 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 2.5 **(4)** 5

Remaining torque of stator bolts
(1) 12.5 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean/Cu plate
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 17 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 7 **(2)** 7 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2465
Unloaded 1.2465

Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9985
Unloaded 0.9985

Bottom thrust washer (crank side)
Appearance scored/Cu plating/bronze plating/wear
Wear polish

Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish

Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040

Shaft in cage bearing
Appearance clean/Cu plating/corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2505
Unloaded 1.2505

TEST HISTORY OF:

Unit Number 109
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	16
Fluoride ion (ppm)	0.84
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	2
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	3
Zinc (ppm)	1

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.255

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/damaged

Suction reed

Condition	good
Condition	metals good
Appearance	corrosion
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

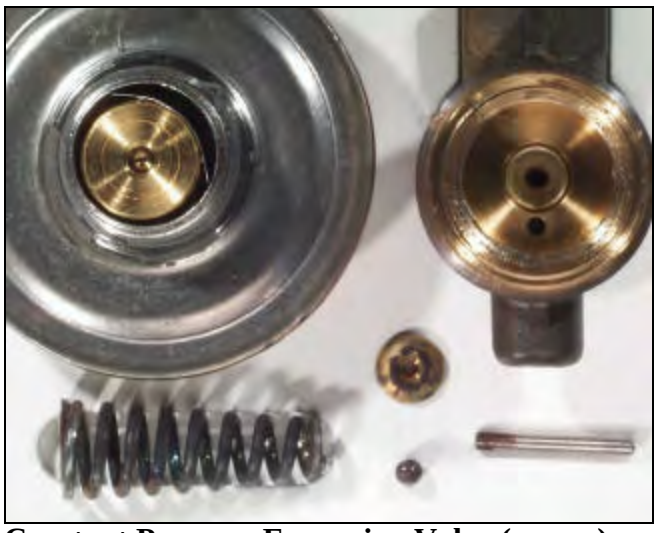
Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Expansion Valve Inspection Observations

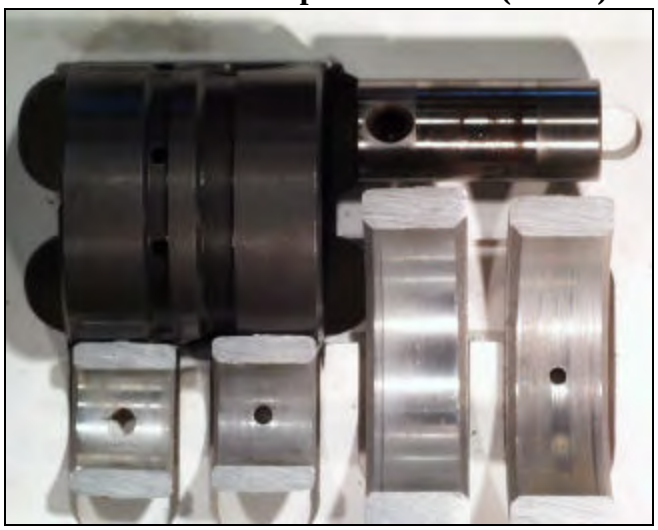
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

Photographic Documentation of R-22 Compressor with Contaminant Acid
175 psig/32 psig

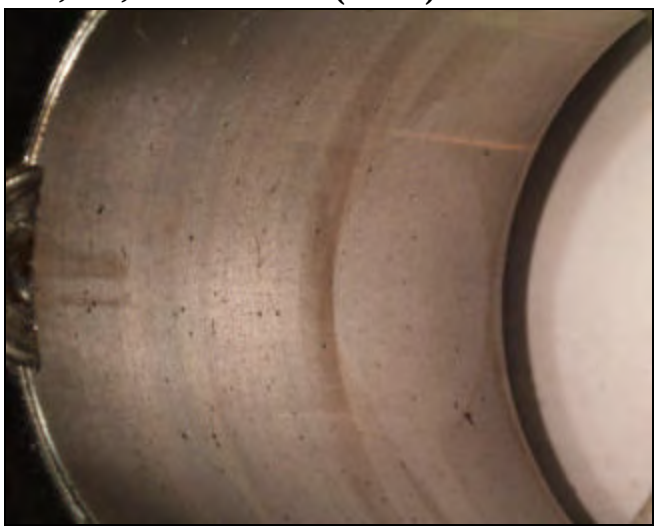


Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

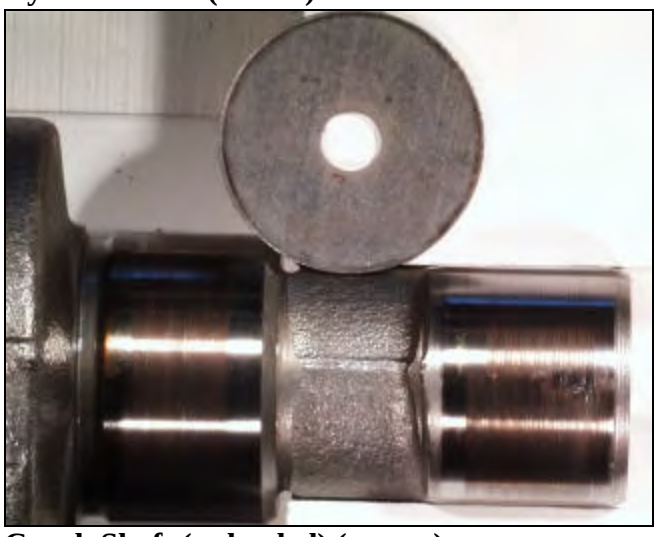


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

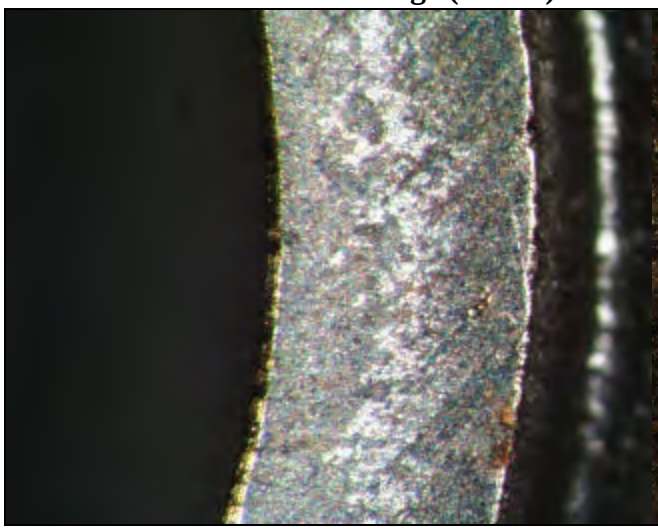


Crank Shaft (unloaded) (macro)

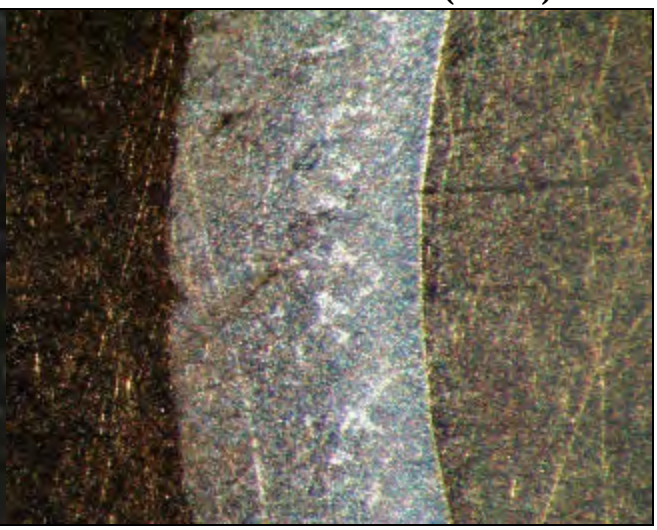
Photographic Documentation of R-22 Compressor with Contaminant Acid
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

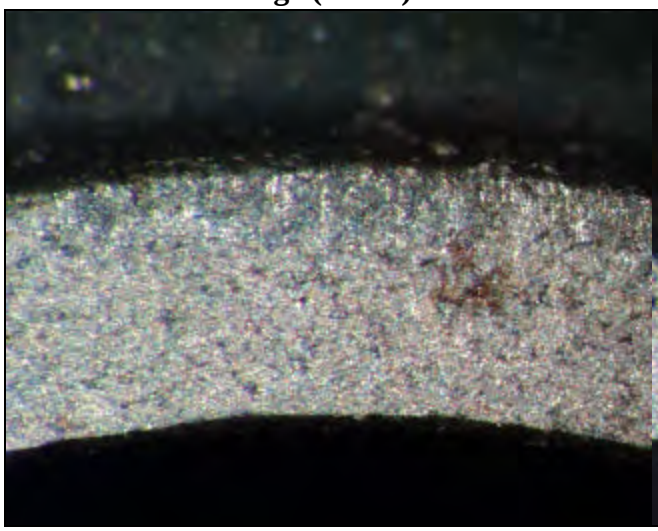
Valve Plate and Reed/Suction (macro)



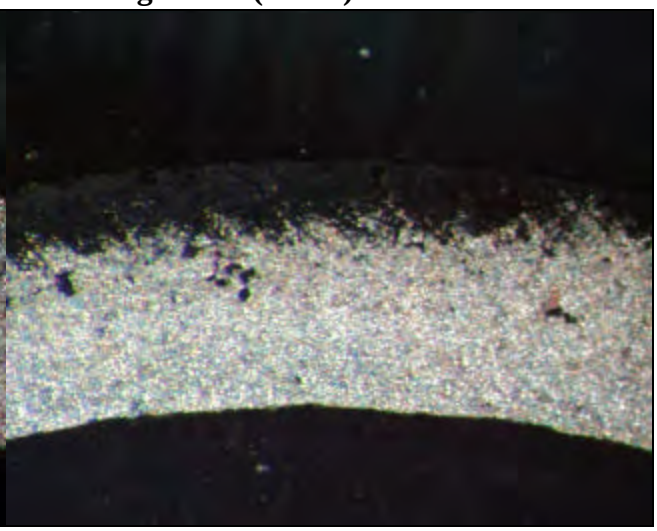
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 110
Model # RS43C1E-CAV-250 **Serial #** 96F16534
Run Time (hr.) 12021 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 2 **(2)** 2 **(3)** 3 **(4)** 3

Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 10 **(4)** 11

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean/Cu plate
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 16 **(4)** 16

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored/Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish, medium	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish, slight	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0010
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3755
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	polish, medium	
Dimensions	**Loaded**	1.2500
	Unloaded	1.2500

TEST HISTORY OF:

Unit Number 110
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)
Appearance contact wear/correct washer/corrosion
Wear polish
Dimensions **Loaded** 0.5000
Unloaded 0.5000

Piston pin washers appearance
contact wear

Piston pin
Appearance Cu plating
Wear medium
Dimensions **Loaded** 0.4980
Unloaded 0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	62
Fluoride ion (ppm)	0.75
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	3
Zinc (ppm)	0

Trash in liquid screen (g)	0.025
Number of screens	1
Debris in compressor bottom (g)	0.003

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion
Suction reed
Condition good
Appearance corrosion
Trepan slight
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance corrosion
Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion
Trepan slight
Varnish ring none

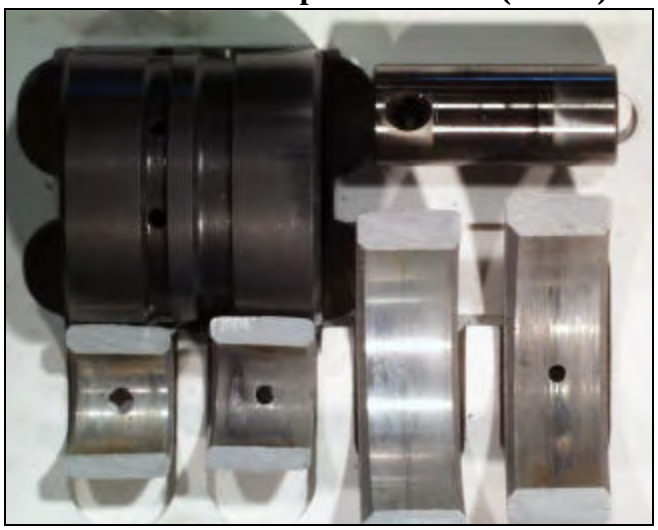
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

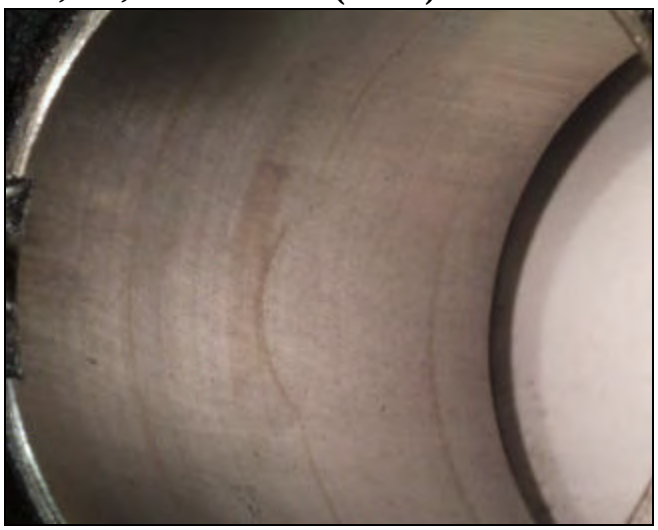
Photographic Documentation of R-22 Compressor with Contaminant Acid
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

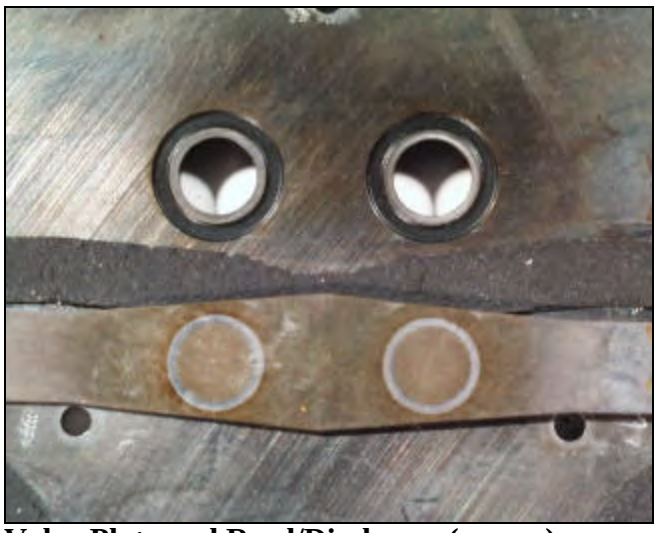


Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

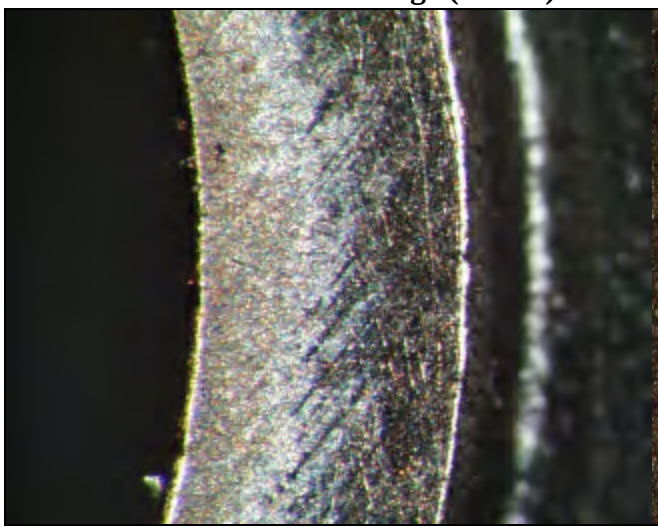
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid
175 psig/32 psig

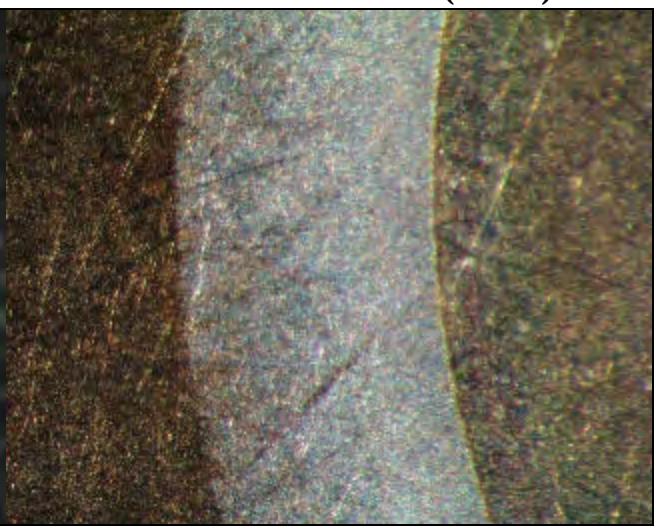


Valve Plate and Reed/Discharge (macro)

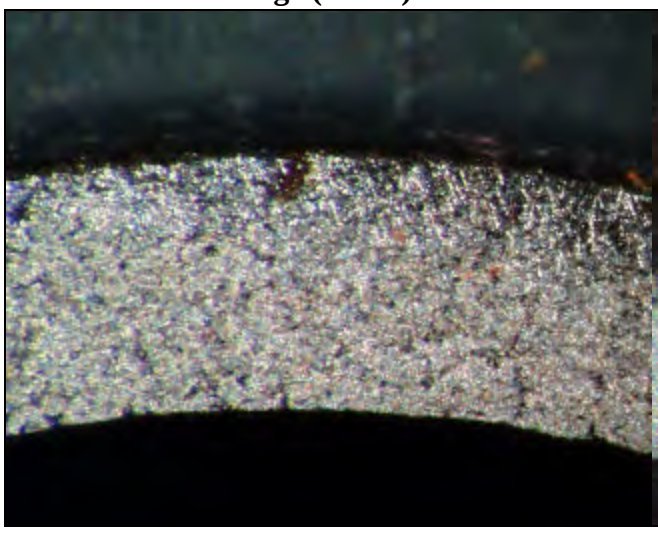
Valve Plate and Reed/Suction (macro)



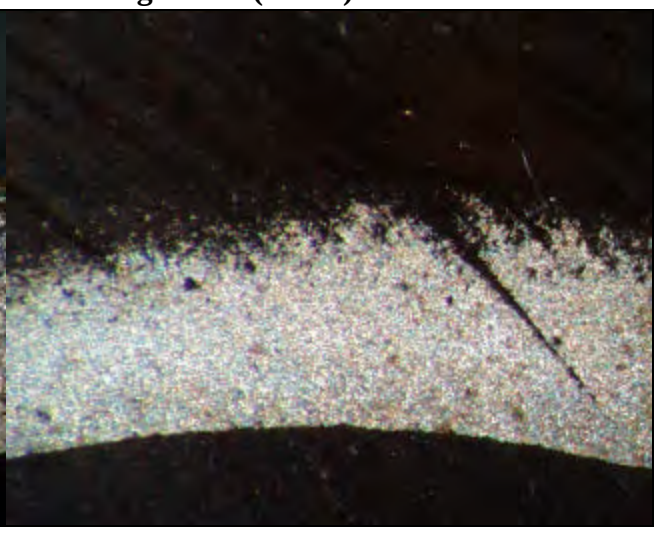
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 111
Model # RS43C1E-CAV-250 **Serial #** 96F16538
Run Time (hr.) 12024 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 175
Suction Pressure (psig) 32
Discharge Temp (°F) 212
Return Gas Temp (°F) 65
SumpTemp (°F) 179

Hi-Pot pass
High-low leak fail
Top shell appearance clean
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 0 **(2)** 1 **(3)** 1 **(4)** 1
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean/stator top green
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance Cu plate
Quantity of bearing chips heavy
Remaining torque of discharge muffler removed
(1) 12.5 **(2)** 12.5 **(3)** 17 **(4)** 15
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/bronze plating/ corrosion/wear
Wear slight
Bottom washer (casting side)
Appearance scored/corrosion
Wear polish
Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance clean/corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 111
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.24
Water (ppm)	33
Fluoride ion (ppm)	0.75
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.013
Number of screens	1
Debris in compressor bottom (g)	0.682

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Condition	metals good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

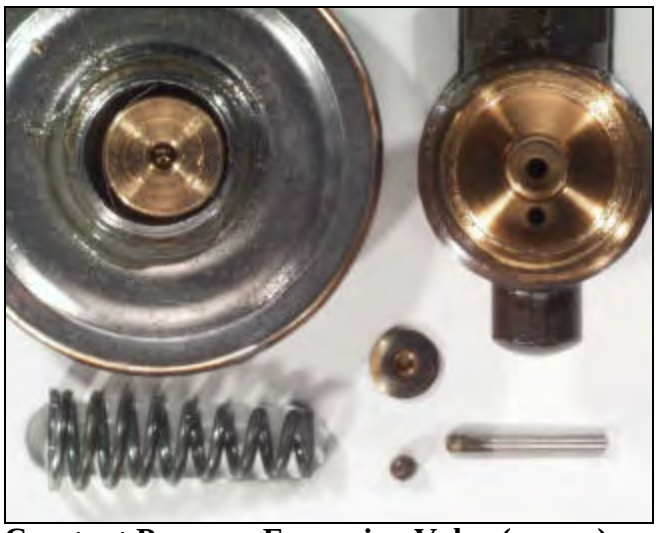
Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Expansion Valve Inspection Observations

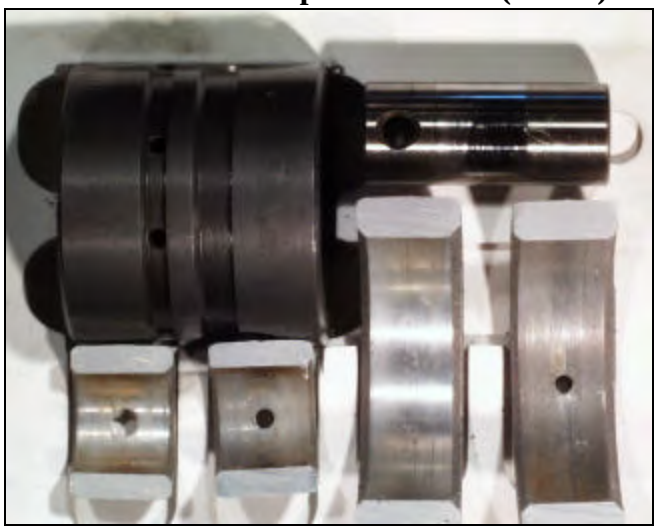
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	medium	black	hard
Spring Seat	slight	black	hard
Ball	medium	black	hard
Front Side	medium	black	hard

Photographic Documentation of R-22 Compressor with Contaminant Air
175 psig/32 psig

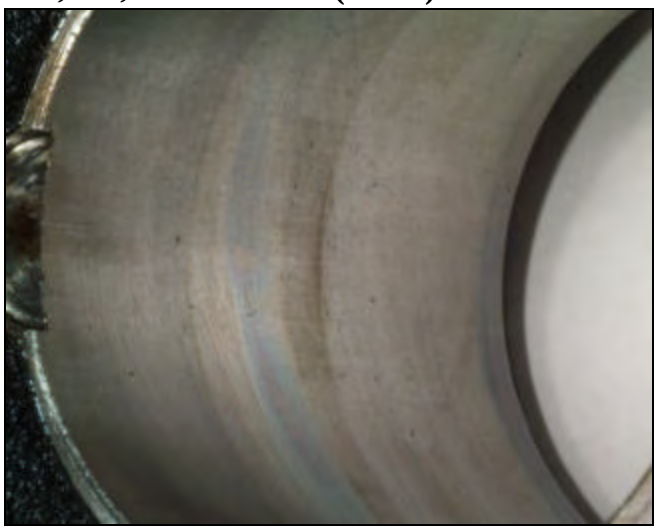


Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

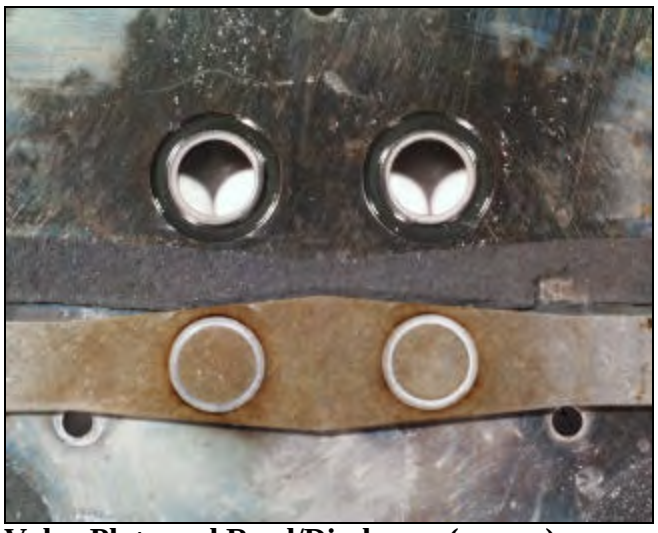


Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

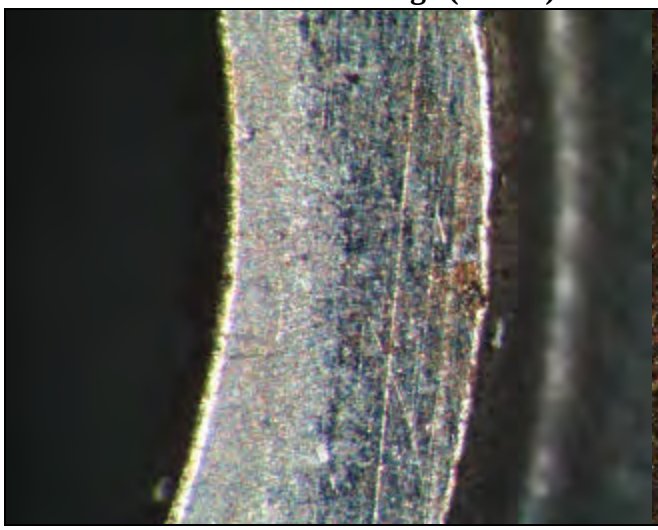
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Air
175 psig/32 psig

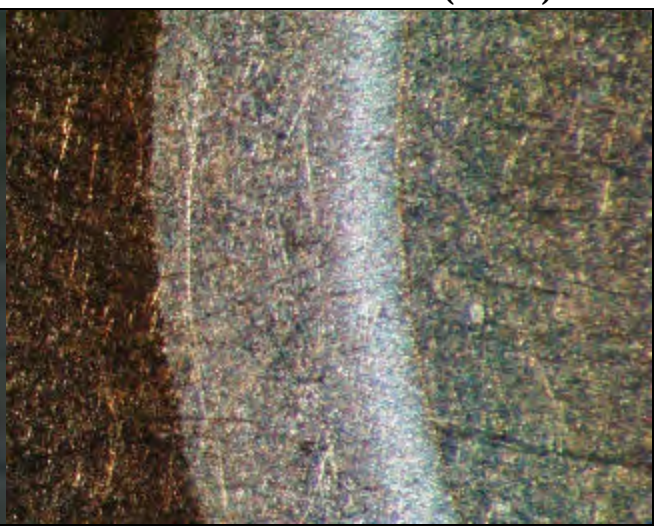


Valve Plate and Reed/Discharge (macro)

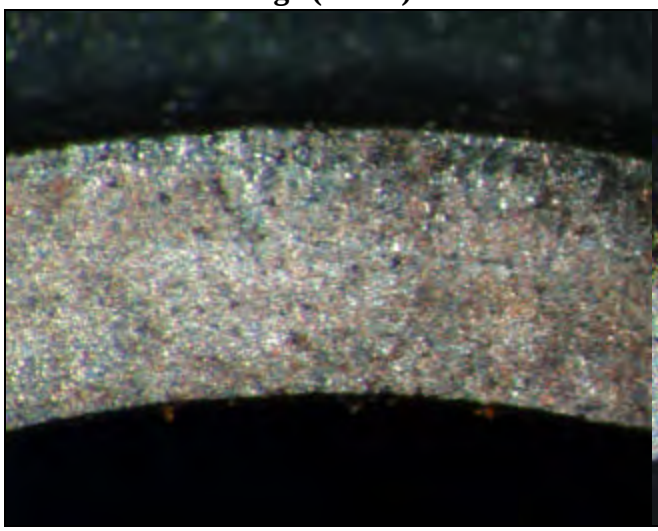
Valve Plate and Reed/Suction (macro)



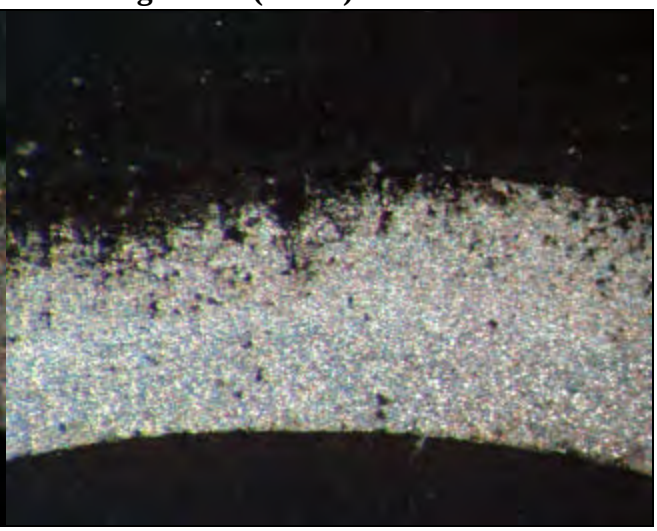
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 112
Model # RS43C1E-CAV-250 **Serial #** 96F16530
Run Time (hr.) 12011 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2 **(3)** 2 **(4)** 2

Remaining torque of stator bolts
(1) 17 **(2)** 15 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	Cu plate
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion/wear metals
Wear polish

Bottom washer (casting side)
Appearance scored/Cu plating/corrosion
Wear polish

Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0035
Unloaded 1.0035

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 112
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	21
Fluoride ion (ppm)	0.70
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	5
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.029
Number of screens	1
Debris in compressor bottom (g)	1.115

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

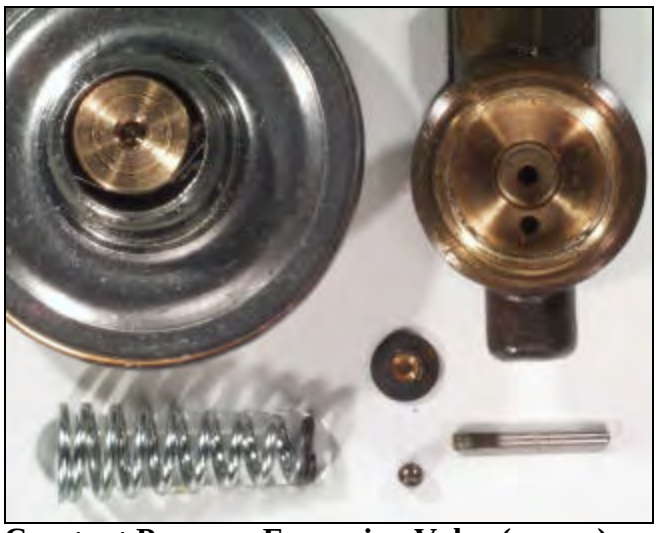
Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Expansion Valve Inspection Observations

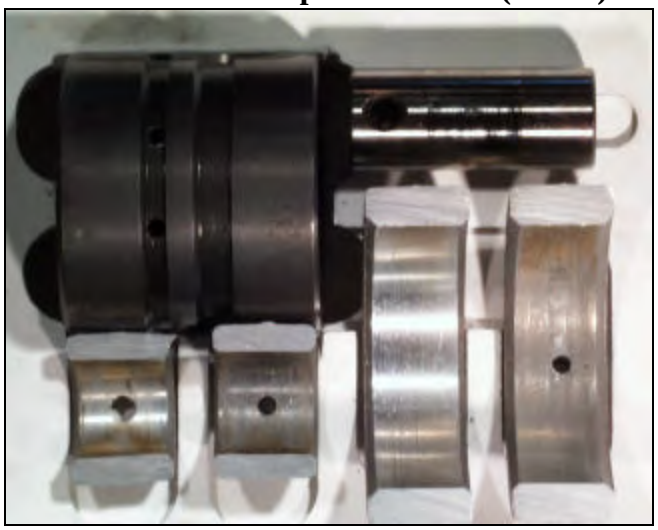
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	hard
Spring	very slight	black	hard
Spring Seat	very slight	black	hard
Ball	medium	black	hard
Front Side	heavy	black	hard

Photographic Documentation of R-22 Compressor with Contaminant Air
175 psig/32 psig



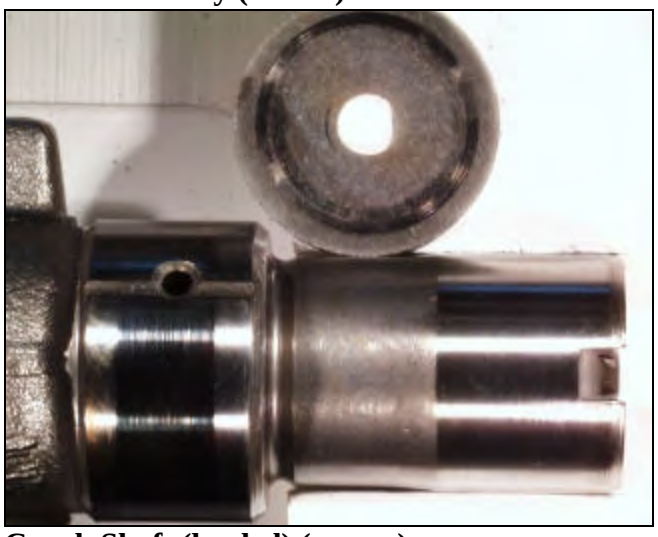
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



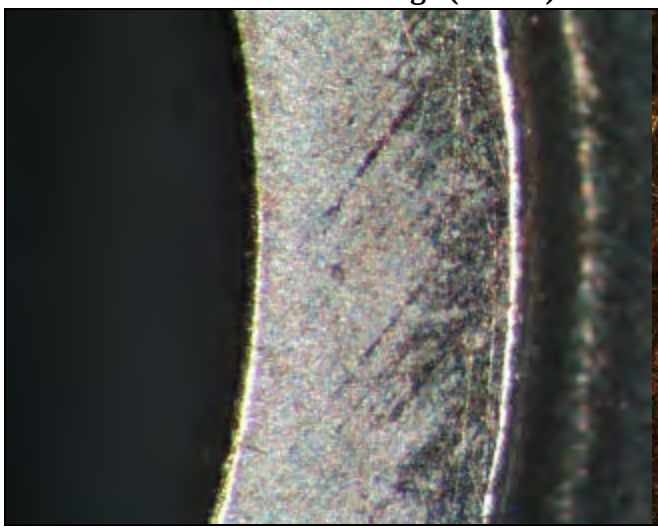
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

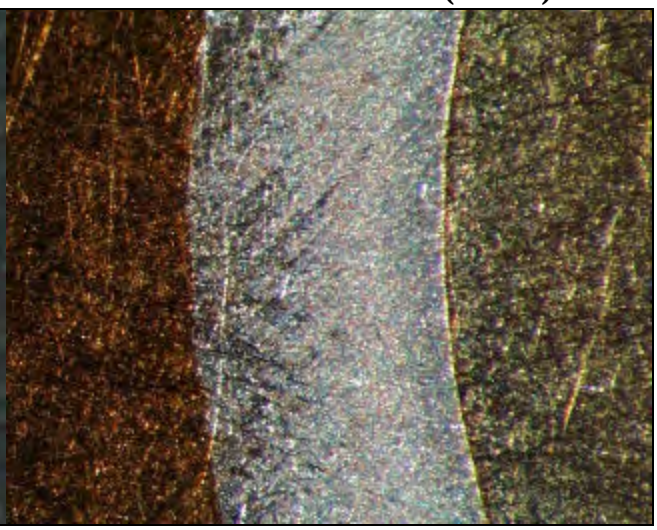
Photographic Documentation of R-22 Compressor with Contaminant Air
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

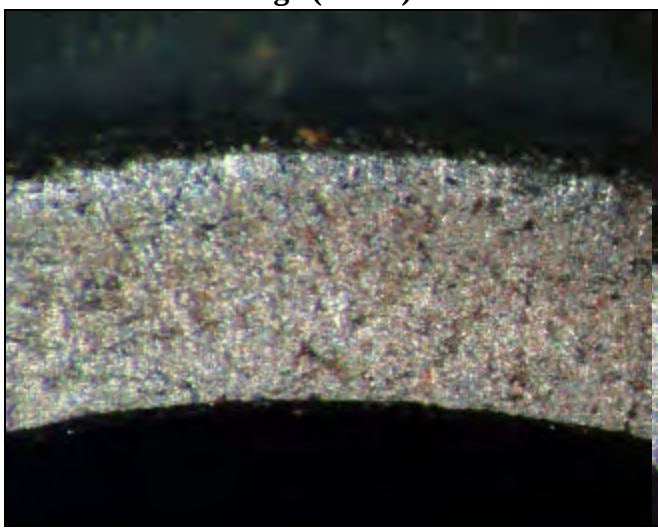
Valve Plate and Reed/Suction (macro)



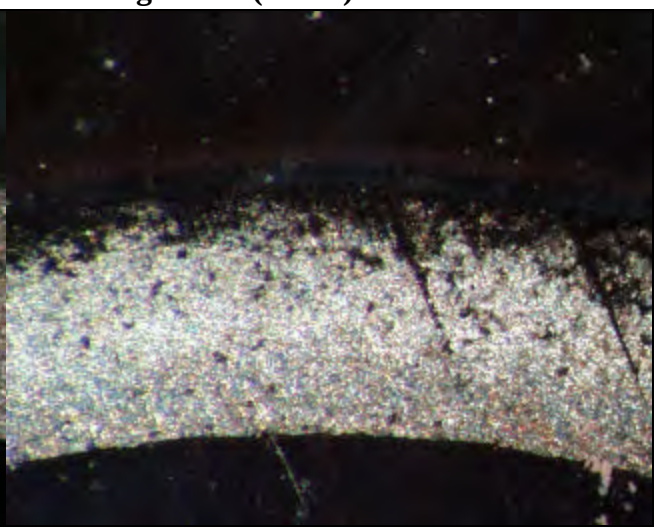
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 113
Model # RS43C1E-CAV-250 **Serial #** 96F16479
Run Time (hr.) 12041 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2 **(3)** 1 **(4)** 2

Remaining torque of stator bolts
(1) 15 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 17 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 7 **(3)** 7 **(4)** 7

Crank journals
Appearance scored/Cu plating/corrosion
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion/wear metals
Wear polish

Bottom washer (casting side)
Appearance scored/Cu plating/corrosion
Wear polish

Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0035
Unloaded 1.0035

Shaft in cage bearing
Appearance corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 113
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.15
Water (ppm)	13
Fluoride ion (ppm)	0.72
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	0
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.064
Number of screens	1
Debris in compressor bottom (g)	1.071

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	none

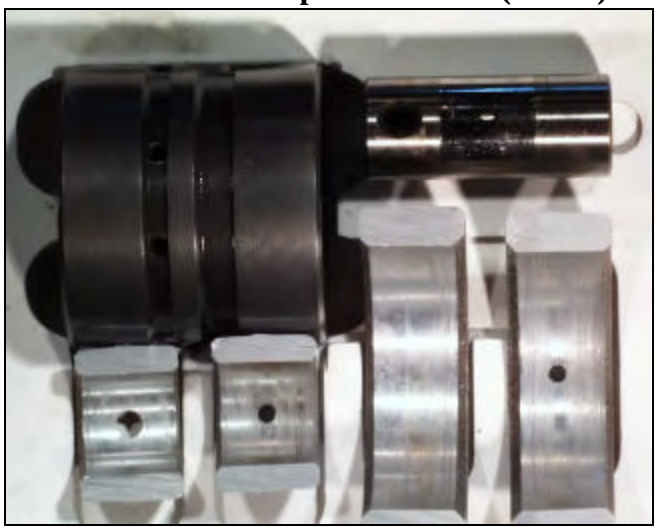
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	gray, brown	hard
Spring	medium	black	hard
Spring Seat	medium	black	hard
Ball	slight	black	hard
Front Side	slight	black	hard

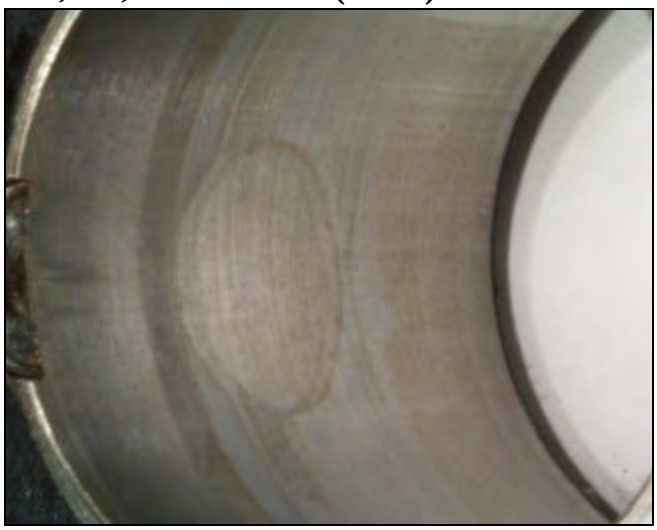
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

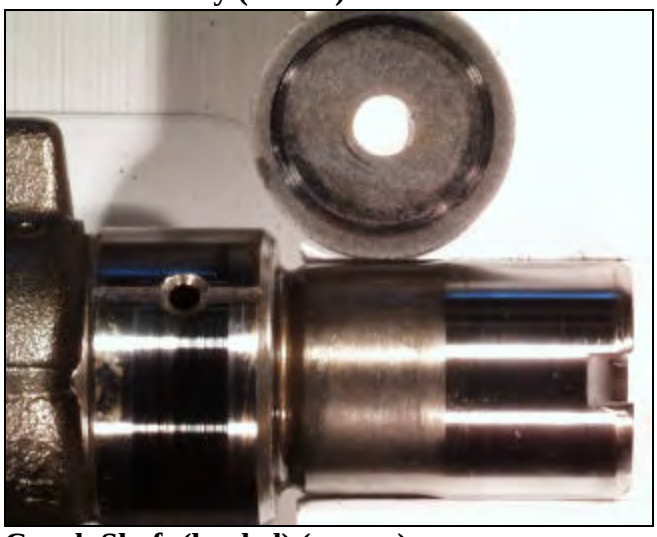
Ball, Pin, Seat of CPEV (micro)



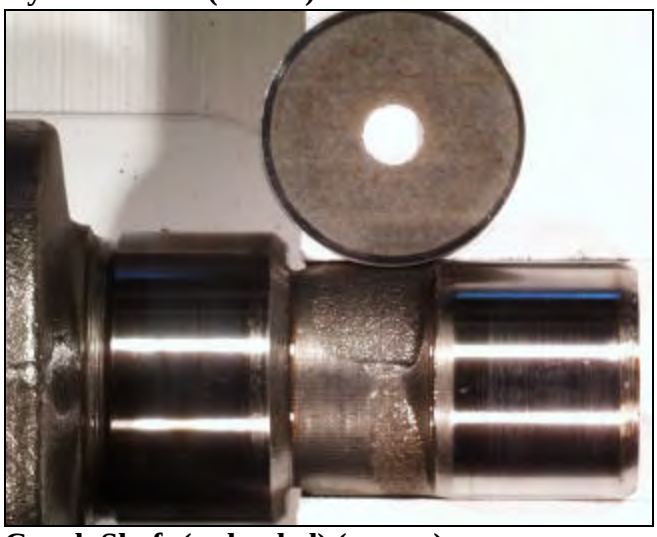
Piston Assembly (macro)



Cylinder Bore (macro)

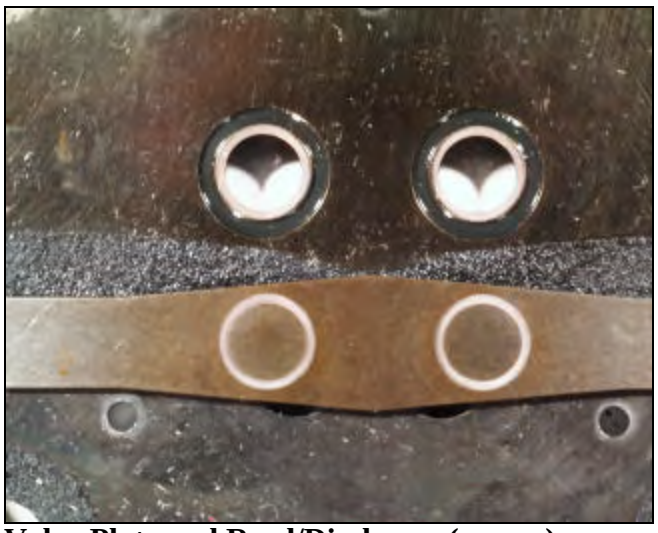


Crank Shaft (loaded) (macro)

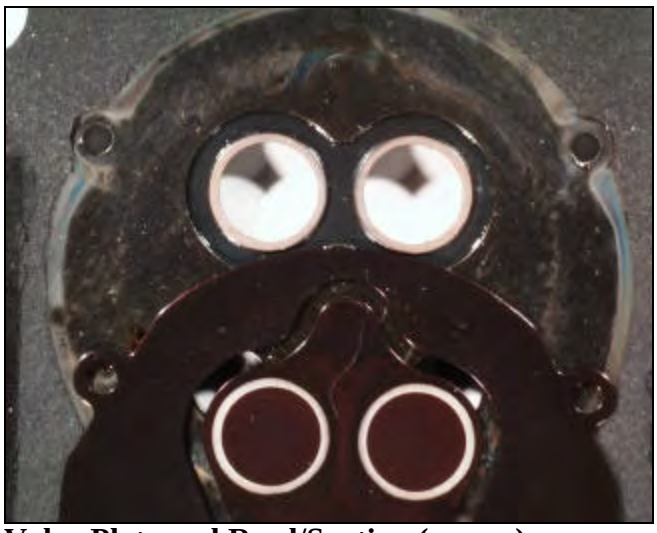


Crank Shaft (unloaded) (macro)

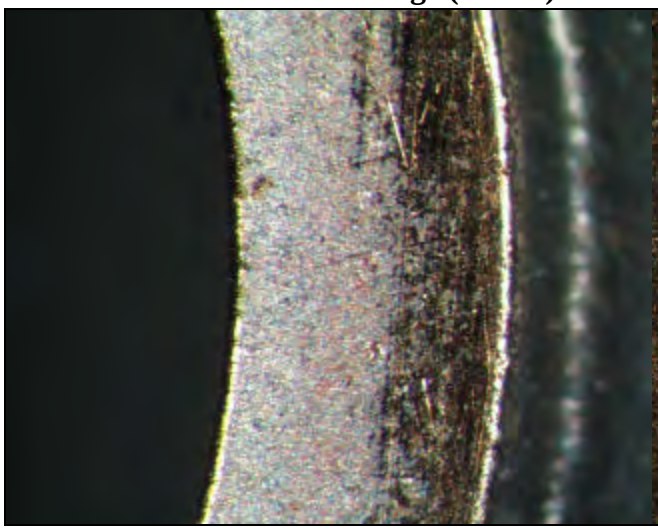
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
175 psig/32 psig



Valve Plate and Reed/Discharge (macro)

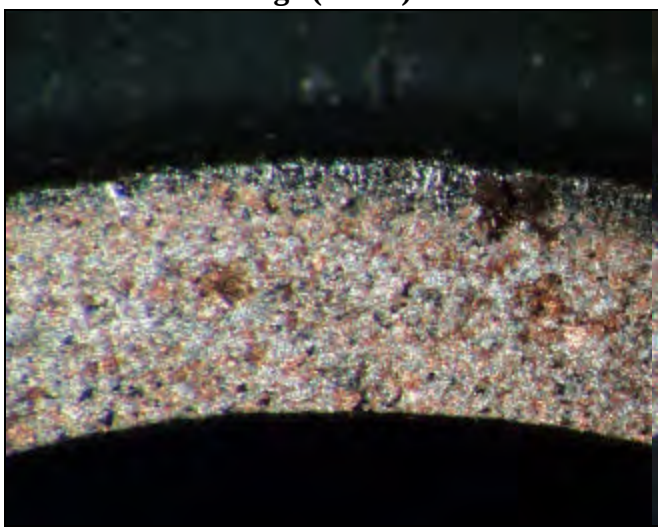


Valve Plate and Reed/Suction (macro)

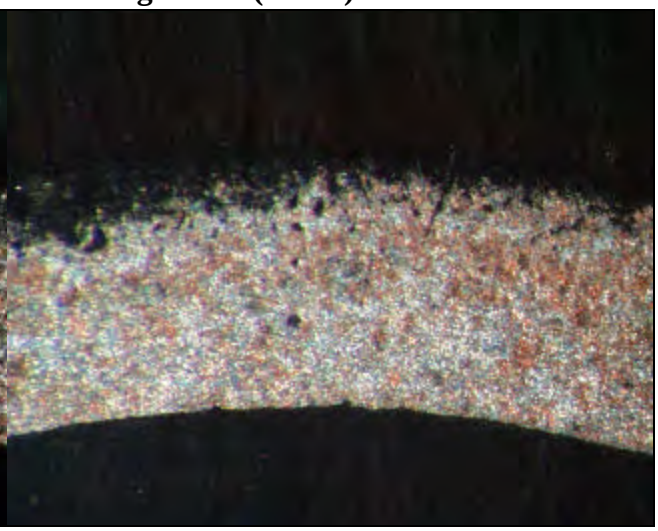


Valve Plate/Discharge (micro)

Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 114
Model # RS43C1E-CAV-250 **Serial #** 96F16462
Run Time (hr.) 12034 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 175
Suction Pressure (psig) 32
Discharge Temp (°F) 212
Return Gas Temp (°F) 65
SumpTemp (°F) 179

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 3 **(2)** 4 **(3)** 4 **(4)** 4
Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 11 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance clean
Top stator windings appearance gray
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance black
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 16 **(2)** 16 **(3)** 15 **(4)** 15
Head gasket brittle? yes
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 3 **(4)** 4

Crank journals
Appearance Cu plating
Wear polish, medium
Dimensions **Loaded** 1.2465
Unloaded 1.2465
Lower crank bearing journal
Appearance Cu plating
Wear polish, medium
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance clean/Cu plating
Wear polish, medium
Bottom washer (casting side)
Appearance clean
Wear polish, slight
Lower bronze bearings
Appearance clean
Wear polish, slight
Dimensions **Loaded** 1.0015
Unloaded 1.0015
Shaft in cage bearing
Appearance clean
Wear polish, slight
Piston top appearance clean
Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3715
Unloaded 1.3715
Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3735
Unloaded 1.3735
Connecting rod (large end)
Appearance corrosion
Wear polish, slight
Dimensions **Loaded** 1.2485
Unloaded 1.2485

TEST HISTORY OF:

Unit Number 114
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No

Air? Yes **R-22?** No
H_2O? No **R-502?** No

Connecting rod (small end)
Appearance contact wear/correct washer/corrosion
Wear polish, slight
Dimensions **Loaded** 0.4990
Unloaded 0.4990

Piston pin washers appearance
contact wear

Piston pin
Appearance Cu plating
Wear polish
Dimensions **Loaded** 0.4970
Unloaded 0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	62
Fluoride ion (ppm)	0.64
Chloride ion (ppm)	17
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	4
Lead (ppm)	0
Silicon (ppm)	7
Tin (ppm)	5
Zinc (ppm)	1

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.720

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion

Suction surface appearance
corrosion

Suction reed
Condition good
Appearance corrosion
Trepan slight
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance corrosion

Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion/Cu plating
Trepan very slight
Varnish ring none

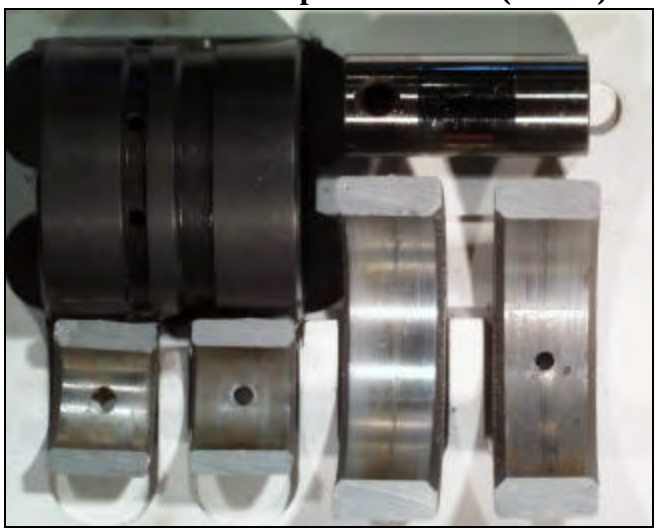
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	medium	black	gummy

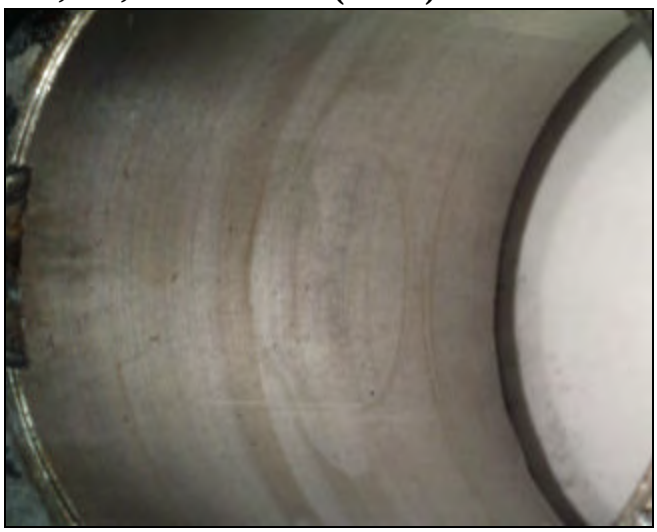
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

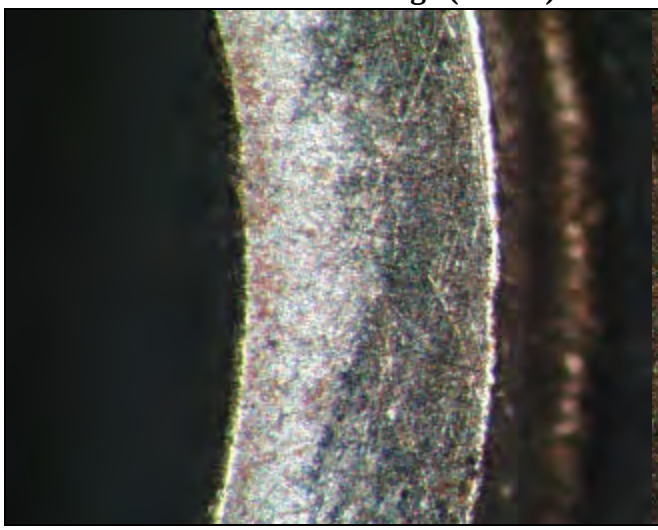
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

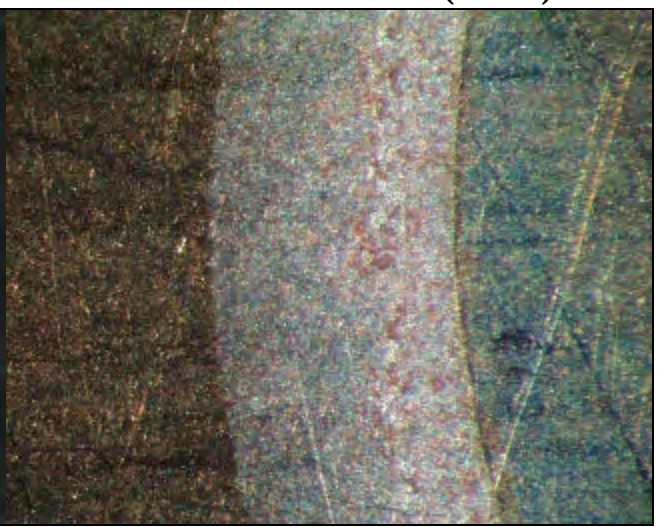
Photographic Documentation of R-22 Compressor with Contaminant Acid and Air
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

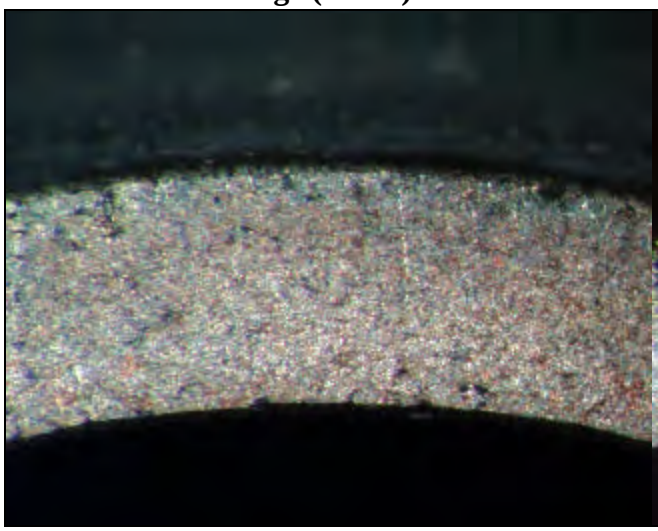
Valve Plate and Reed/Suction (macro)



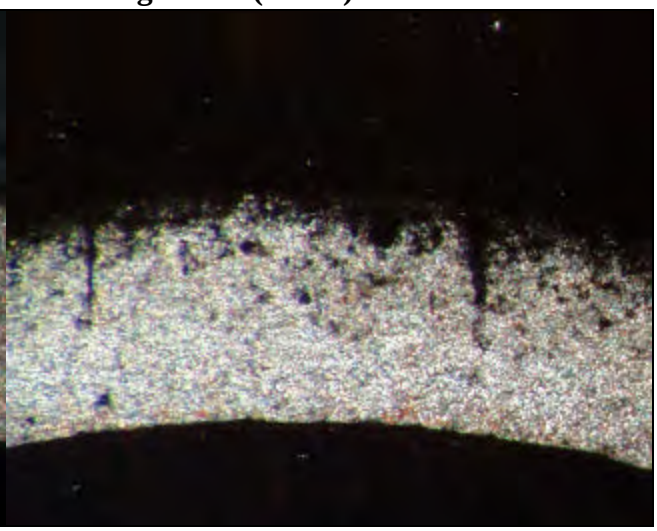
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 115
Model # RS43C1E-CAV-250 **Serial #** 96F16542
Run Time (hr.) 12023 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	black/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 2 **(2)** 2 **(3)** 2 **(4)** 2
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	Cu plate/corrosion
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 17 **(4)** 17

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 7 **(2)** 7 **(3)** 7 **(4)** 7

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2460
Unloaded 1.2460

Lower crank bearing journal
Appearance Cu plating
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance scored/Cu plating/wear metals
Wear slight

Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish

Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040

Shaft in cage bearing
Appearance clean/Cu plating
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 115
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5005
	Unloaded	0.5005

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	15
Fluoride ion (ppm)	0.70
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.043
Number of screens	1
Debris in compressor bottom (g)	0.546

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

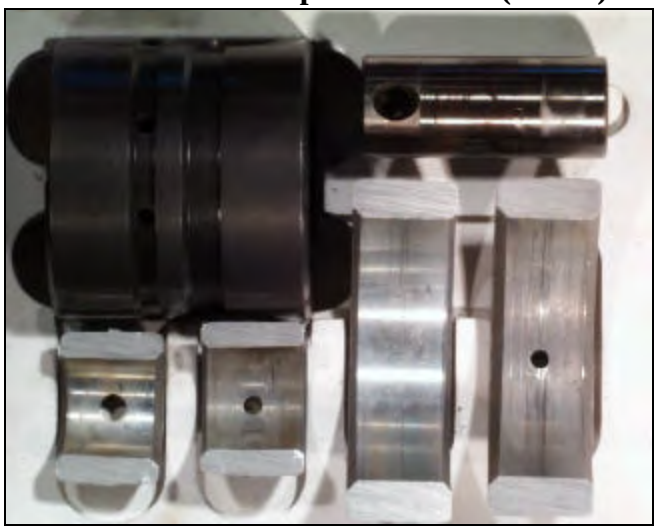
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

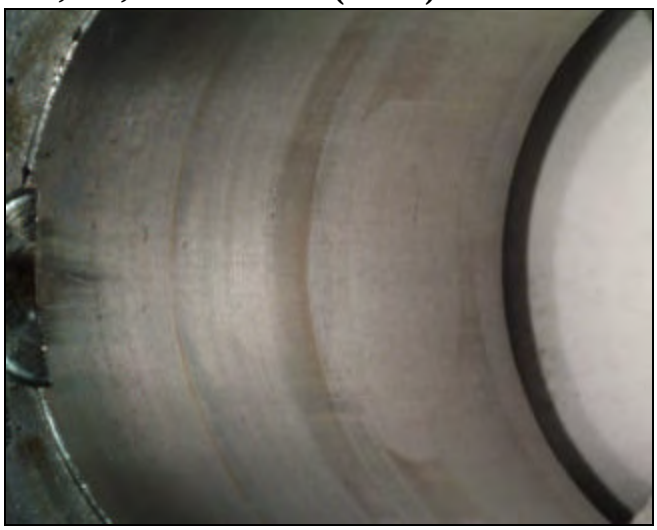
Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

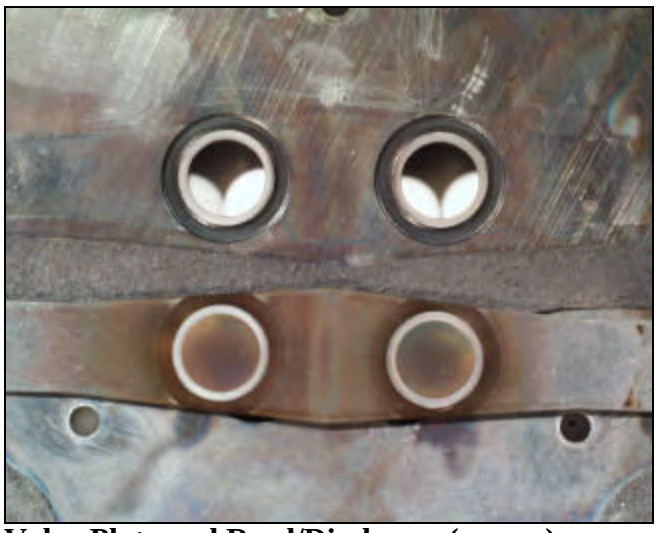


Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

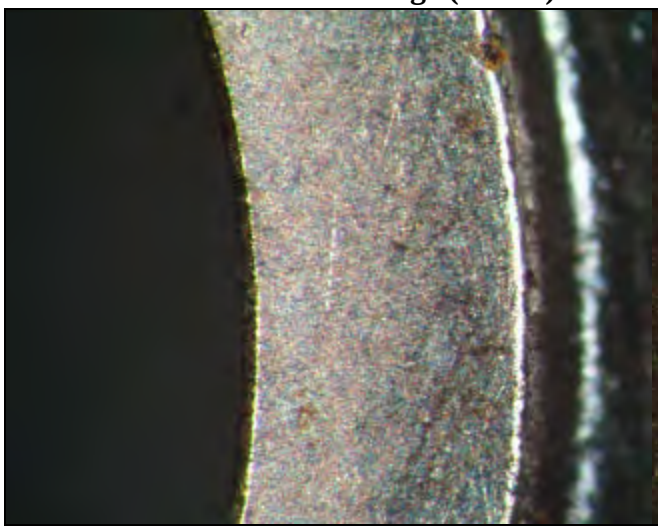
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
175 psig/32 psig

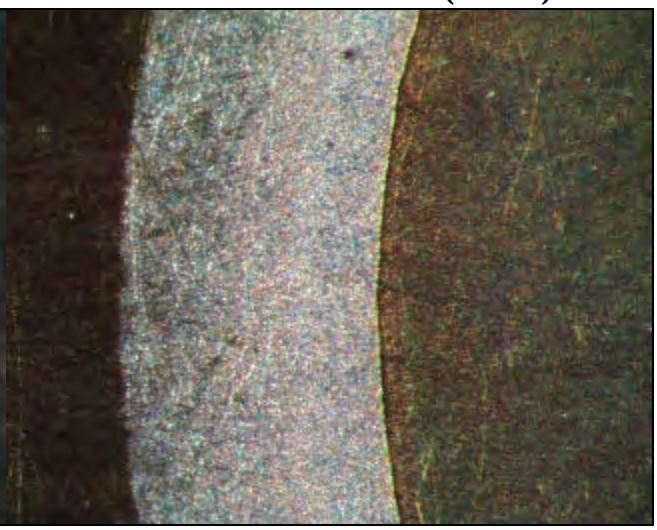


Valve Plate and Reed/Discharge (macro)

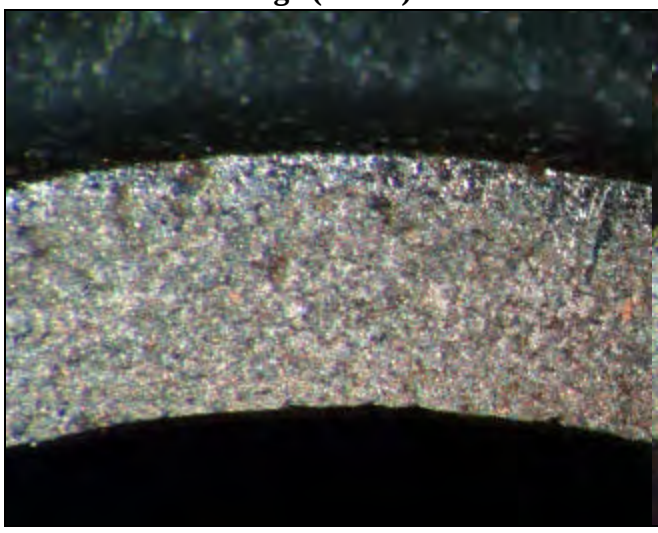
Valve Plate and Reed/Suction (macro)



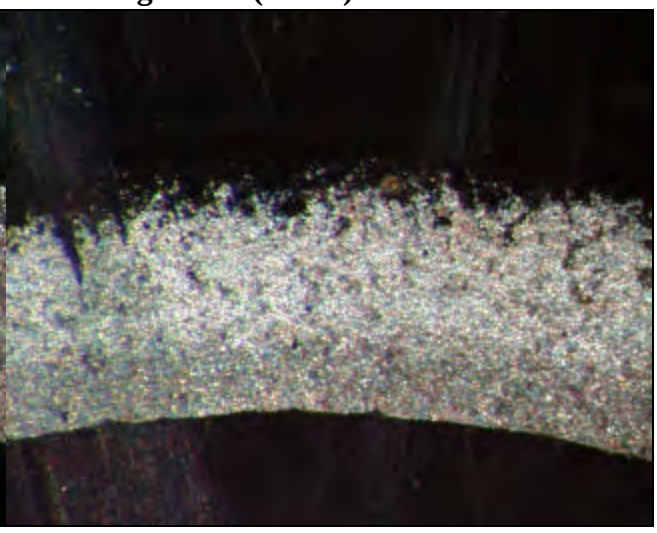
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 116
Model # RS43C1E-CAV-250 **Serial #** 96F16457
Run Time (hr.) 12003 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 175
Suction Pressure (psig) 32
Discharge Temp (°F) 212
Return Gas Temp (°F) 65
SumpTemp (°F) 179

Hi-Pot pass
High-low leak fail
Top shell appearance clean
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 0 **(2)** 0 **(3)** 1 **(4)** 1
Remaining torque of stator bolts
(1) 12.5 **(2)** 10 **(3)** 12.5 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance gray/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance black/Cu plate
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 2 **(2)** 5 **(3)** 5 **(4)** 12.5
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 7 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 1.2460
Unloaded 1.2460
Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9985
Unloaded 0.9985
Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear polish
Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish
Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0035
Shaft in cage bearing
Appearance clean/corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear/scored
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 116
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.13
Water (ppm)	22
Fluoride ion (ppm)	0.67
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	17
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.029
Number of screens	2
Debris in compressor bottom (g)	0.346

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

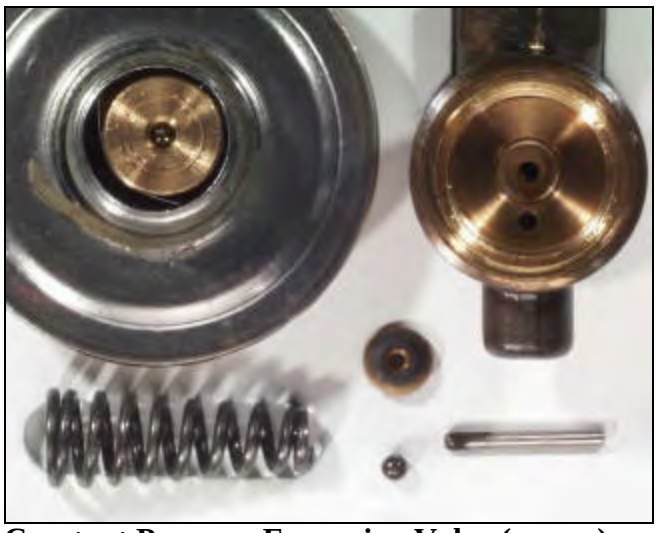
Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	medium

Expansion Valve Inspection Observations

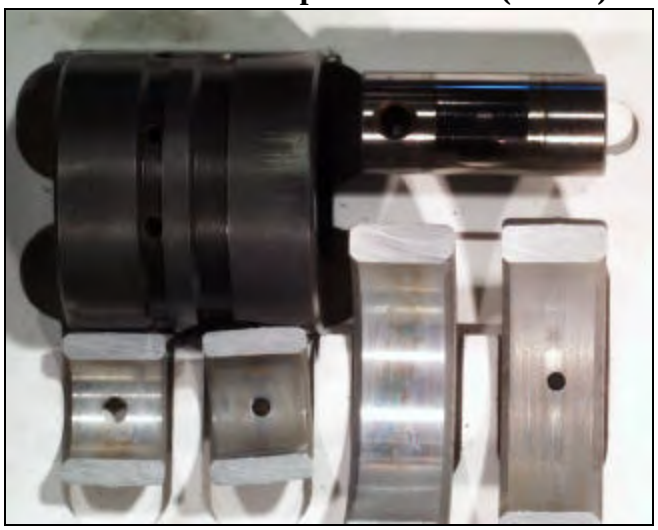
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
175 psig/32 psig

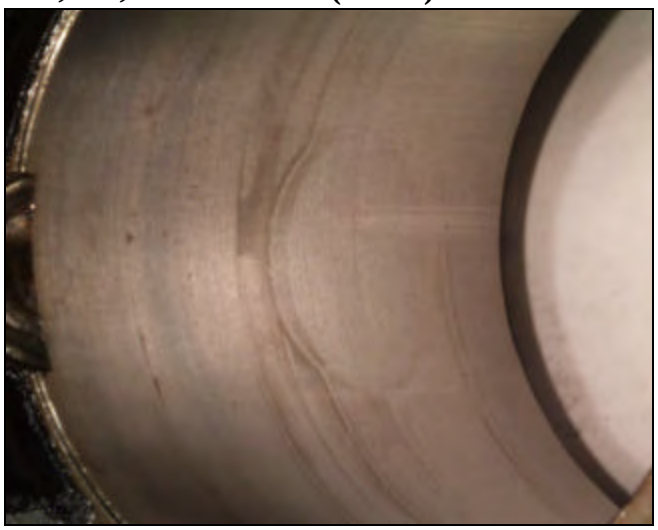


Constant Pressure Expansion Valve (macro)

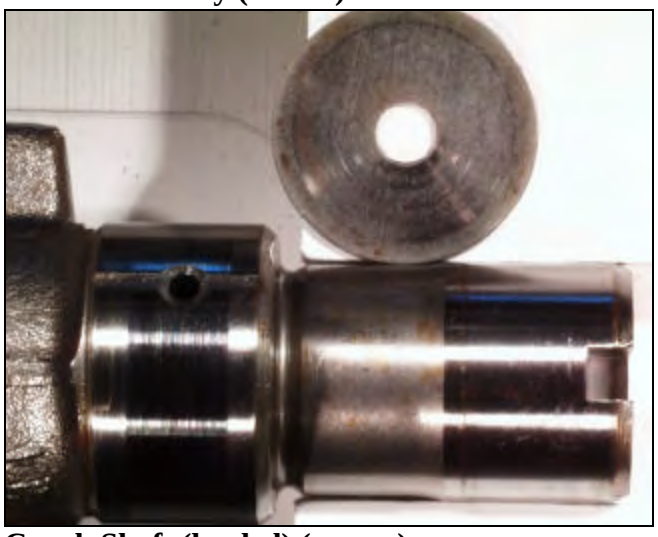
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



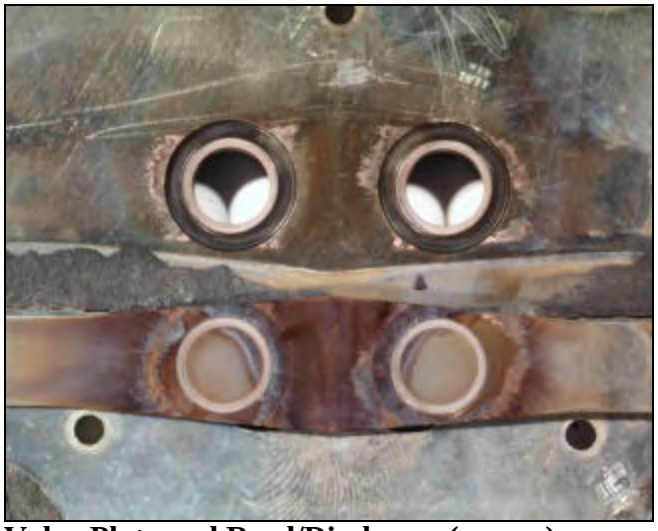
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

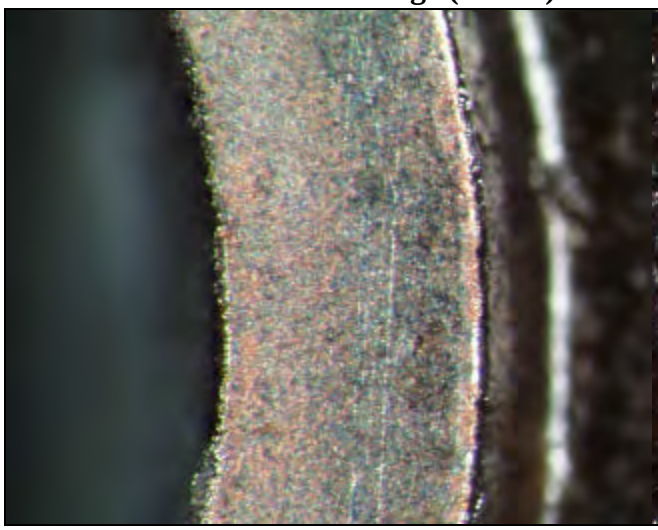
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid and Water
175 psig/32 psig

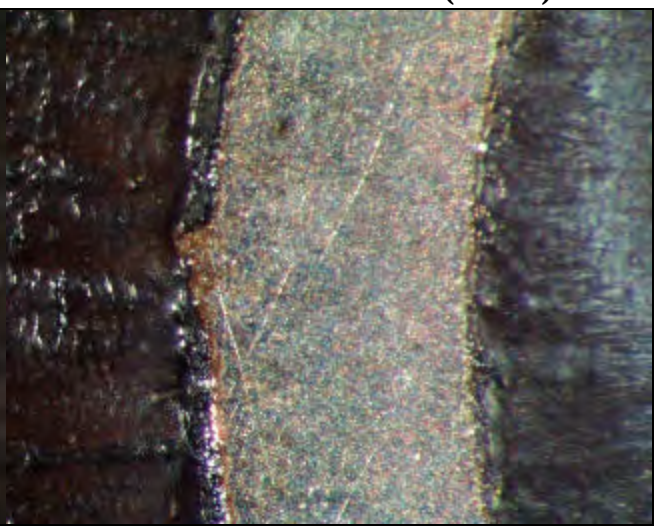


Valve Plate and Reed/Discharge (macro)

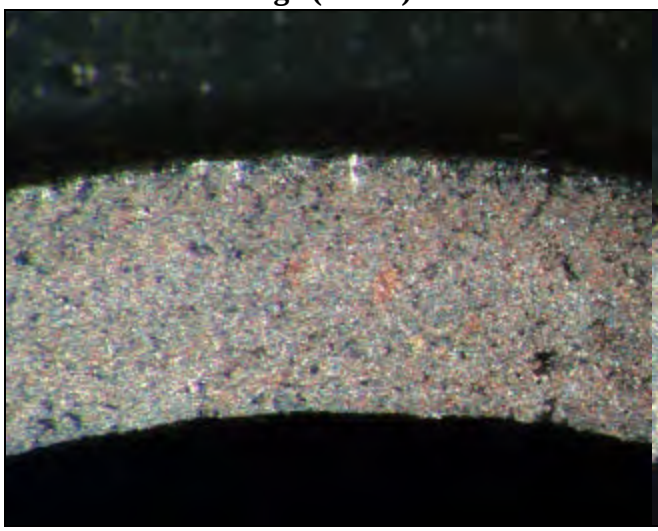
Valve Plate and Reed/Suction (macro)



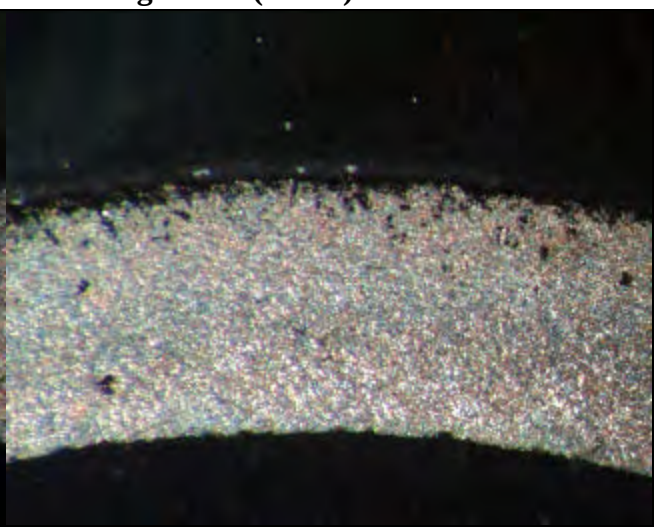
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 117
Model # RS43C1E-CAV-250 **Serial #** 96F16535
Run Time (hr.) 12014 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	gray
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 2 **(2)** 1 **(3)** 2 **(4)** 2

Remaining torque of stator bolts
(1) 11 **(2)** 9 **(3)** 10 **(4)** 9

Suction muffler appearance	rust
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 16 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 4

Crank journals
Appearance scored
Wear polish, medium
Dimensions **Loaded** 1.2480
Unloaded 1.2480

Lower crank bearing journal
Appearance scored
Wear polish, slight
Dimensions **Loaded** 1.0000
Unloaded 1.0000

Bottom thrust washer (crank side)
Appearance Cu plating
Wear polish, medium

Bottom washer (casting side)
Appearance clean/bronze plating
Wear polish, slight

Lower bronze bearings
Appearance clean
Wear polish, slight
Dimensions **Loaded** 1.0020
Unloaded 1.0020

Shaft in cage bearing
Appearance clean
Wear polish, slight

Piston top appearance clean

Piston skirt
Appearance low wear/scored
Dimensions **Loaded** 1.3730
Unloaded 1.3730

Cylinder bore
Appearance low wear/scored/Cu plating
Varnish ring slight
Dimensions **Loaded** 1.3745
Unloaded 1.3745

Connecting rod (large end)
Appearance scored/Cu plating
Wear polish, medium
Dimensions **Loaded** 1.2500
Unloaded 1.2500

TEST HISTORY OF:

Unit Number 117
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.4995
	Unloaded	0.4995

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating	
Wear	polish, medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.10
Water (ppm)	124
Fluoride ion (ppm)	0.64
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.045
Number of screens	1
Debris in compressor bottom (g)	0.344

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	very slight

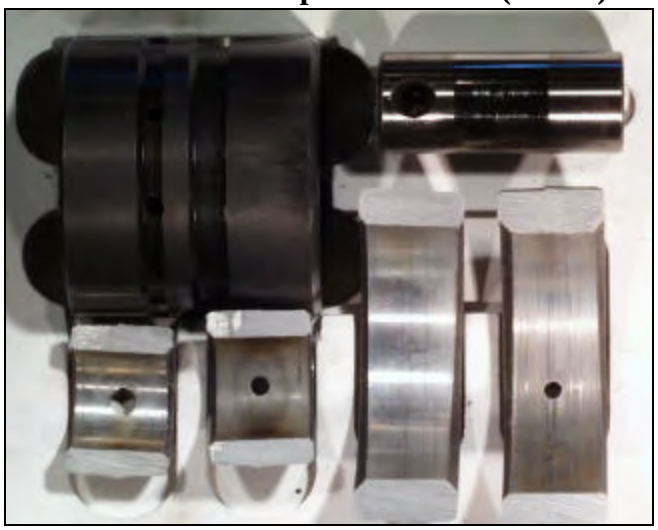
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	slight	black	gummy

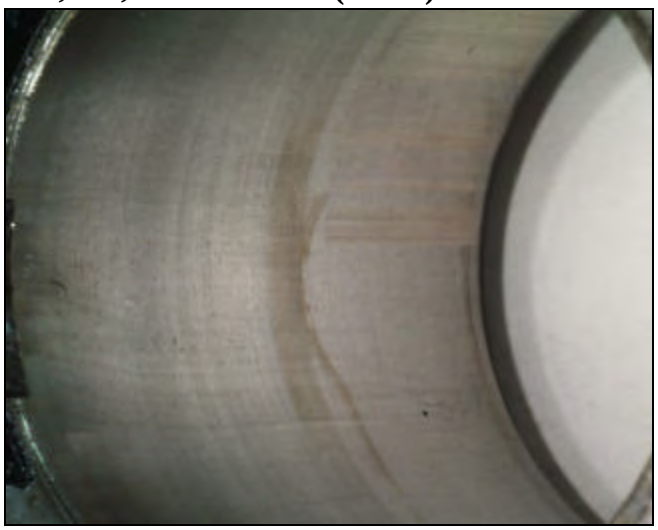
Photographic Documentation of R-22 Compressor with Contaminant Air and Water
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

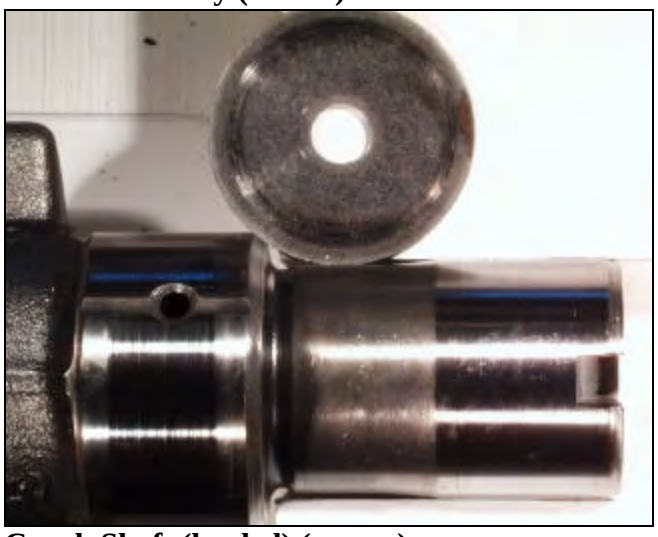
Ball, Pin, Seat of CPEV (micro)



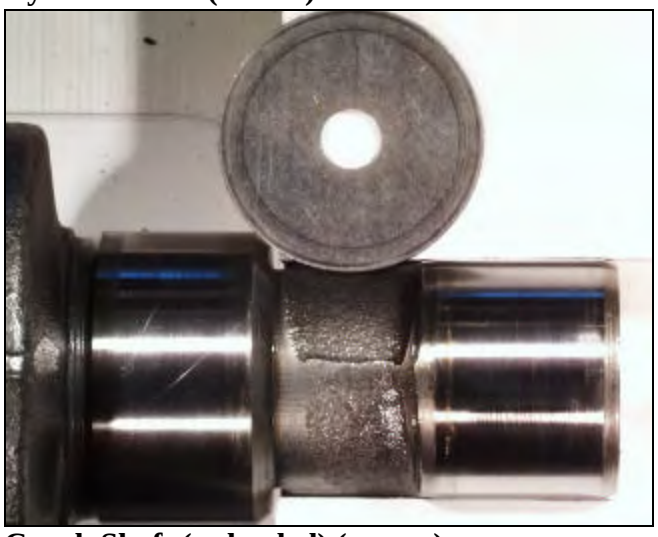
Piston Assembly (macro)



Cylinder Bore (macro)

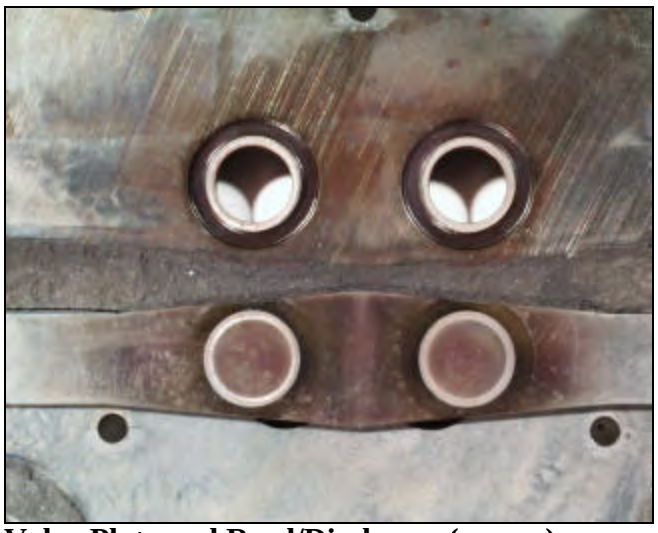


Crank Shaft (loaded) (macro)



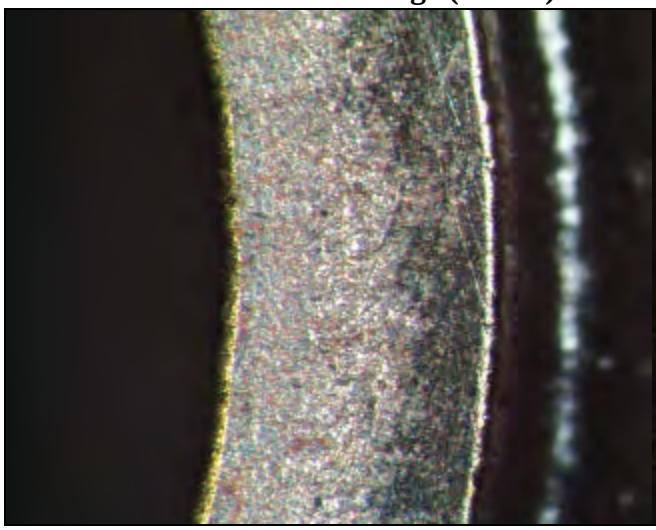
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Air and Water
175 psig/32 psig

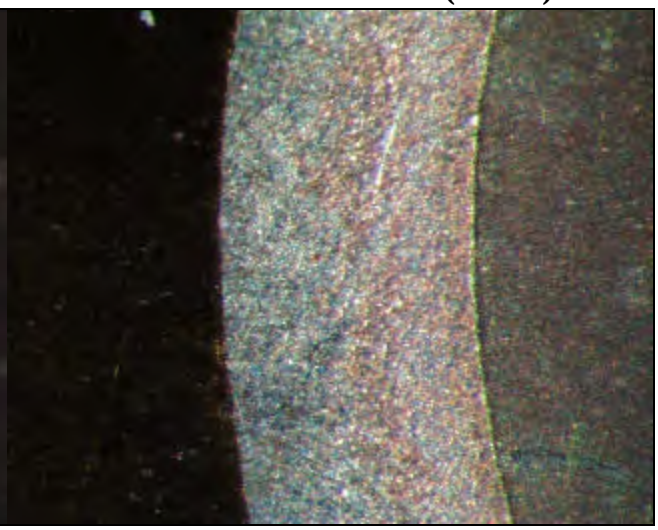


Valve Plate and Reed/Discharge (macro)

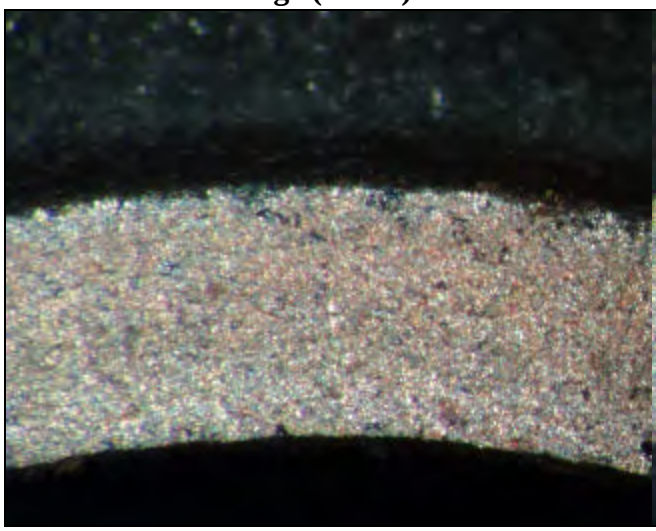
Valve Plate and Reed/Suction (macro)



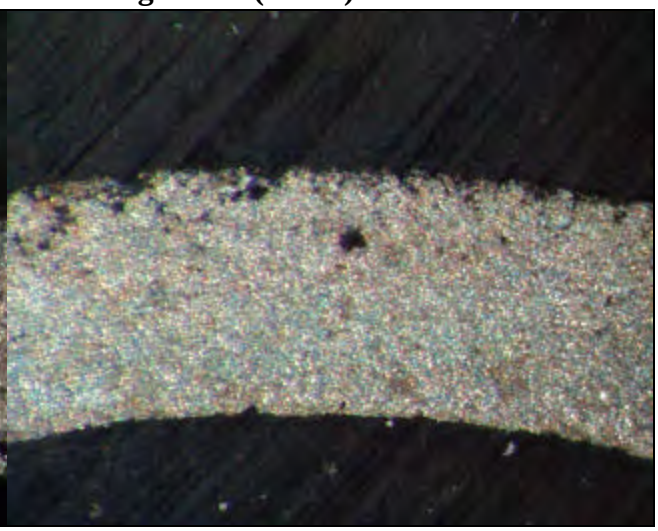
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 118
Model # RS43C1E-CAV-250 **Serial #** 96F16531
Run Time (hr.) 12045 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 1 **(2)** 2 **(3)** 2 **(4)** 1

Remaining torque of stator bolts
(1) 12 **(2)** 11 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 8 **(3)** 15 **(4)** 7

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 4

Crank journals
Appearance clean/Cu plating
Wear polish, slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean/Cu plating
Wear polish, slight
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance clean/Cu plating
Wear polish, medium

Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish, medium

Lower bronze bearings
Appearance clean
Wear polish, slight
Dimensions **Loaded** 1.0020
Unloaded 1.0015

Shaft in cage bearing
Appearance clean
Wear polish, slight

Piston top appearance clean

Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3725
Unloaded 1.3725

Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3750
Unloaded 1.3750

Connecting rod (large end)
Appearance Cu plating
Wear polish
Dimensions **Loaded** 1.2475
Unloaded 1.2475

TEST HISTORY OF:

Unit Number 118
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/Cu plating	
Wear	polish, slight	
Dimensions	**Loaded**	0.4995
	Unloaded	0.4995

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.13
Water (ppm)	49
Fluoride ion (ppm)	0.67
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	2
Zinc (ppm)	0

Trash in liquid screen (g)	0.014
Number of screens	1
Debris in compressor bottom (g)	0.338

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	very slight
Varnish ring	very slight

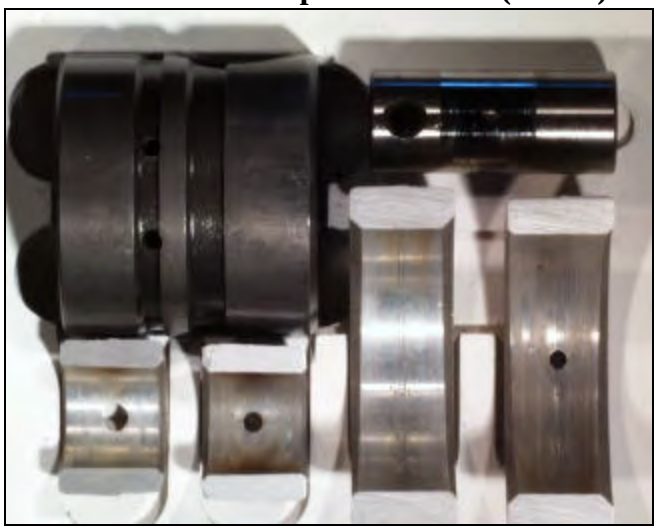
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	slight	gray	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-22 Compressor with Contaminant Air and Water
175 psig/32 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



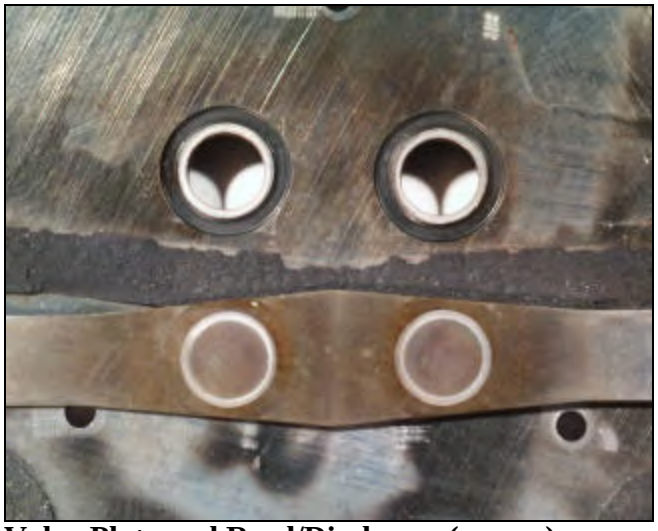
Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

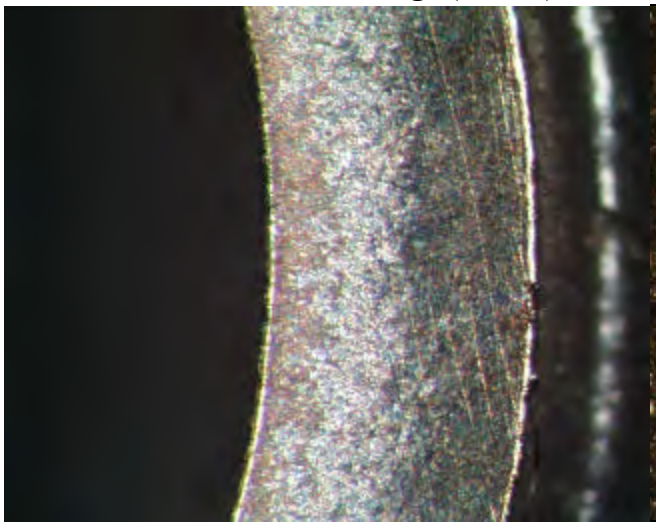
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Air and Water
175 psig/32 psig

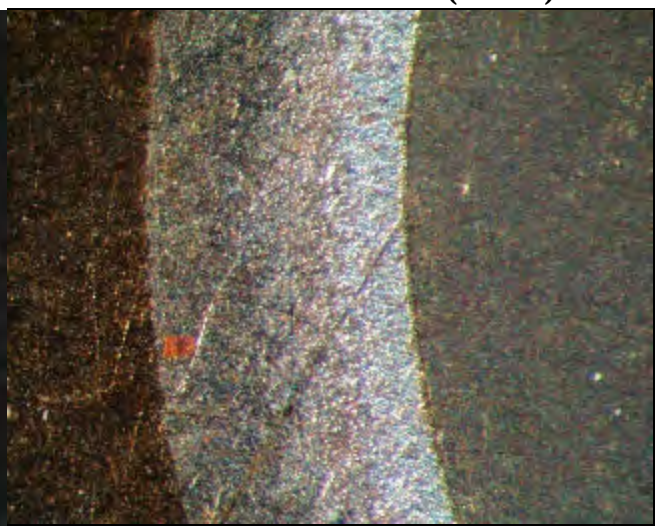


Valve Plate and Reed/Discharge (macro)

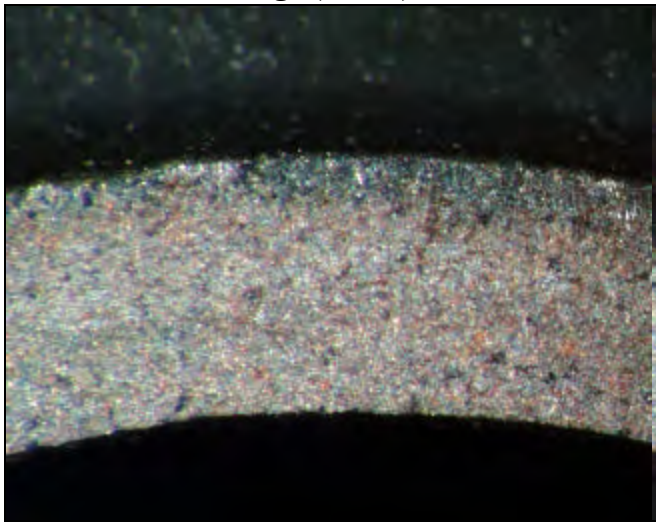
Valve Plate and Reed/Suction (macro)



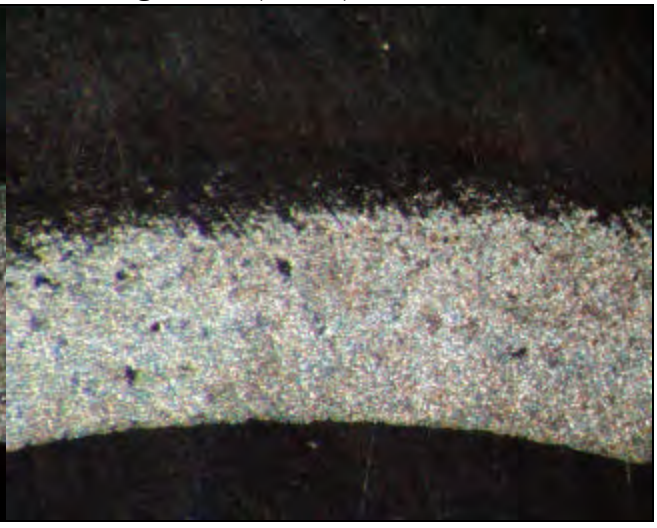
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 119
Model # RS43C1E-CAV-250 **Serial #** 96F16525
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 175
Suction Pressure (psig) 32
Discharge Temp (°F) 212
Return Gas Temp (°F) 65
SumpTemp (°F) 179

Hi-Pot pass
High-low leak fail
Top shell appearance gray
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 1 **(2)** 1 **(3)** 1 **(4)** 1
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 10 **(4)** 10
Suction muffler appearance

OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean/stator top green
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance black/Cu plate
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 7.5 **(2)** 12.5 **(3)** 15 **(4)** 7.5
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 7

Crank journals
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance scored
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980
Bottom thrust washer (crank side)
Appearance scored/wear metals
Wear polish

Bottom washer (casting side)
Appearance scored/corrosion
Wear polish
Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040

Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear/scored
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 119
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	30
Fluoride ion (ppm)	0.59
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	2
Lead (ppm)	0
Silicon (ppm)	3
Tin (ppm)	2
Zinc (ppm)	0

Trash in liquid screen (g)	0.068
Number of screens	1
Debris in compressor bottom (g)	0.583

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

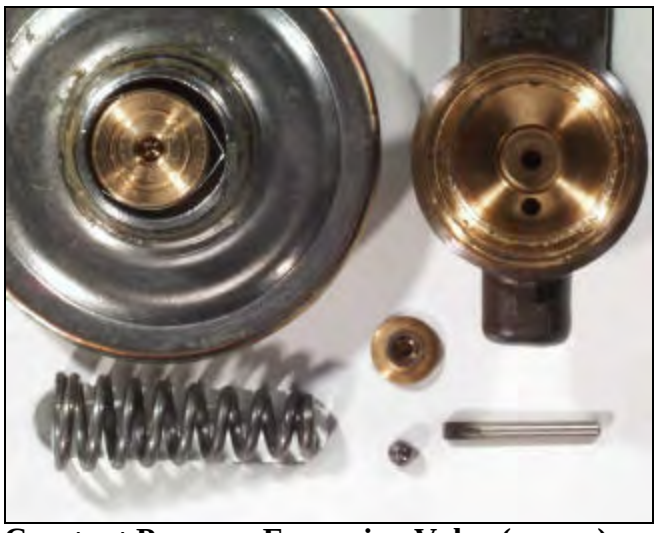
Discharge reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	medium

Expansion Valve Inspection Observations

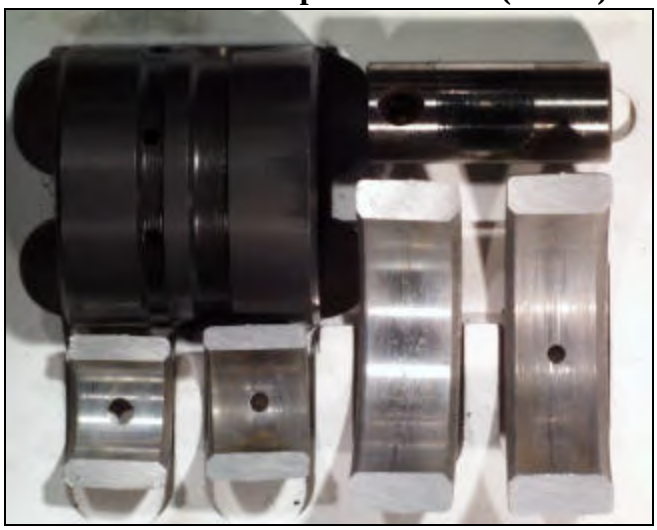
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	hard
Spring	slight	black	hard
Spring Seat	medium	black	hard
Ball	slight	black	hard
Front Side	very slight	black	hard

Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
175 psig/32 psig



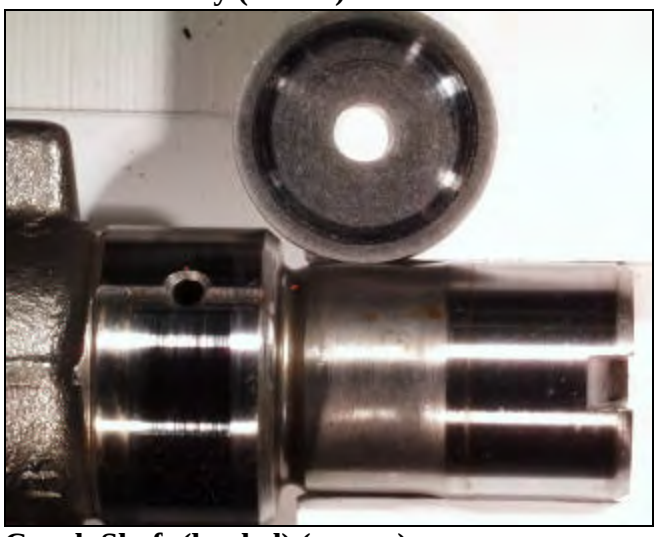
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

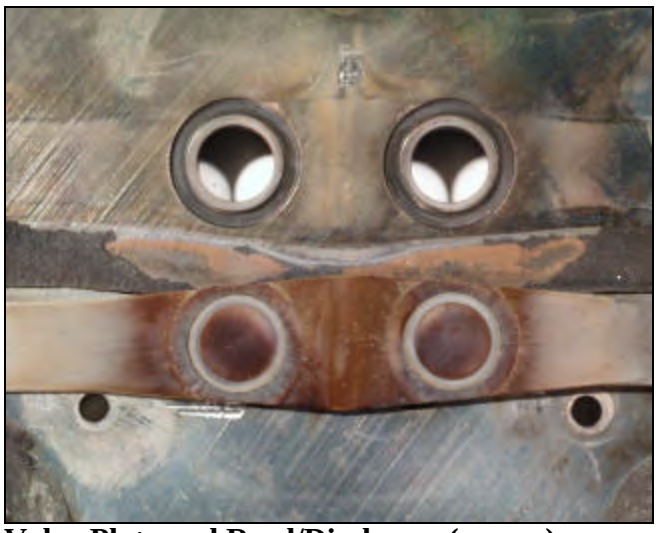
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

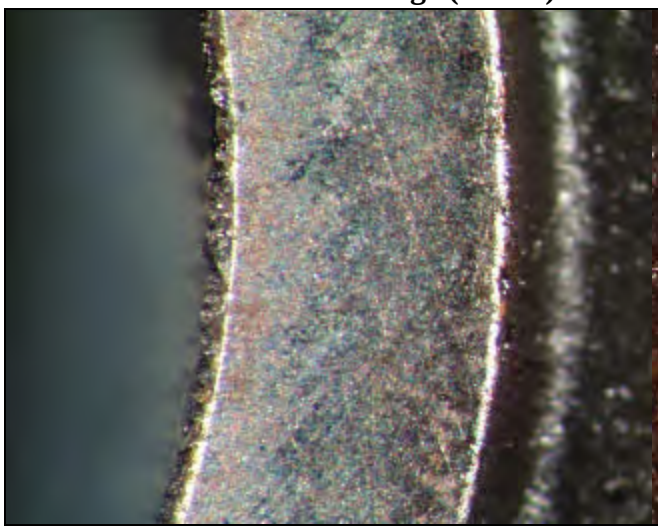
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
175 psig/32 psig

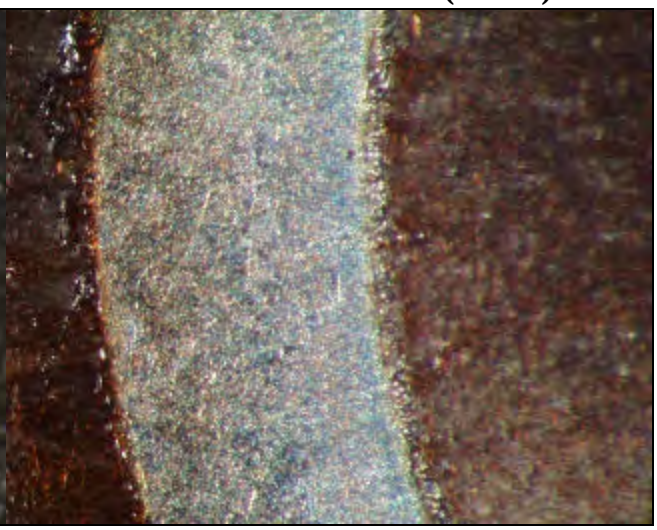


Valve Plate and Reed/Discharge (macro)

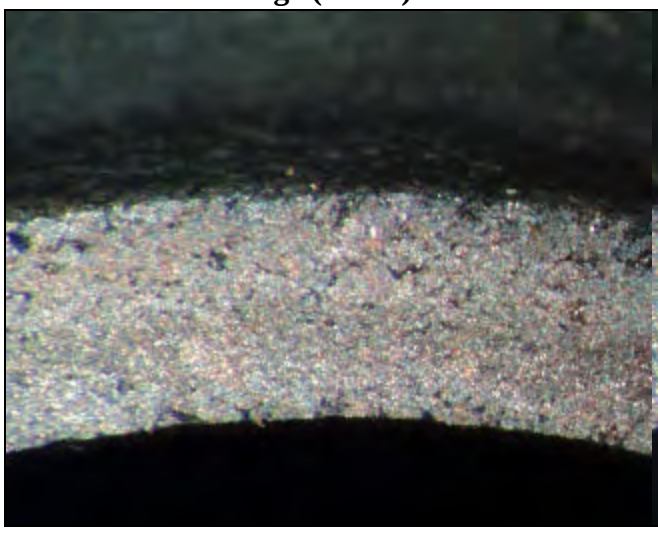
Valve Plate and Reed/Suction (macro)



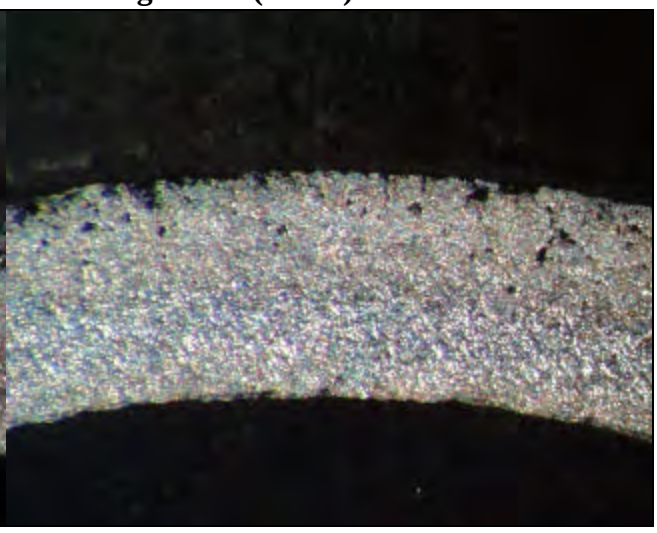
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-22 Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 120
Model # RS43C1E-CAV-250 **Serial #** 96F16537
Run Time (hr.) 12003 **Failed?** No
Refrigerant R-22
Lubricant 3GS
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	175
Suction Pressure (psig)	32
Discharge Temp (°F)	212
Return Gas Temp (°F)	65
SumpTemp (°F)	179
Hi-Pot	pass
High-low leak	fail
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 2 **(2)** 1 **(3)** 2 **(4)** 2
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 15 **(3)** 17.5 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance clean
Wear polish
Dimensions **Loaded** 1.2465
Unloaded 1.2465

Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance scored/bronze plating/wear metals
Wear slight

Bottom washer (casting side)
Appearance scored/corrosion/wear metals
Wear polish

Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear/scored
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear/scored
Varnish ring none
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 120
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	69
Fluoride ion (ppm)	0.68
Chloride ion (ppm)	11
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	3
Lead (ppm)	0
Silicon (ppm)	7
Tin (ppm)	3
Zinc (ppm)	1

Trash in liquid screen (g)	0.033
Number of screens	1
Debris in compressor bottom (g)	0.954

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	medium

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

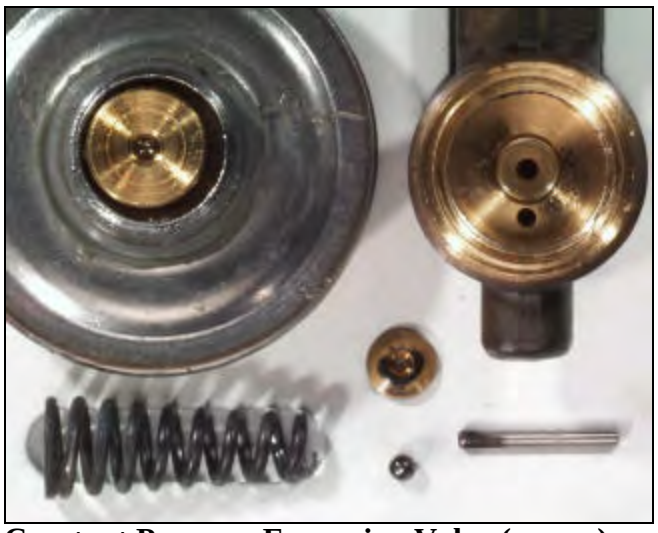
Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Expansion Valve Inspection Observations

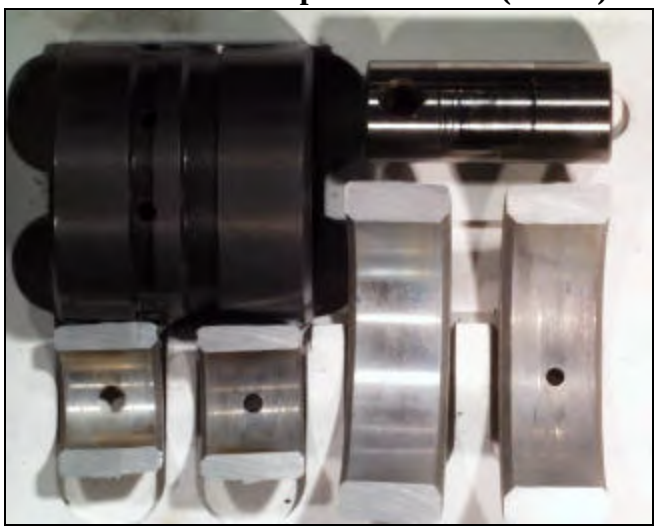
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	medium	black	hard
Spring Seat	medium	black	hard
Ball	medium	black	hard
Front Side	slight	black	hard

Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
175 psig/32 psig



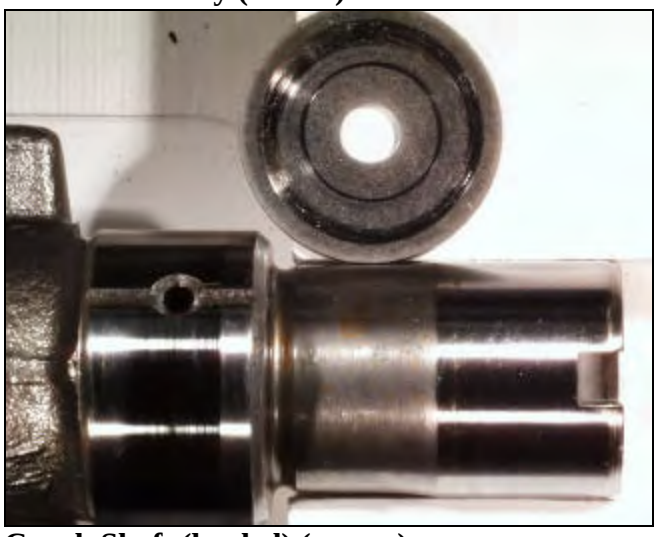
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

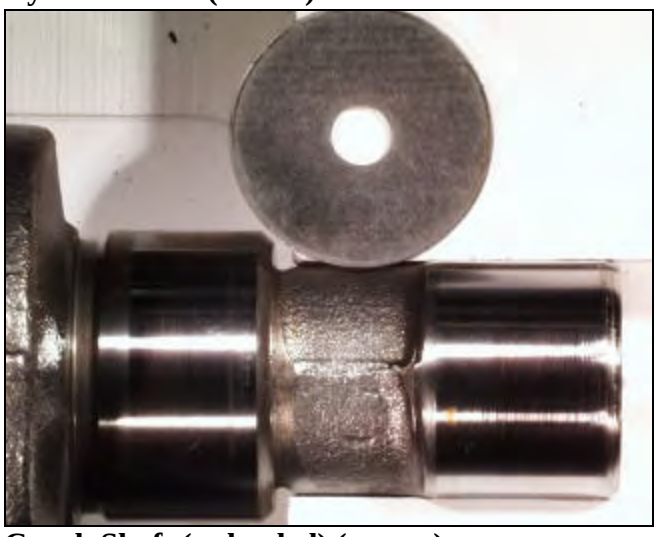


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

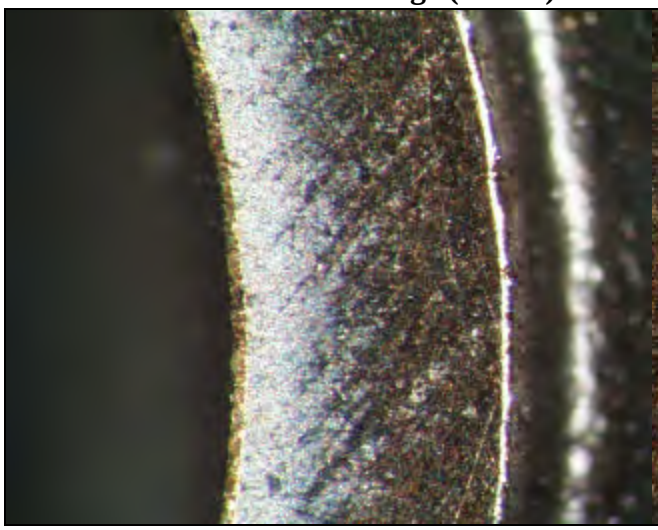


Crank Shaft (unloaded) (macro)

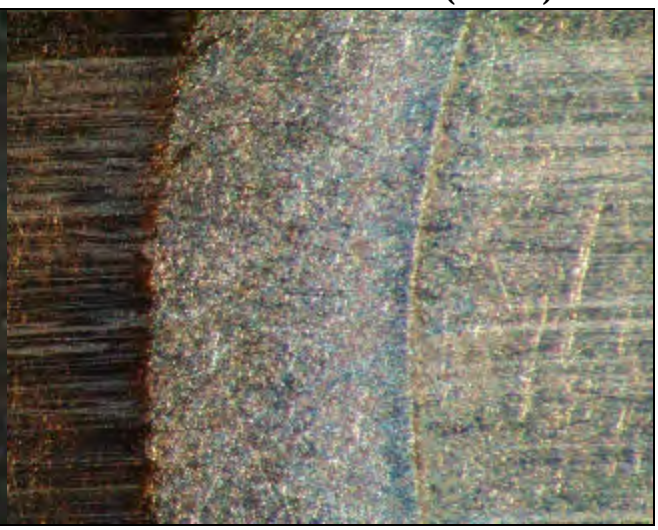
Photographic Documentation of R-22 Compressor with Contaminant Acid, Air, and Water
175 psig/32 psig

Valve Plate and Reed/Discharge (macro)

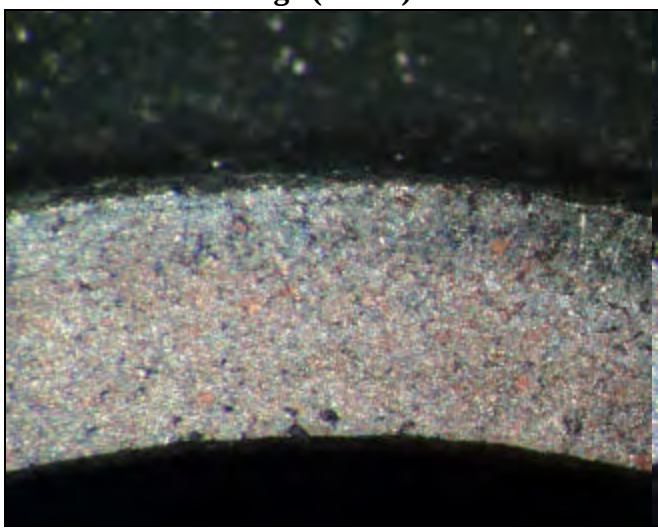
Valve Plate and Reed/Suction (macro)



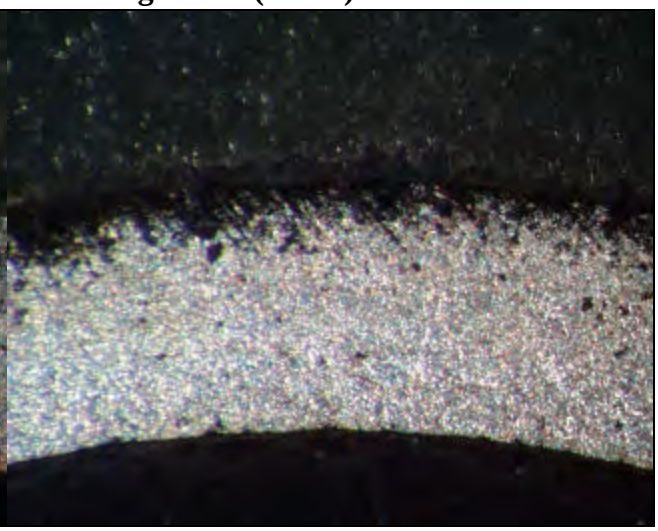
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Control Compressor

TEST HISTORY OF:

Unit Number	121		
Model #	RS40C1E-IAV-250	**Serial #**	96F16558
Run Time (hr.)	12010	**Failed?**	No
Refrigerant	R-134a		
Lubricant	RL32S		
Contaminants:			
Control Unit?	Yes		
Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler

(1) 5 **(2)** 6.7 **(3)** 5 **(4)** 4.3

Remaining torque of stator bolts

(1) 11.7 **(2)** 11.7 **(3)** 11.7 **(4)** 11.7

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed

(1) 15 **(2)** 14 **(3)** 15 **(4)** 15

Head gasket brittle?	no/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts

(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 121
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	220
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.001
Number of screens	1
Debris in compressor bottom (g)	0.380

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	none	none	none
Spring Seat	heavy	black	hard
Ball	medium	black	gummy
Front Side	none	none	none

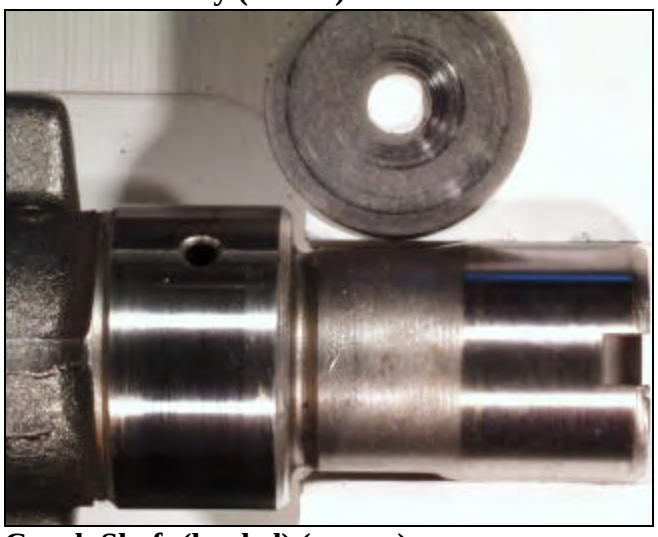
Photographic Documentation of R-134a Control Compressor
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

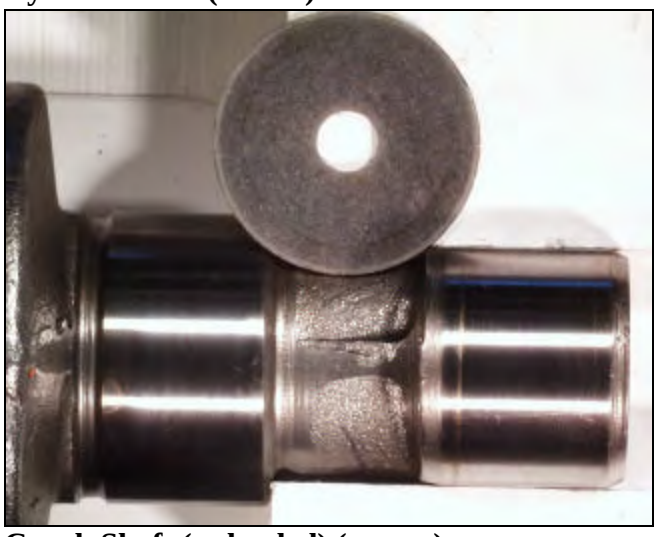
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

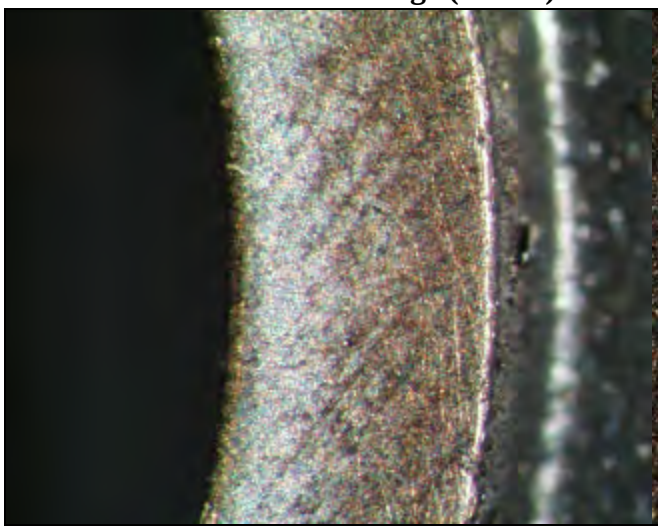


Crank Shaft (unloaded) (macro)

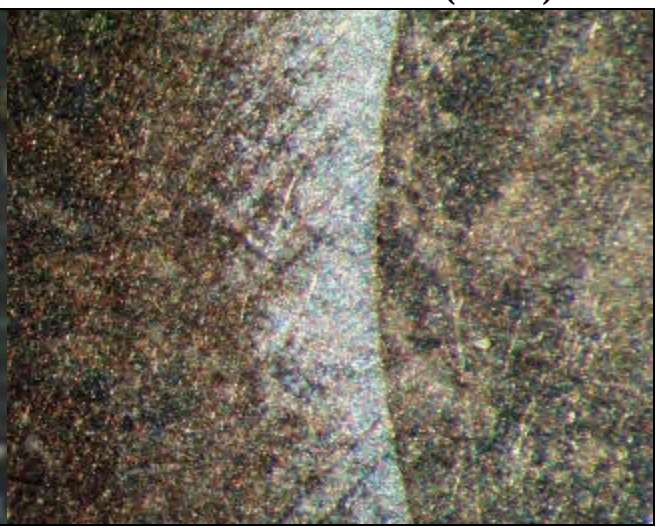
Photographic Documentation of R-134a Control Compressor
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

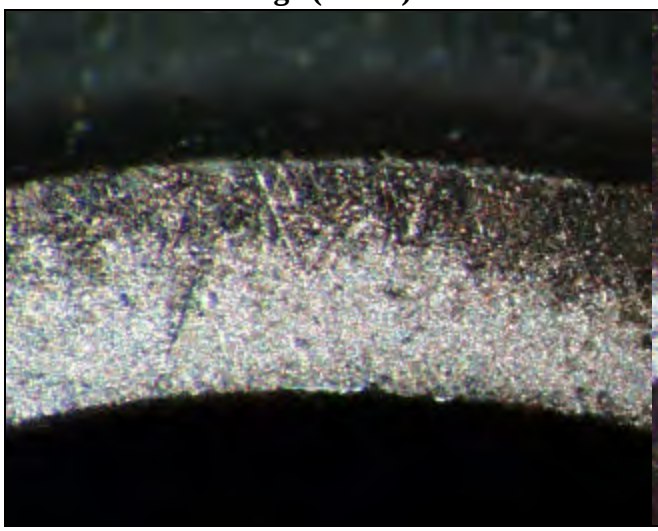
Valve Plate and Reed/Suction (macro)



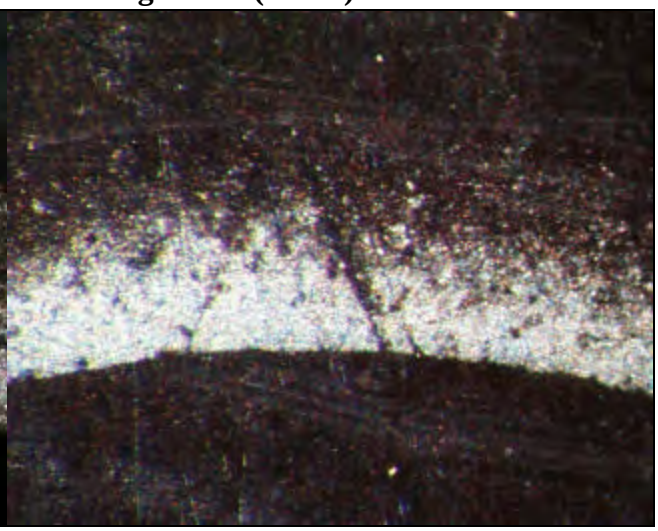
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Control Compressor

TEST HISTORY OF:

Unit Number 122
Model # RS40C1E-IAV-250 **Serial #** 96F16557
Run Time (hr.) 12026 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 3.8 **(2)** 6.3 **(3)** 5 **(4)** 3.8
Remaining torque of stator bolts
(1) 11.7 **(2)** 11.7 **(3)** 11.7 **(4)** 11.7

Suction muffler appearance	clean
OEM flux?	No
Loose restrictor?	No
Discharge plate appearance	clean/Cu
Top stator windings appearance	black
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 14 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 3 **(2)** 5 **(3)** 5 **(4)** 6

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	polish	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2505

TEST HISTORY OF:

Unit Number 122
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/bronze plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	209
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.024
Number of screens	2
Debris in compressor bottom (g)	0.314

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/carbon
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	medium	black	gummy
Tip of Pin	heavy	black	gummy
Spring	none	none	none
Spring Seat	medium	black	hard
Ball	slight	brown	gummy
Front Side	very slight	brown	hard

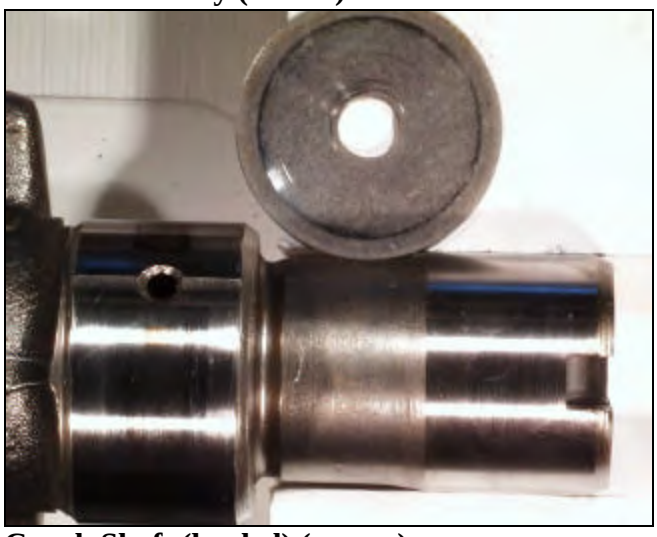
Photographic Documentation of R-134a Control Compressor
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

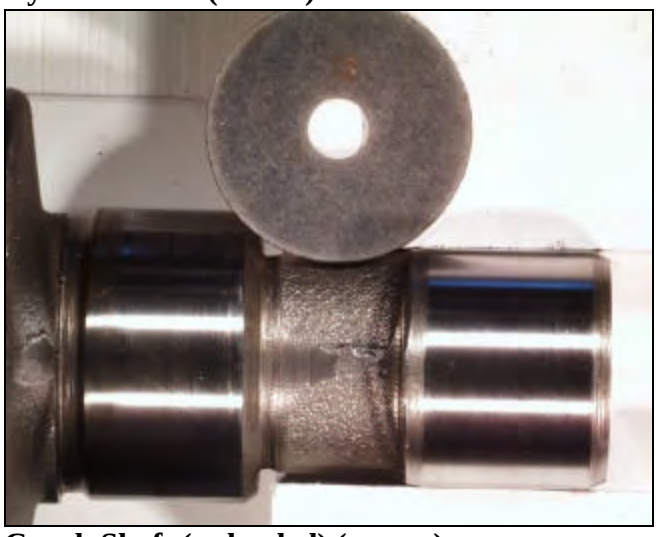
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)



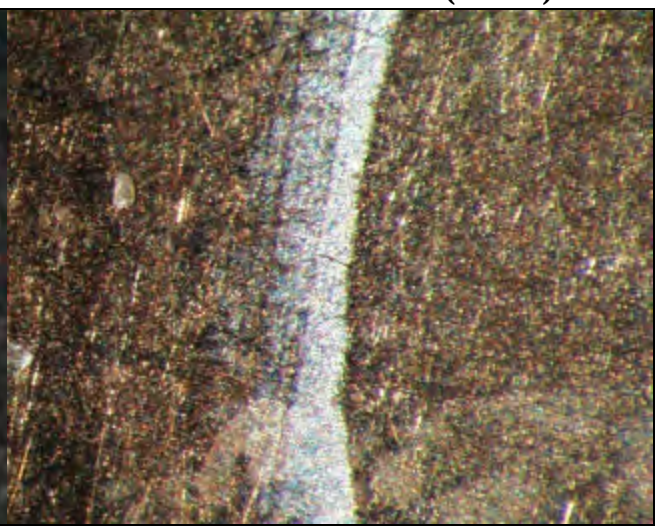
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Control Compressor
145 psig/20 psig

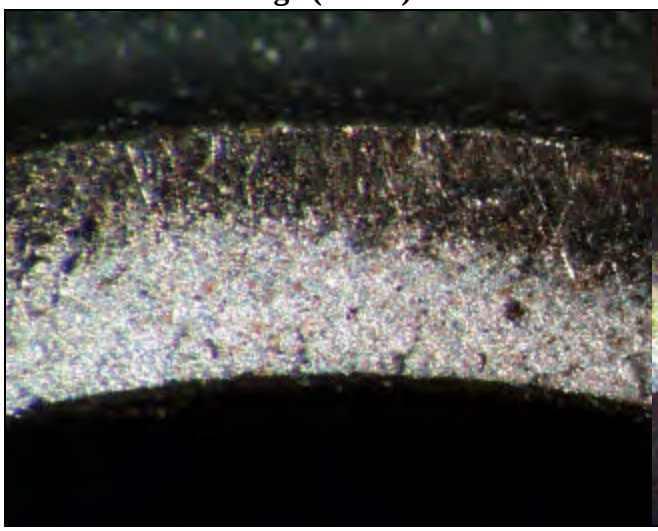
Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

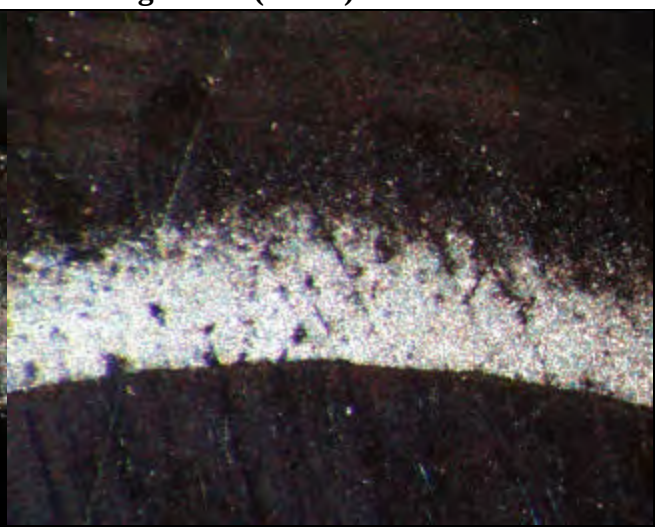
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Control Compressor

TEST HISTORY OF:

Unit Number 123
Model # RS40C1E-IAV-250 **Serial #** 96F16572
Run Time (hr.) 12005 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	none
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.6 **(2)** 5 **(3)** 5 **(4)** 4.6
Remaining torque of stator bolts
(1) 11.7 **(2)** 11.7 **(3)** 11.7 **(4)** 11.7

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean/Cu
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6 **(2)** 7 **(3)** 6 **(4)** 6

Crank journals		
Appearance	clean/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	none	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 123
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/bronze plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.04
Water (ppm)	188
Fluoride ion (ppm)	1.2
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.001
Number of screens	1
Debris in compressor bottom (g)	0.510

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

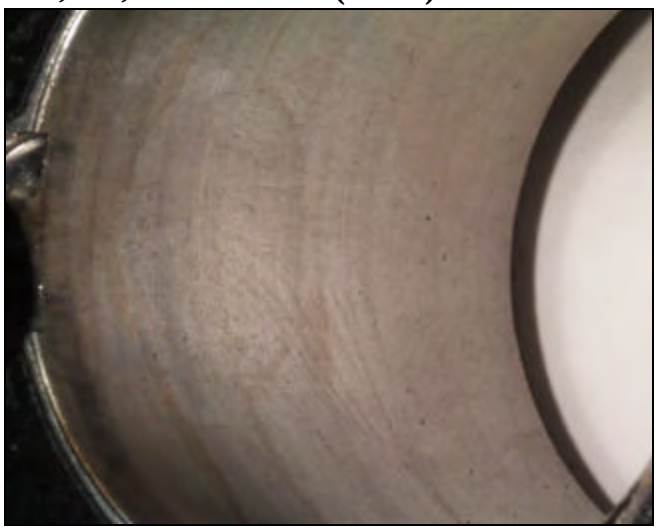
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	very slight	black	hard
Tip of Pin	medium	black	hard
Spring	very slight	gray	gummy
Spring Seat	medium	brown	gummy
Ball	slight	gray	gummy
Front Side	very slight	gray	hard

Photographic Documentation of R-134a Control Compressor
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

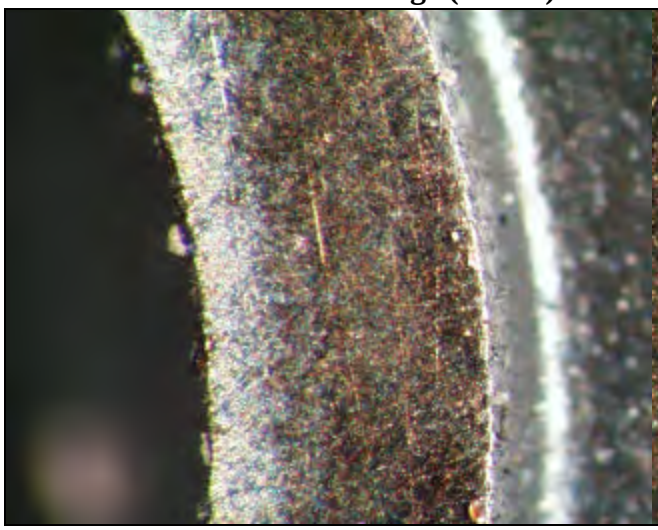
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

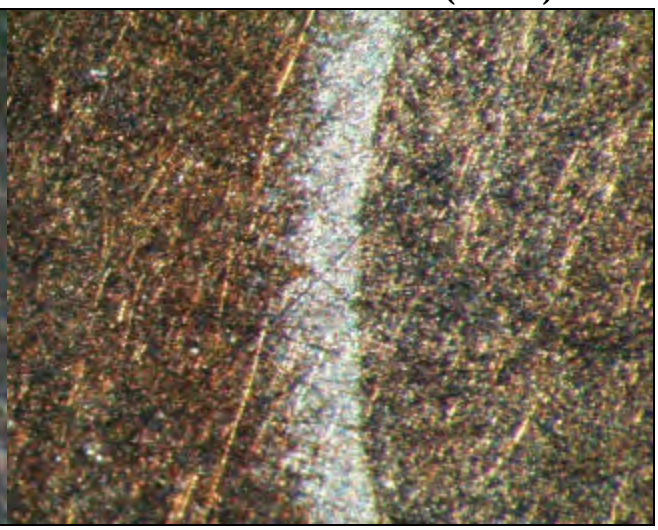
Photographic Documentation of R-134a Control Compressor
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

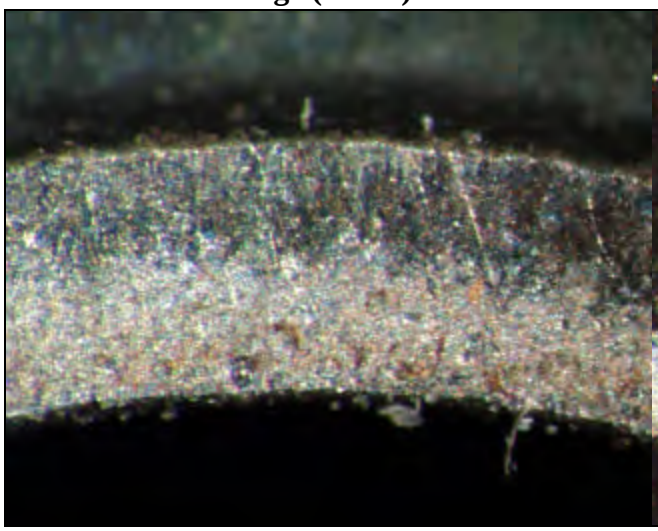
Valve Plate and Reed/Suction (macro)



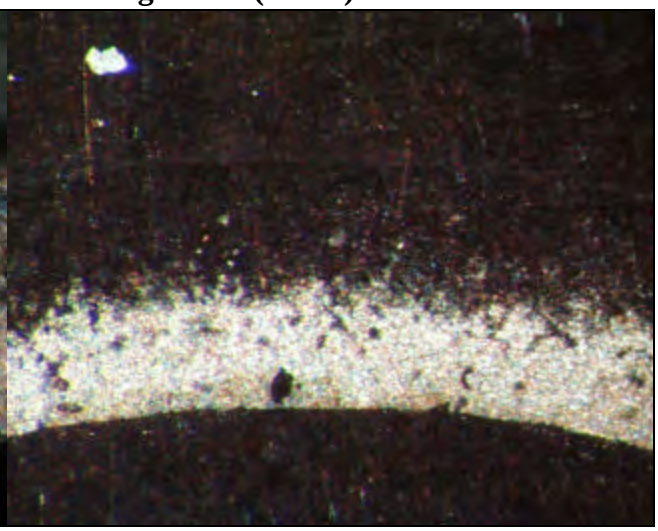
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant R-12

TEST HISTORY OF:

Unit Number 124
Model # RS40C1E-IAV-250 **Serial #** 96F16570
Run Time (hr.) 12012 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** Yes
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 15 **(2)** 12.5 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 17.5 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	low wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	medium	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3765
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 124
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.5020
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	48
Fluoride ion (ppm)	1.3
Chloride ion (ppm)	17
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	0
Lead (ppm)	2
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.011
Number of screens	1
Debris in compressor bottom (g)	0.717

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

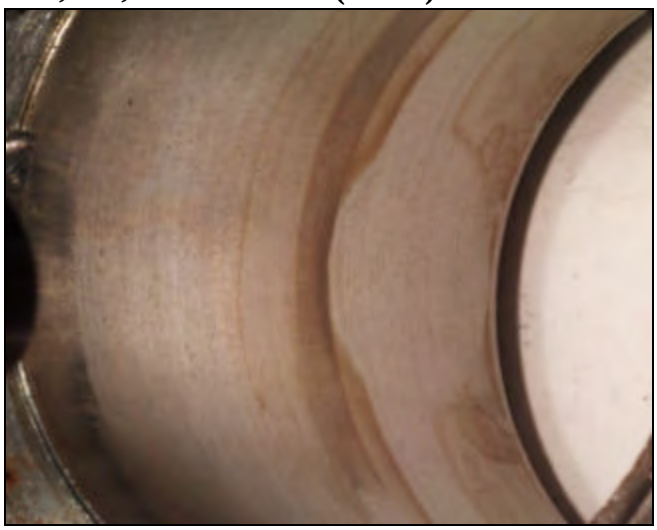
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	slight	tan	hard
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	slight	tan	gummy
Spring Seat	very slight	tarnished	hard
Ball	medium	gray, brown	hard, gummy
Front Side	medium	brown, tan	hard

Photographic Documentation of R-134a Compressor with Contaminant R-12
145 psig/20 psig

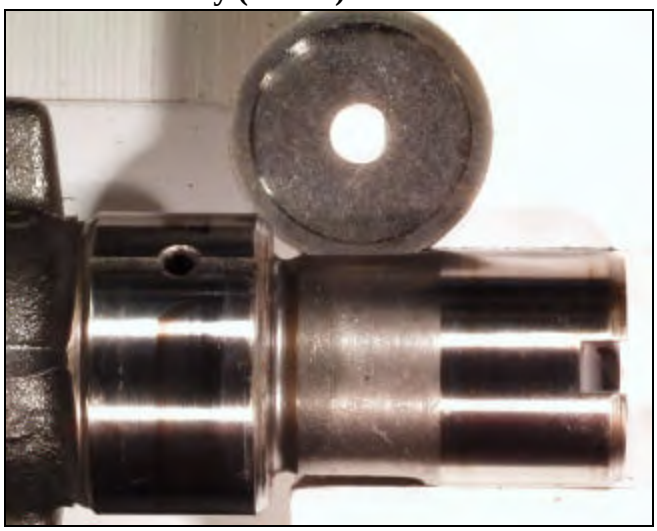
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

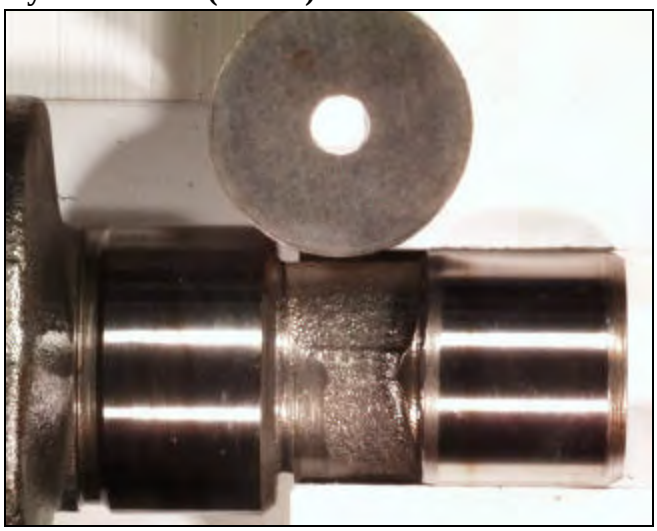
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

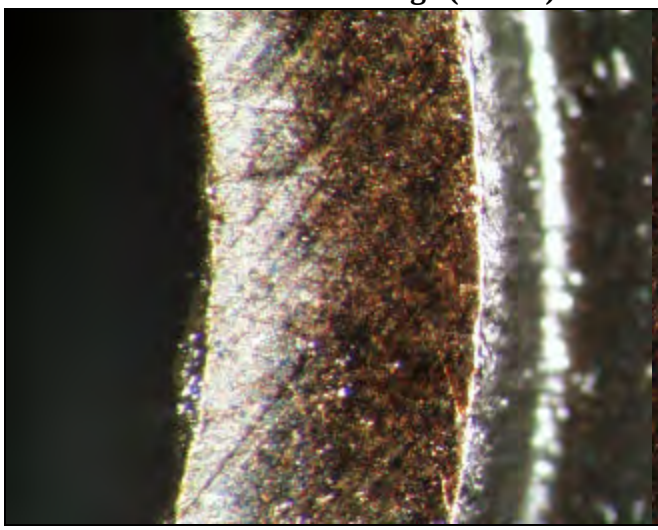


Crank Shaft (unloaded) (macro)

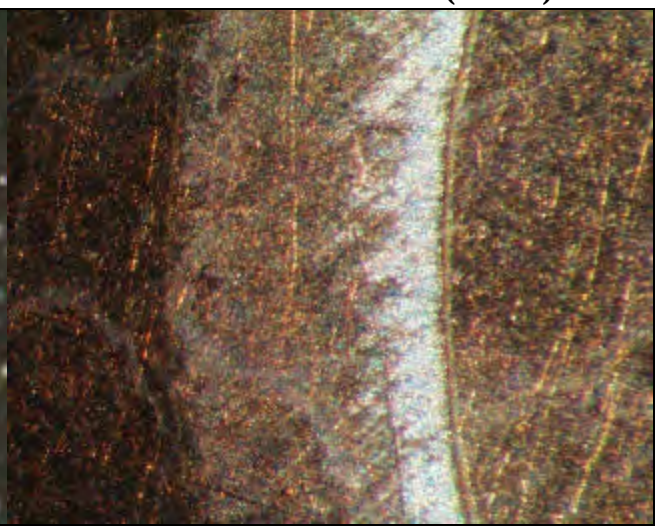
Photographic Documentation of R-134a Compressor with Contaminant R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

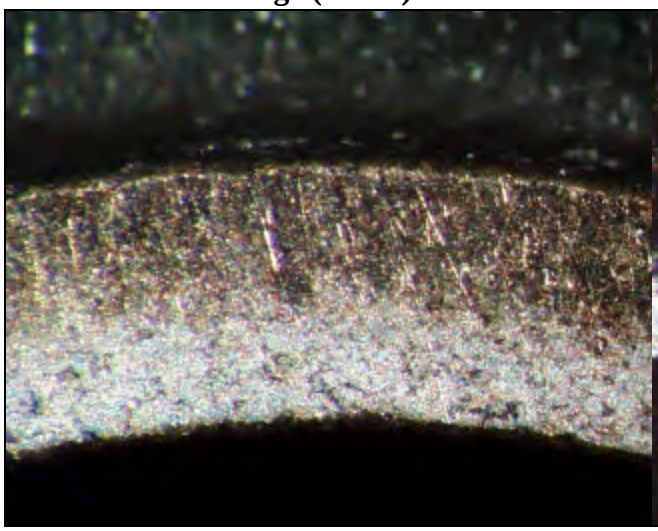
Valve Plate and Reed/Suction (macro)



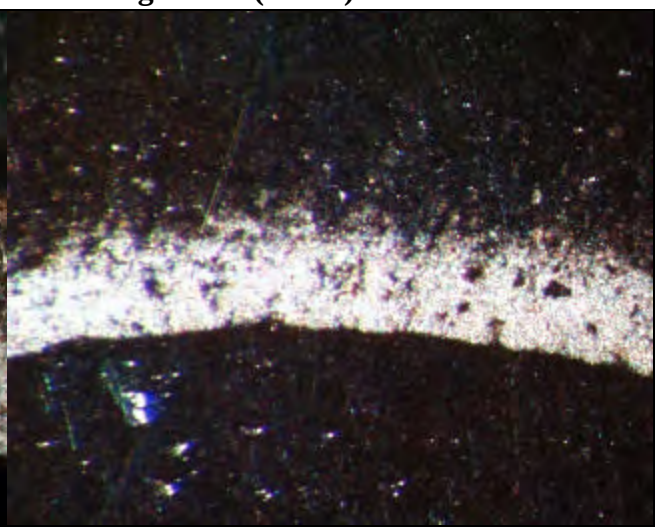
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 125
Model # RS40C1E-IAV-250 **Serial #** 96F16554
Run Time (hr.) 12085 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 145
Suction Pressure (psig) 20
Discharge Temp (°F) 187
Return Gas Temp (°F) 64
SumpTemp (°F) 174

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance black
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance Cu
Top stator windings appearance gray
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2

Crank journals
Appearance Cu plating/corrosion
Wear slight
Dimensions **Loaded** 1.2465
Unloaded 1.2465
Lower crank bearing journal
Appearance clean/Cu plating
Wear slight
Dimensions **Loaded** 0.9995
Unloaded 0.9995
Bottom thrust washer (crank side)
Appearance clean/scored/corrosion
Wear slight
Bottom washer (casting side)
Appearance clean/scored
Wear slight
Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0045
Unloaded 1.0045
Shaft in cage bearing
Appearance clean
Wear slight
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3725
Unloaded 1.3725
Cylinder bore
Appearance no wear/scored/corrosion
Varnish ring slight
Dimensions **Loaded** 1.3765
Unloaded 1.3765
Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 125
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	43
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	1
Lead (ppm)	4
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	2

Trash in liquid screen (g)	0.032
Number of screens	2
Debris in compressor bottom (g)	1.168

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

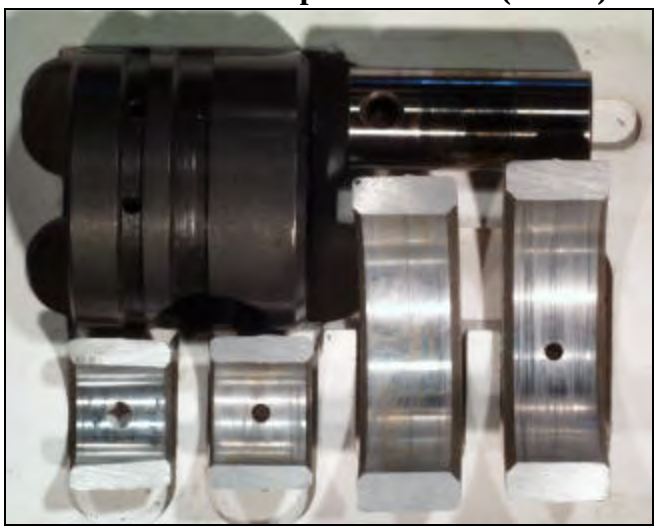
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	medium	black	hard
Spring Seat	slight	black	hard
Ball	medium	black	hard
Front Side	none	none	none

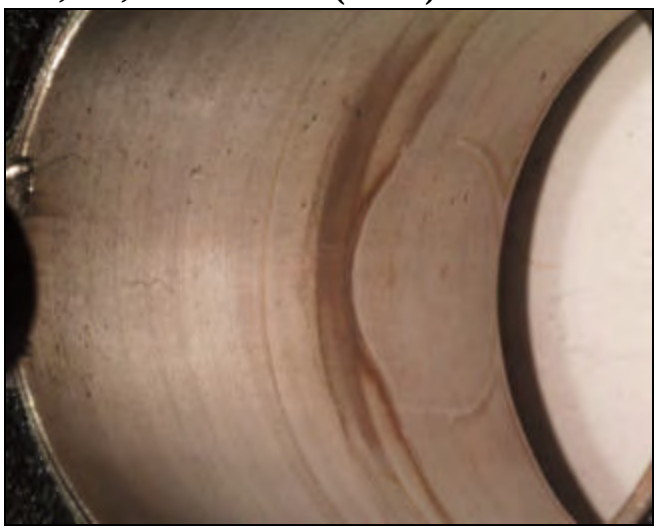
Photographic Documentation of R-134a Compressor with Contaminant Acid
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

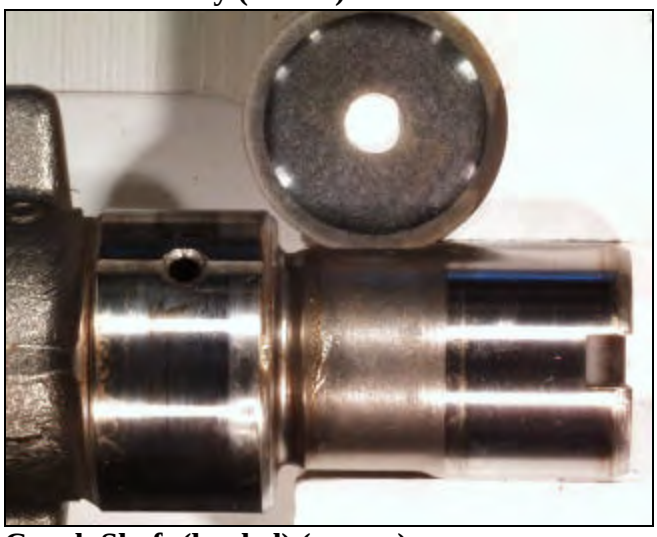
Ball, Pin, Seat of CPEV (micro)



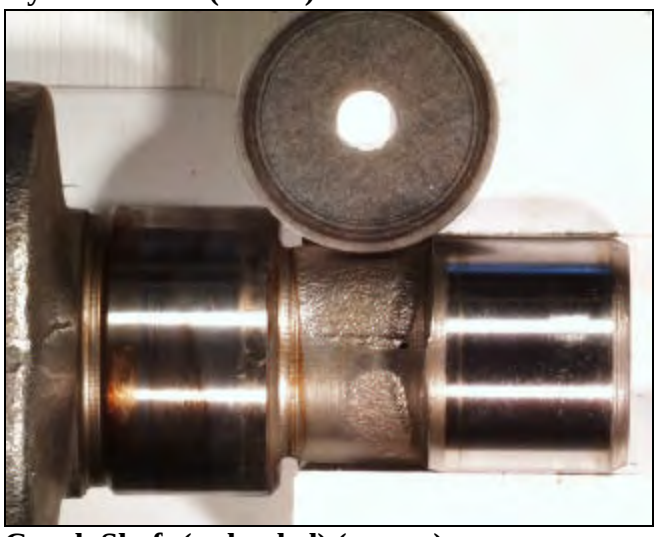
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

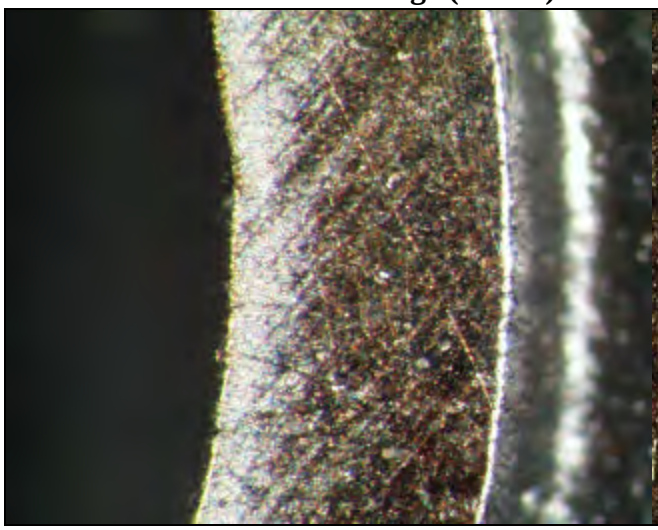


Crank Shaft (unloaded) (macro)

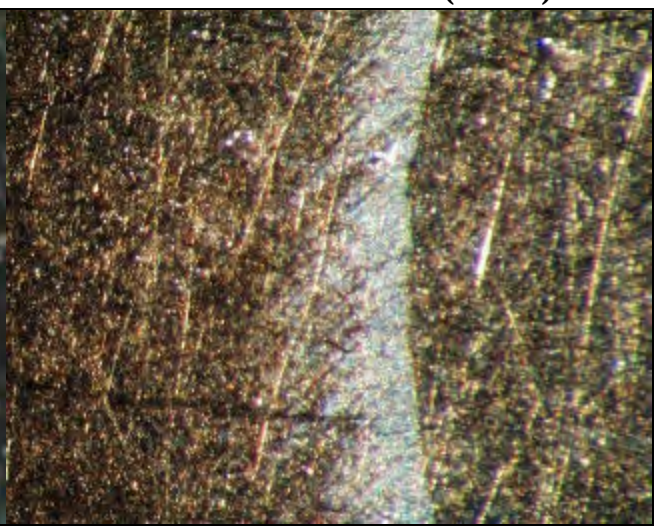
Photographic Documentation of R-134a Compressor with Contaminant Acid
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

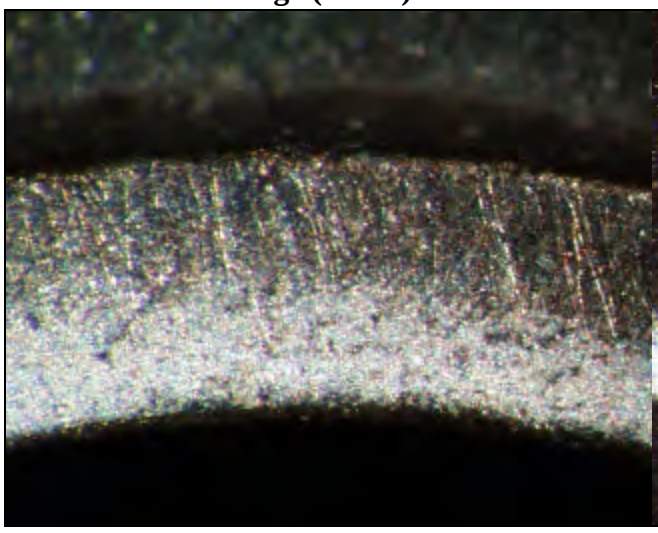
Valve Plate and Reed/Suction (macro)



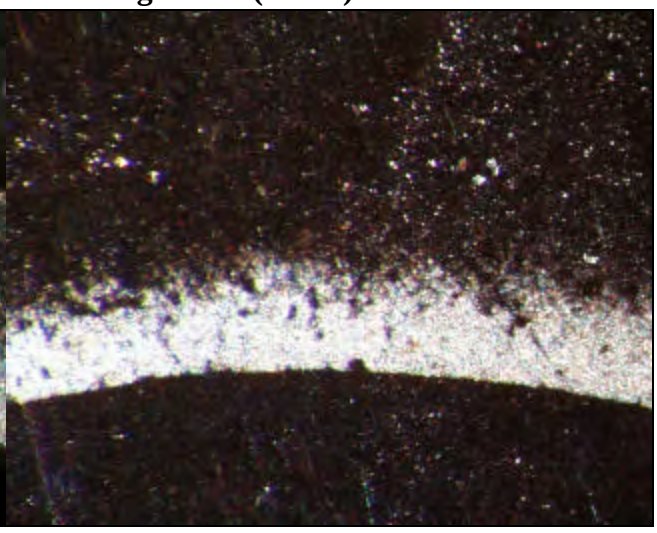
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 126
Model # RS40C1E-IAV-250 **Serial #** 96F16578
Run Time (hr.) 12012 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 6.3 **(2)** 4.2 **(3)** 4.2 **(4)** 6.3
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 6.3

Crank journals		
Appearance	clean/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2475
	Unloaded	1.2475
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.0000
	Unloaded	1.0000
Bottom thrust washer (crank side)		
Appearance	clean/Cu plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean/Cu plating	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.2520
	Unloaded	1.2520

TEST HISTORY OF:

Unit Number 126
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5020
	Unloaded	0.5020

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	27
Fluoride ion (ppm)	0.92
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.100
Number of screens	3
Debris in compressor bottom (g)	0.974

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	gummy
Rear Pin	none	none	none
Equalizer Hole	slight	black	gummy
Tip of Pin	slight	black	gummy
Spring	slight	black	gummy
Spring Seat	very slight	black	hard
Ball	very slight	black	gummy
Front Side	medium	black	hard

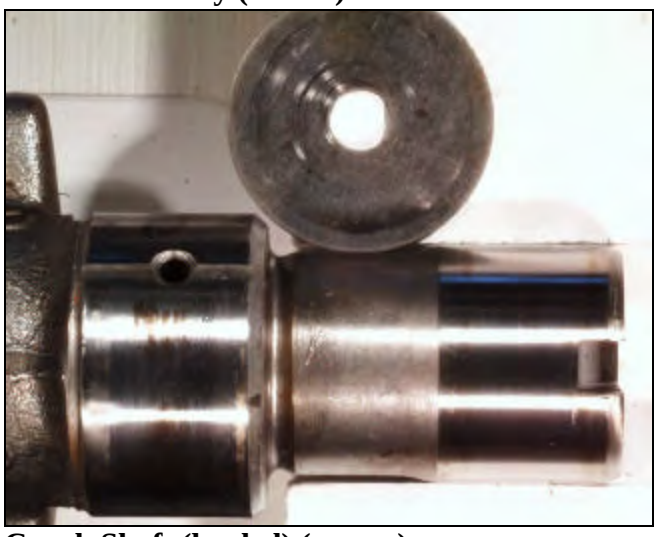
Photographic Documentation of R-134a Compressor with Contaminant Air
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

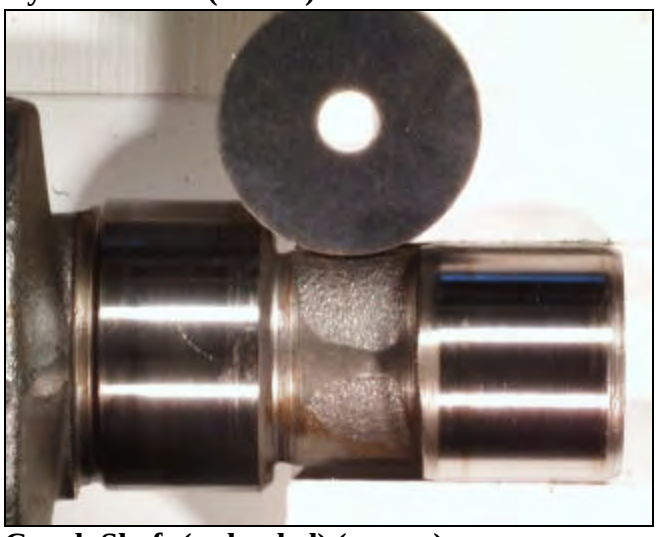
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

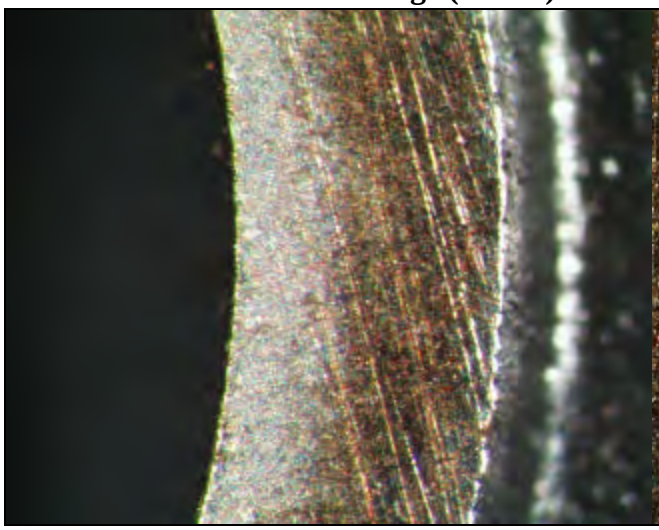


Crank Shaft (unloaded) (macro)

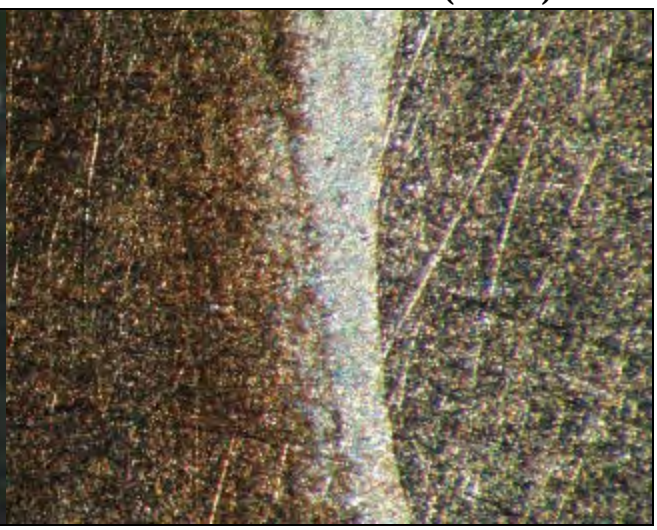
Photographic Documentation of R-134a Compressor with Contaminant Air
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

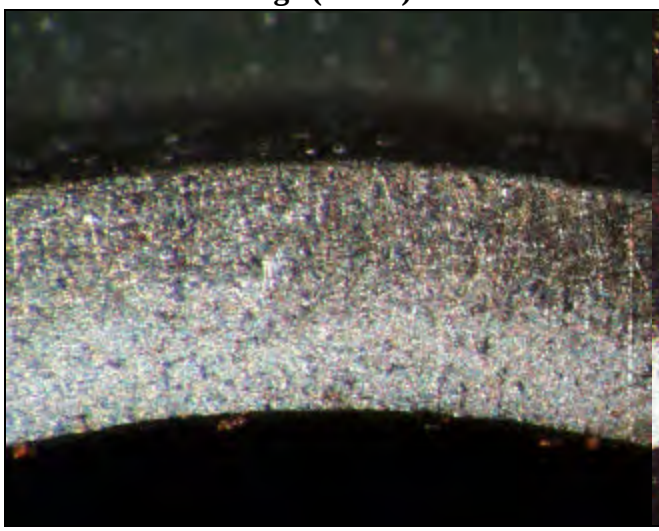
Valve Plate and Reed/Suction (macro)



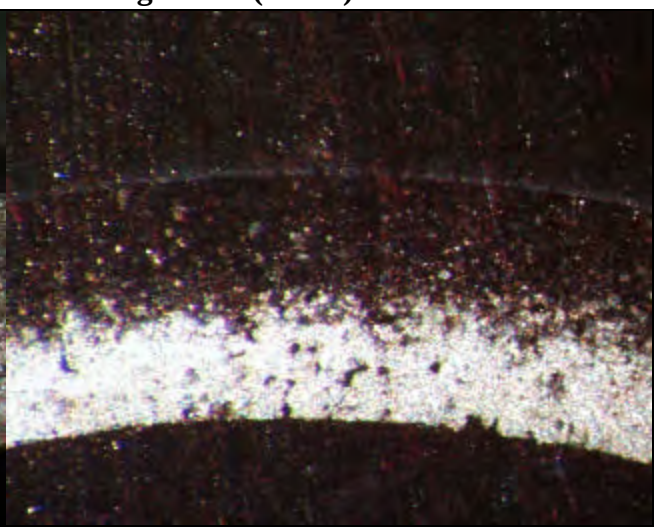
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid and R-12

TEST HISTORY OF:

Unit Number 127
Model # RS40C1E-IAV-250 **Serial #** 96F16579
Run Time (hr.) 12025 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 6.3 **(3)** 6.3 **(4)** 6.3

Crank journals
Appearance clean/Cu plating/corrosion
Wear slight
Dimensions **Loaded** 1.2485
Unloaded 1.2485

Lower crank bearing journal
Appearance clean/bronze plating
Wear polish
Dimensions **Loaded** 1.0020
Unloaded 1.0020

Bottom thrust washer (crank side)
Appearance clean/Cu plating
Wear slight

Bottom washer (casting side)
Appearance clean
Wear polish

Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0040
Unloaded 1.0040

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3730
Unloaded 1.3730

Cylinder bore
Appearance no wear
Varnish ring very slight
Dimensions **Loaded** 1.3745
Unloaded 1.3745

Connecting rod (large end)
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 127
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5020
	Unloaded	0.5020

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.14
Water (ppm)	41
Fluoride ion (ppm)	0.95
Chloride ion (ppm)	17
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	1
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.073
Number of screens	2
Debris in compressor bottom (g)	0.752

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

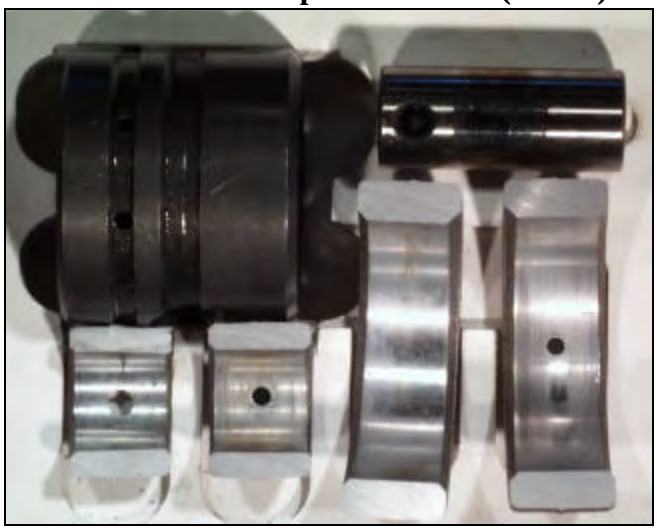
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	heavy	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	slight	black	hard
Spring Seat	medium	black	hard
Ball	medium	black	hard
Front Side	heavy	black	hard

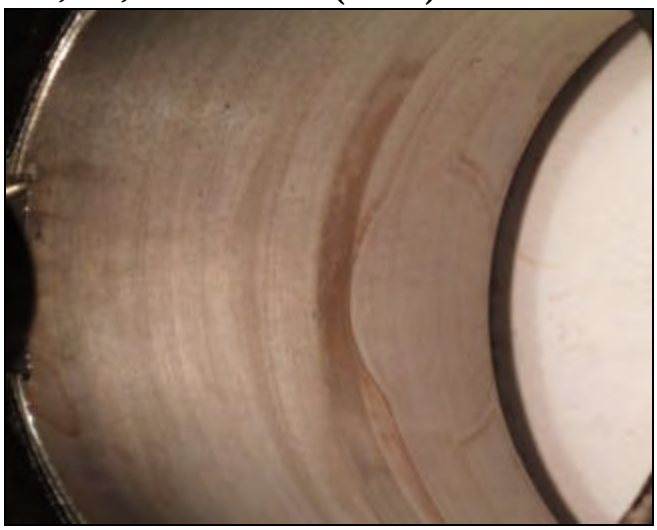
Photographic Documentation of R-134a Compressor with Contaminant Acid and R-12
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

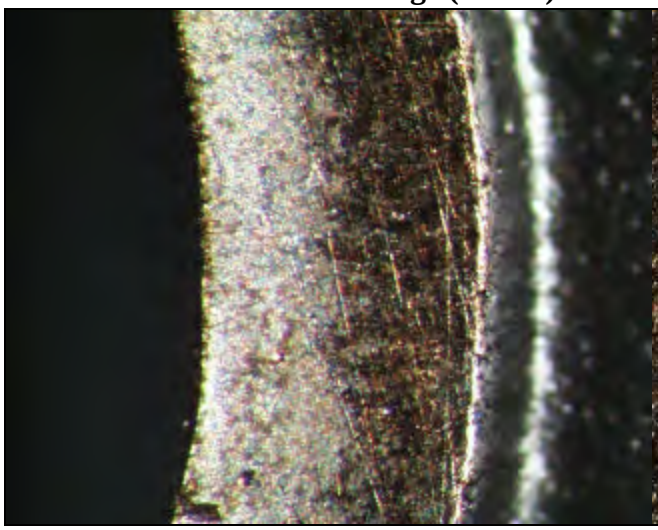
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

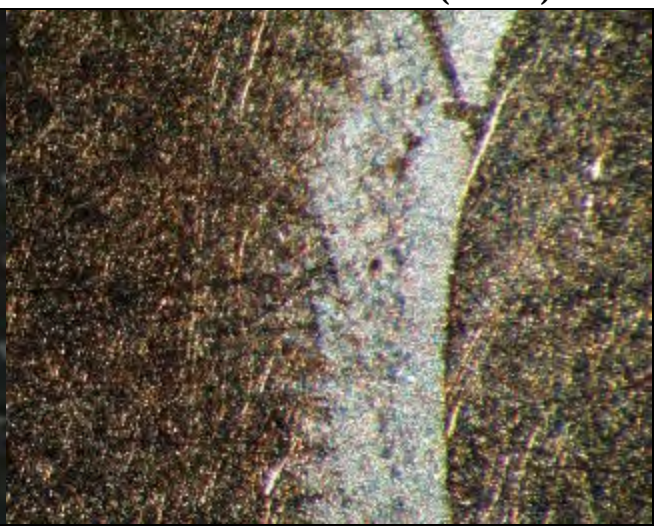
Photographic Documentation of R-134a Compressor with Contaminant Acid and R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

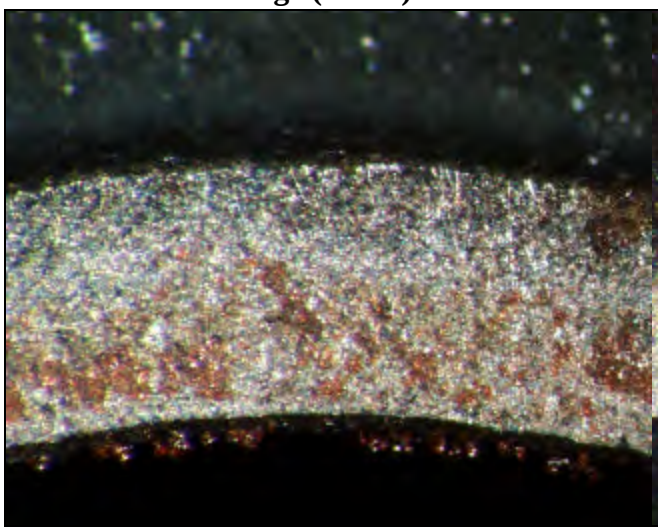
Valve Plate and Reed/Suction (macro)



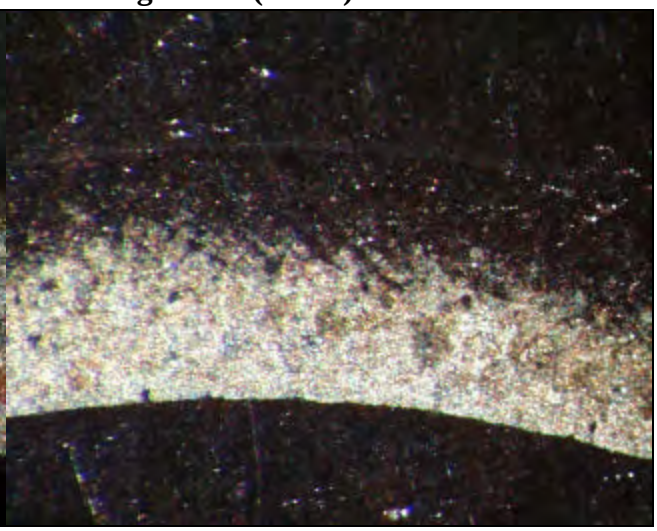
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Air, and R-12

TEST HISTORY OF:

Unit Number 128
Model # RS40C1E-IAV-250 **Serial #** 96F16553
Run Time (hr.) 12109 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 14.6

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/black/Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2

Crank journals		
Appearance	clean/Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.2480
	Unloaded	1.2480
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Bottom thrust washer (crank side)		
Appearance	clean/scored	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	slight	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	low wear/corrosion	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3755
	Unloaded	1.3755
Connecting rod (large end)		
Appearance	none	
Wear	polish	
Dimensions	**Loaded**	1.2505
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 128
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	Cu plating/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.11
Water (ppm)	50
Fluoride ion (ppm)	0.99
Chloride ion (ppm)	17
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	3
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.036
Number of screens	2
Debris in compressor bottom (g)	0.694

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

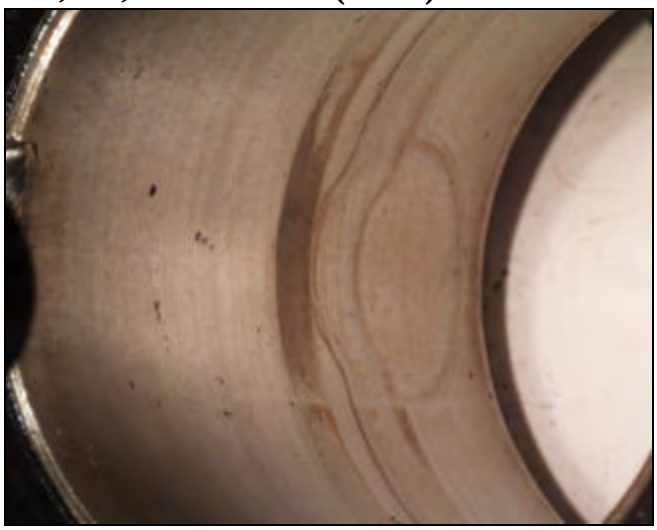
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	slight	black	hard
Spring Seat	slight	gray	hard
Ball	very slight	gray	hard
Front Side	very slight	gray	hard

Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and R-12
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

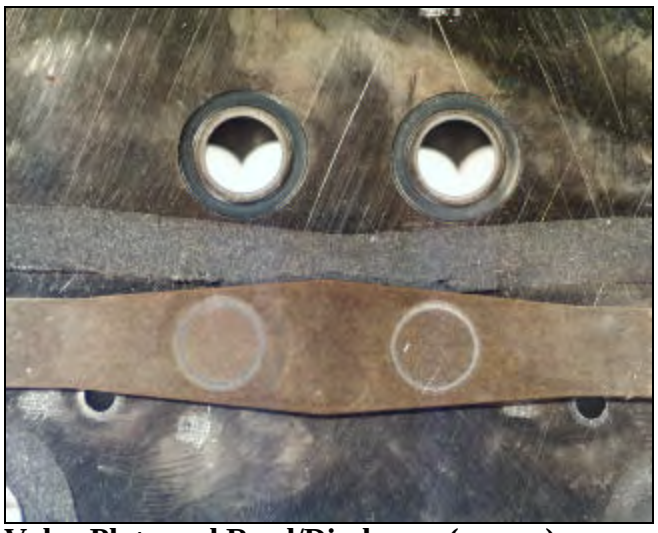


Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

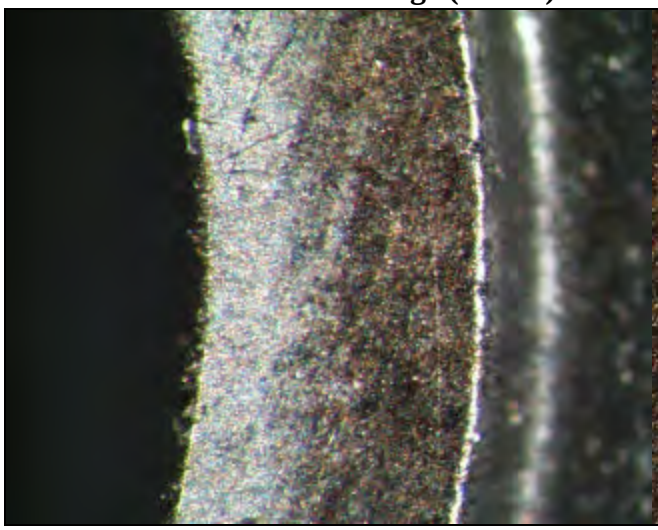
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and R-12
145 psig/20 psig

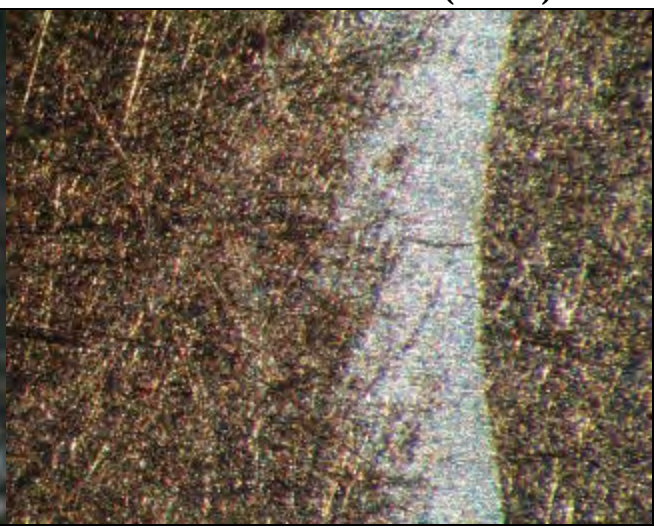


Valve Plate and Reed/Discharge (macro)

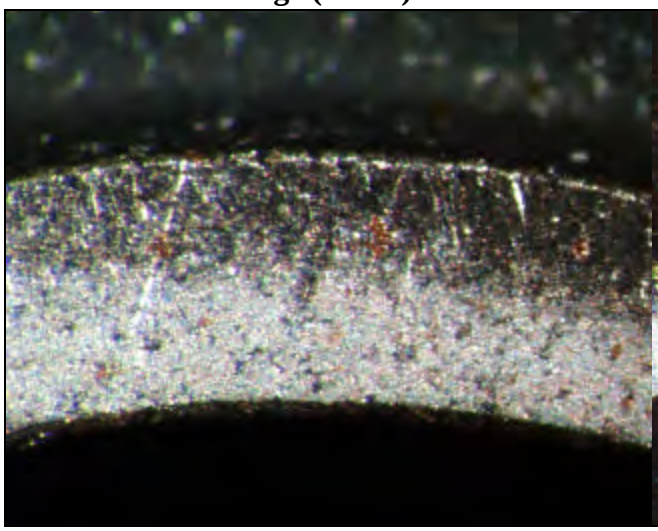
Valve Plate and Reed/Suction (macro)



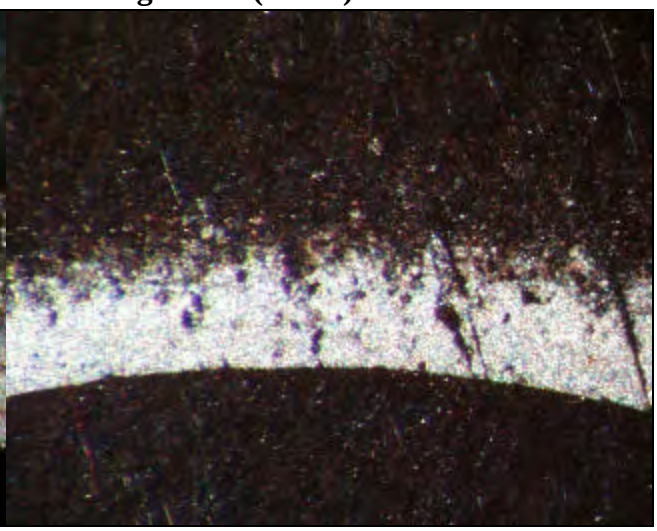
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air and R-12

TEST HISTORY OF:

Unit Number 129
Model # RS40C1E-IAV-250 **Serial #** 96F16569
Run Time (hr.) 12053 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** Yes
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray/black
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 6.3 **(2)** 4.2 **(3)** 6.3 **(4)** 6.3
Remaining torque of stator bolts
(1) 10.4 **(2)** 10.4 **(3)** 10.4 **(4)** 10.4

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 14.6

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2

Crank journals
Appearance clean/corrosion
Wear slight
Dimensions **Loaded** 1.2500
Unloaded 1.2500

Lower crank bearing journal
Appearance clean/corrosion
Wear slight
Dimensions **Loaded** 1.0015
Unloaded 1.0015

Bottom thrust washer (crank side)
Appearance scored/bronze plating
Wear medium

Bottom washer (casting side)
Appearance clean
Wear slight

Lower bronze bearings
Appearance clean/corrosion
Wear slight
Dimensions **Loaded** 1.0020
Unloaded 1.0030

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3730
Unloaded 1.3730

Cylinder bore
Appearance no wear/Cu plating
Varnish ring very slight
Dimensions **Loaded** 1.3745
Unloaded 1.3745

Connecting rod (large end)
Appearance none
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 129
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)
- **Appearance** correct washer
- **Wear** slight
- **Dimensions** **Loaded** 0.5015
  Unloaded 0.5015

Piston pin washers appearance
contact wear

Piston pin
- **Appearance** corrosion
- **Wear** slight
- **Dimensions** **Loaded** 0.4985
  Unloaded 0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.05
Water (ppm)	40
Fluoride ion (ppm)	0.91
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	2
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.022
Number of screens	1
Debris in compressor bottom (g)	0.546

Valve Plate Assembly Inspection

Suction side (reed backer)
- **Condition** good
- **Appearance** clean

Suction surface appearance
corrosion

Suction reed
- **Condition** good
- **Appearance** corrosion
- **Trepan** very slight
- **Varnish ring** none

Discharge side (reed backer)
- **Condition** good
- **Appearance** corrosion

Discharge surface appearance
corrosion

Discharge reed
- **Condition** good
- **Appearance** clean
- **Trepan** very slight
- **Varnish ring** none

Expansion Valve Inspection Observations

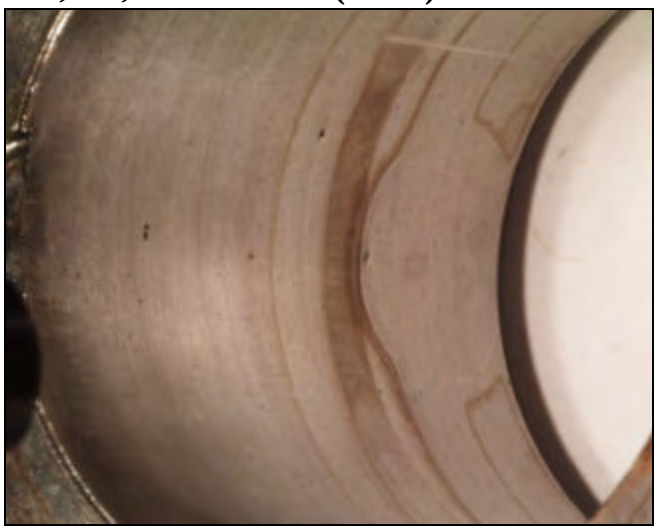
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	hard
Spring	none	none	none
Spring Seat	slight	gray	hard
Ball	slight	gray	hard
Front Side	slight	gray	hard

Photographic Documentation of R-134a Compressor with Contaminant Air and R-12
145 psig/20 psig

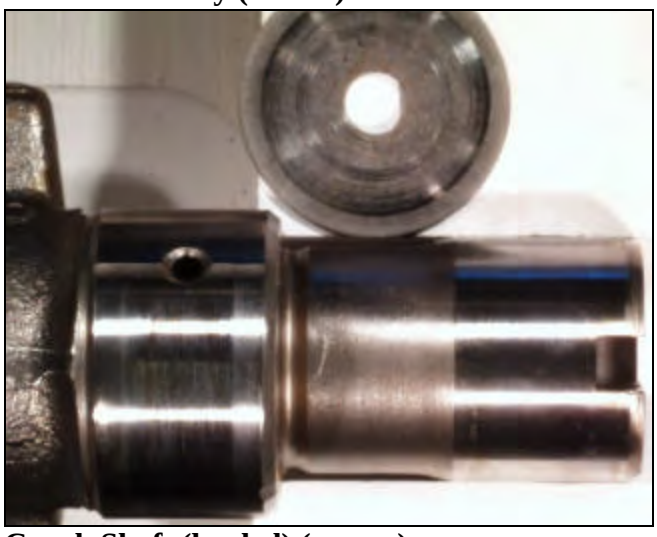
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)



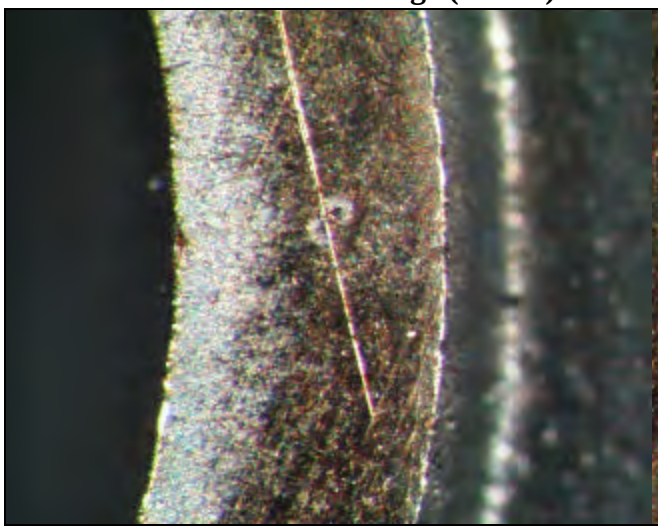
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

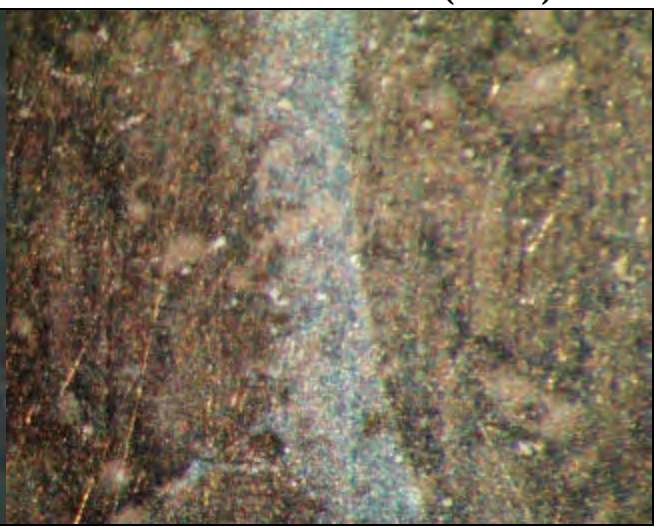
Photographic Documentation of R-134a Compressor with Contaminant Air and R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

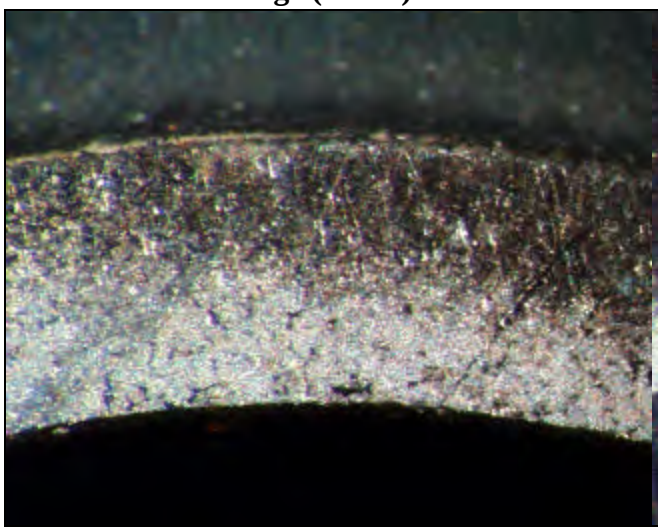
Valve Plate and Reed/Suction (macro)



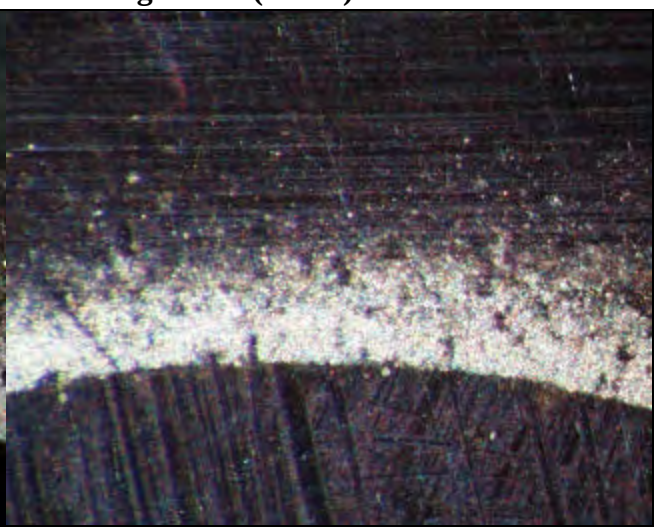
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 130
Model # RS40C1E-IAV-250 **Serial #** 96F16561
Run Time (hr.) 12023 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 8.3 **(2)** 8.3 **(3)** 8.3 **(4)** 8.3

Suction muffler appearance	gray
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/Cu
Top stator windings appearance	clean/Cu trace
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 14.6

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2

Crank journals
Appearance corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2515

Lower crank bearing journal
Appearance corrosion
Wear slight
Dimensions **Loaded** 1.0015
Unloaded 1.0015

Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear slight

Bottom washer (casting side)
Appearance bronze plating
Wear polish

Lower bronze bearings
Appearance corrosion
Wear polish
Dimensions **Loaded** 1.0035
Unloaded 1.0035

Shaft in cage bearing
Appearance clean/corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3735
Unloaded 1.3740

Cylinder bore
Appearance low wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 130
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	41
Fluoride ion (ppm)	0.82
Chloride ion (ppm)	9.0
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	1
Lead (ppm)	4
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	2

Trash in liquid screen (g)	0.019
Number of screens	2
Debris in compressor bottom (g)	0.282

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

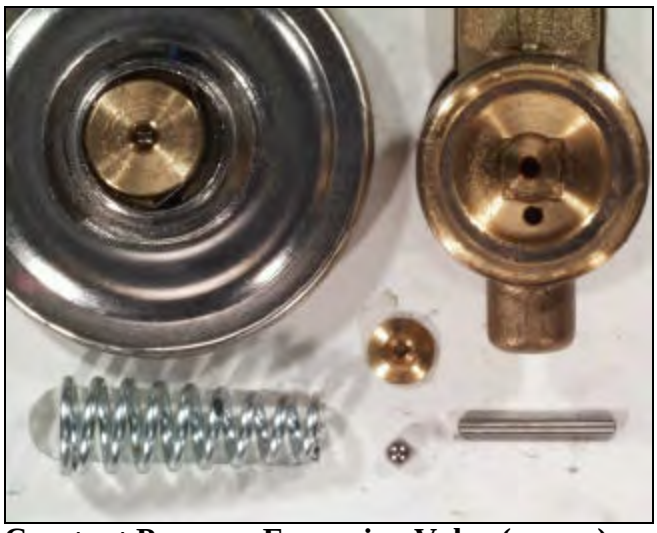
Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

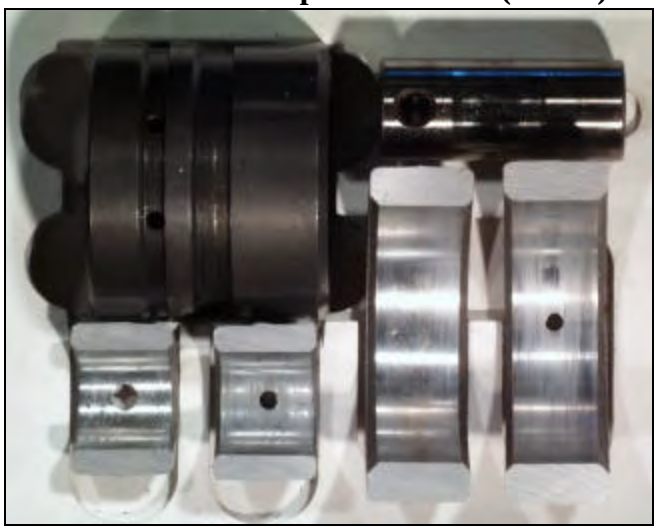
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	hard
Rear Pin	very slight	gray	hard
Equalizer Hole	very slight	gray	hard
Tip of Pin	heavy	black	gummy
Spring	slight	gray	hard
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	very slight	gray	hard

Photographic Documentation of R-134a Compressor with Contaminant Acid and Air
145 psig/20 psig

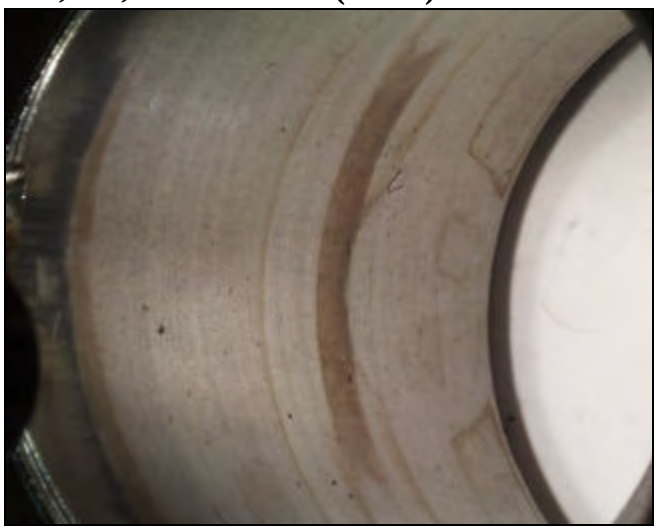


Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

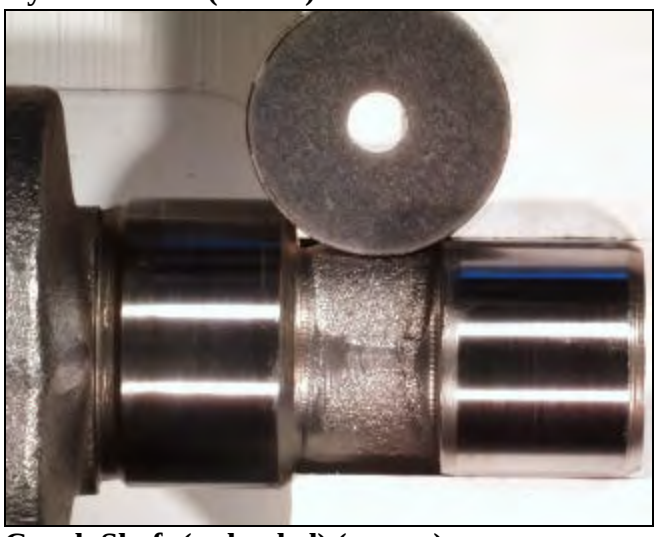


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

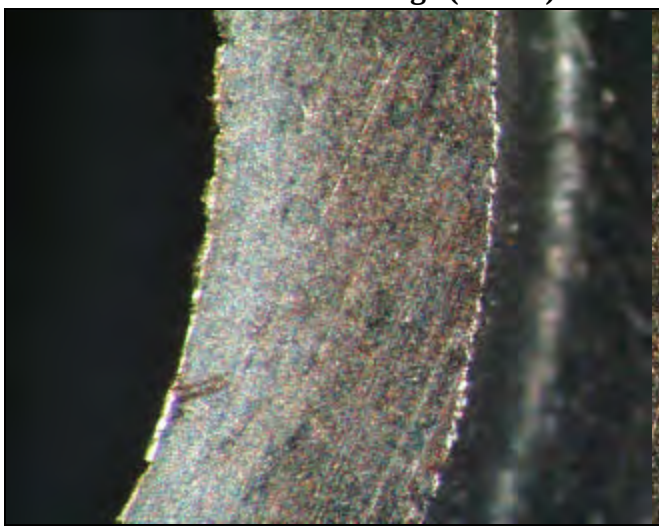


Crank Shaft (unloaded) (macro)

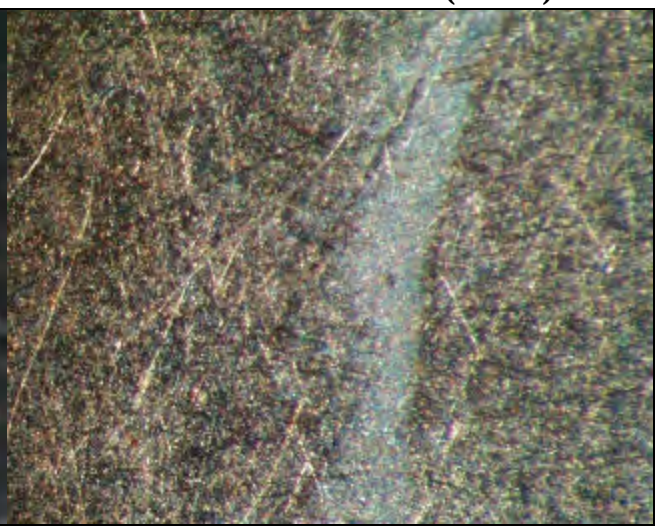
Photographic Documentation of R-134a Compressor with Contaminant Acid and Air
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

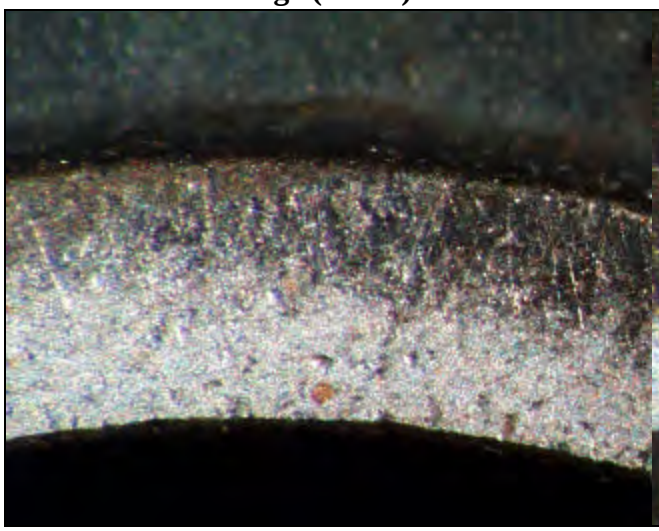
Valve Plate and Reed/Suction (macro)



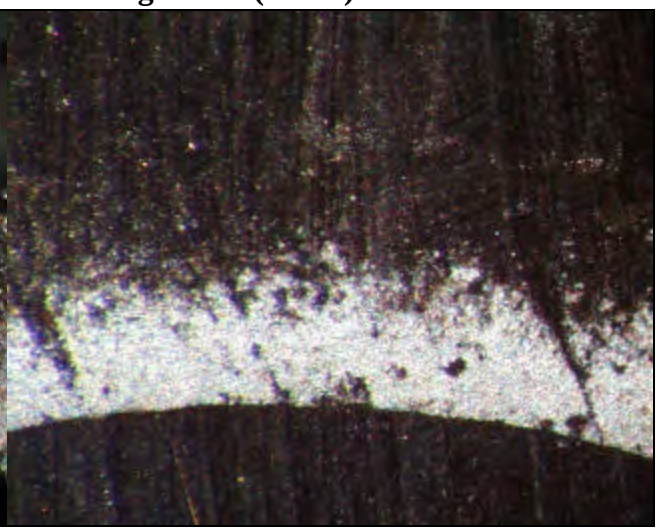
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Water and R-12

TEST HISTORY OF:

Unit Number 131
Model # RS40C1E-IAV-250 **Serial #** 96F16556
Run Time (hr.) 12005 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** Yes
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 2.5 **(3)** 3 **(4)** 2.5

Remaining torque of stator bolts
(1) 10 **(2)** 15 **(3)** 10 **(4)** 7.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 17.5 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/corrosion	
Wear	medium	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	medium	
Bottom washer (casting side)		
Appearance	scored/Cu plating	
Wear	slight	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	scored	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	low wear/scored	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	medium	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 131
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)/Cu plating

Piston pin

Appearance	corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.10
Water (ppm)	57
Fluoride ion (ppm)	0.95
Chloride ion (ppm)	15
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	3
Debris in compressor bottom (g)	0.380

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

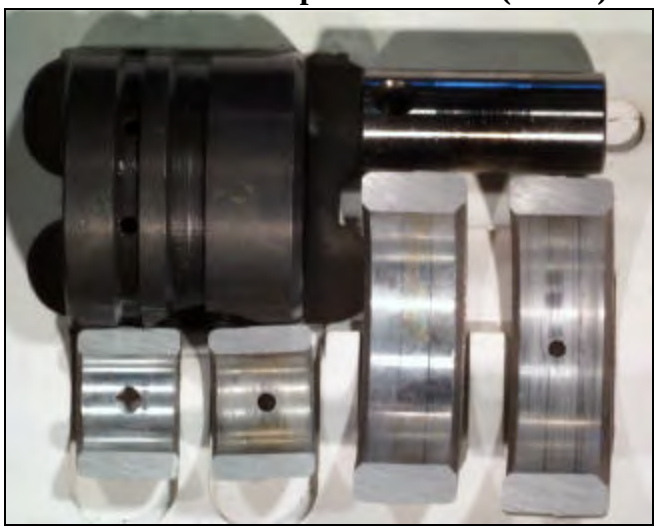
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	slight	black	gummy
Spring Seat	none	none	none
Ball	slight	black	gummy
Front Side	medium	black	gummy

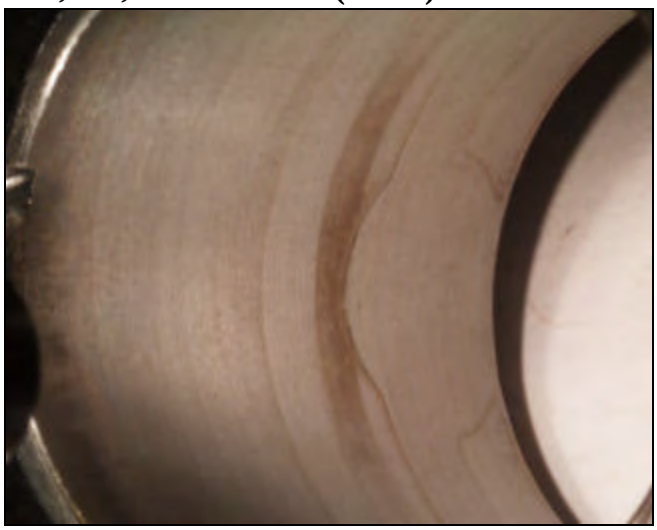
Photographic Documentation of R-134a Compressor with Contaminant Water and R-12
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)



Cylinder Bore (macro)

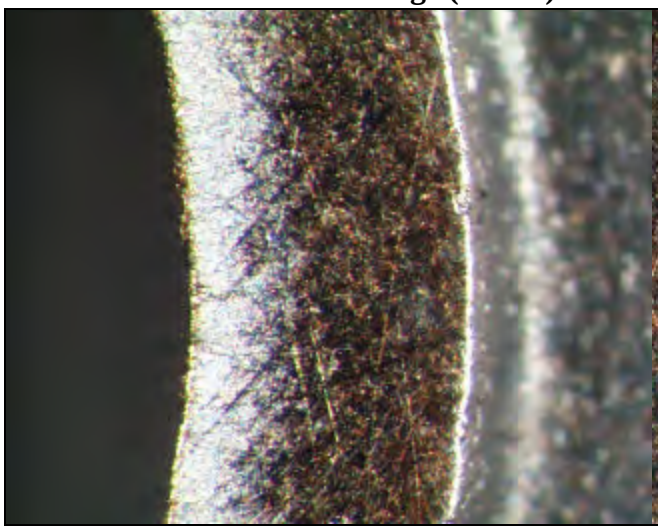
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

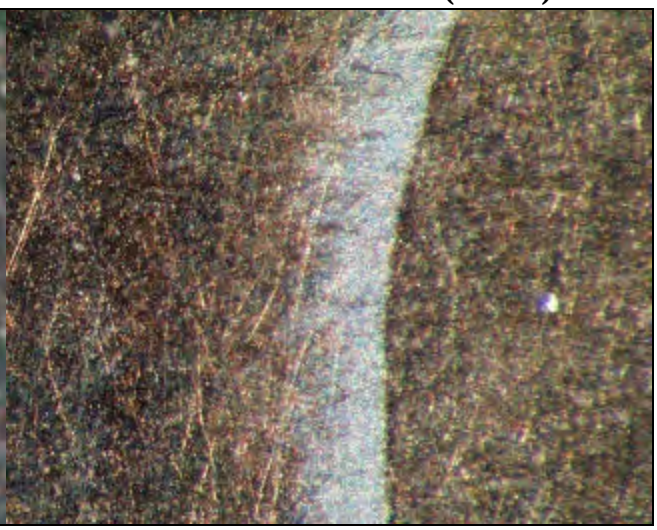
Photographic Documentation of R-134a Compressor with Contaminant Water and R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

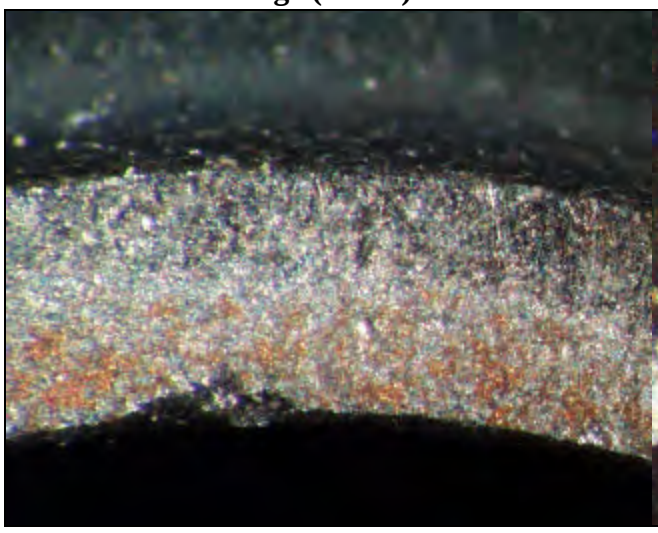
Valve Plate and Reed/Suction (macro)



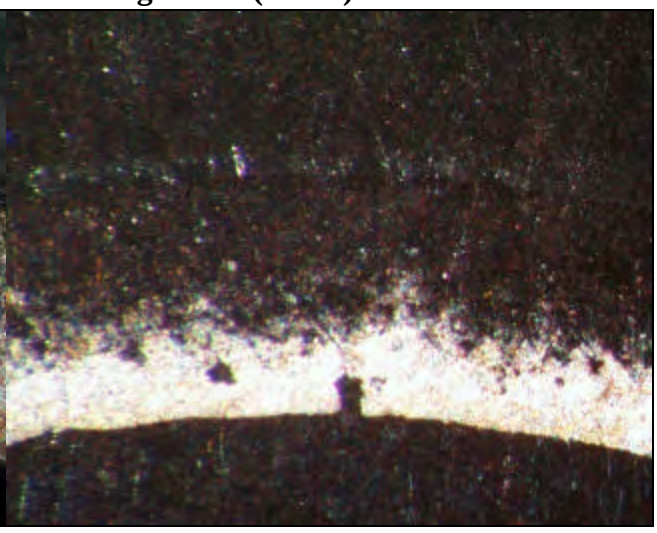
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 132
Model # RS40C1E-IAV-250 **Serial #** 96F16552
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 4 **(2)** 4 **(3)** 5 **(4)** 4
Remaining torque of stator bolts
(1) 9 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals		
Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.9985
	Unloaded	0.9985
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	1.0045
	Unloaded	1.0045
Shaft in cage bearing		
Appearance	scored	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 132
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	126
Fluoride ion (ppm)	0.87
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	0
Lead (ppm)	2
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.009
Number of screens	1
Debris in compressor bottom (g)	0.709

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

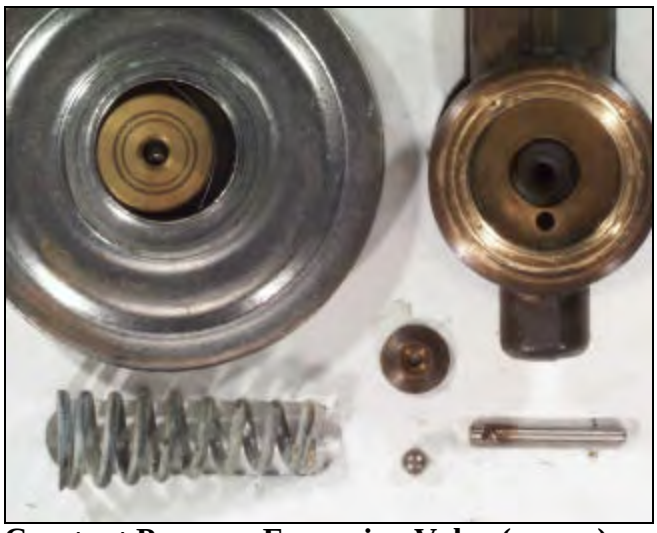
Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	gray	gummy
Spring Seat	slight	gray	gummy
Ball	medium	black	gummy
Front Side	medium	black	hard

Photographic Documentation of R-134a Compressor with Contaminant Acid and Water
145 psig/20 psig



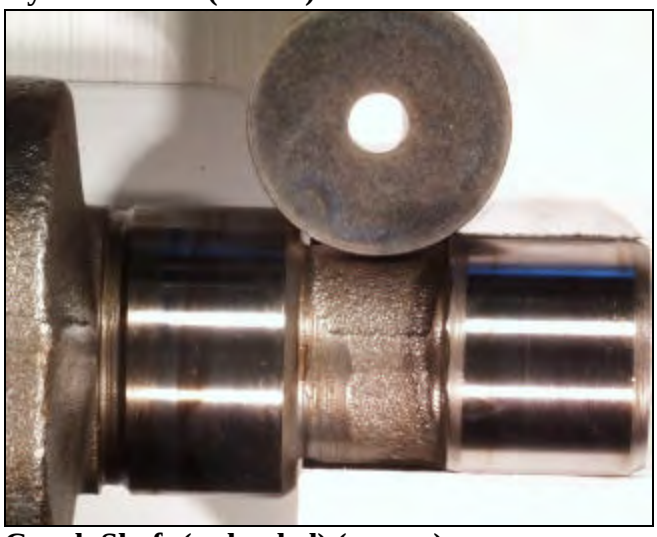
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

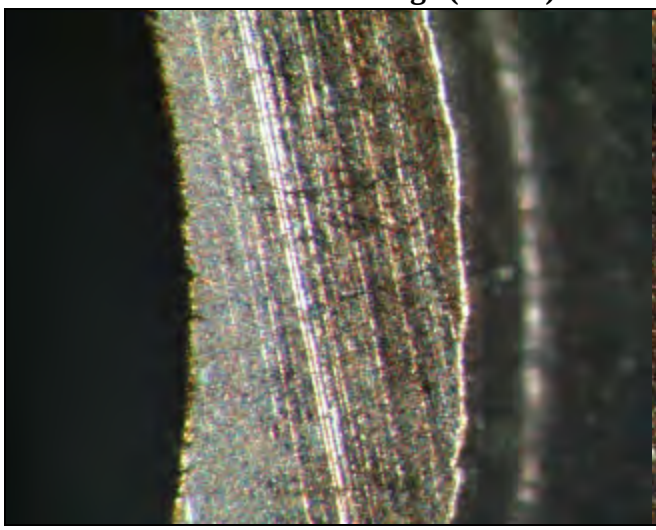


Crank Shaft (unloaded) (macro)

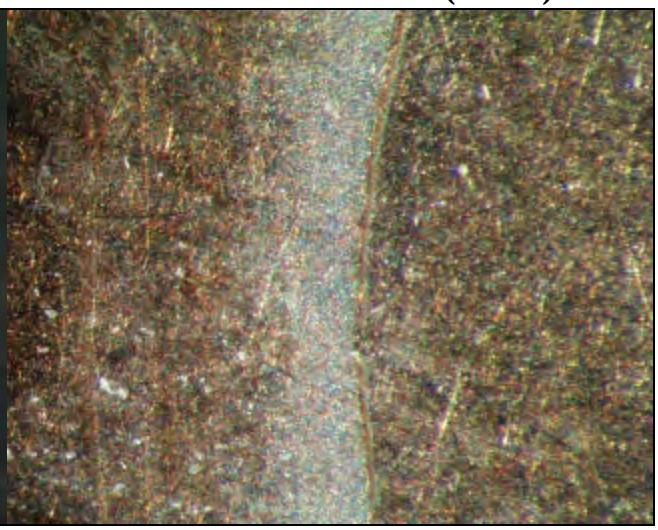
Photographic Documentation of R-134a Compressor with Contaminant Acid and Water
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

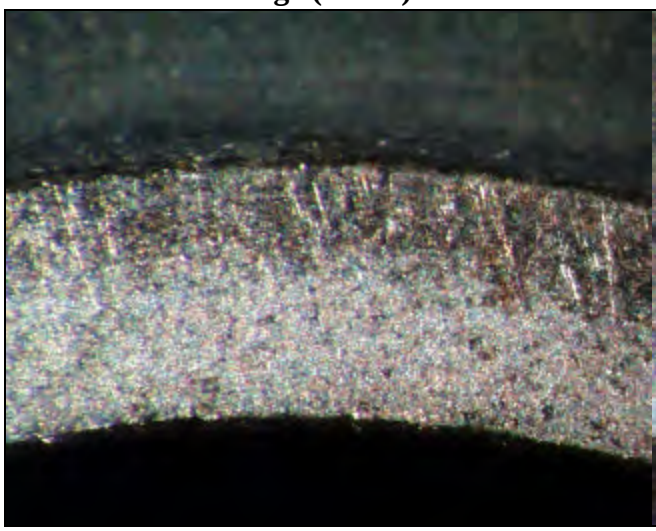
Valve Plate and Reed/Suction (macro)



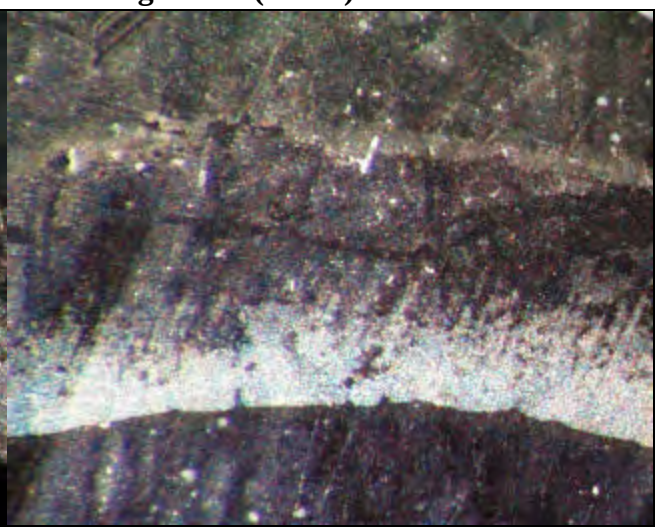
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 133
Model # RS40C1E-IAV-250 **Serial #** 96F16575
Run Time (hr.) 12073 **Failed?** No
discolored
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 145
Suction Pressure (psig) 20
Discharge Temp (°F) 187
Return Gas Temp (°F) 64
SumpTemp (°F) 174

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance black/Cu
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 2.5 **(4)** 2.5
Remaining torque of stator bolts
(1) 12.5 **(2)** 15 **(3)** 10 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance black/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance black
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 17 **(2)** 17.5 **(3)** 17 **(4)** 15
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/corrosion/heavily

Wear slight
Dimensions **Loaded** 1.2465
Unloaded 1.2465
Lower crank bearing journal
Appearance clean/heavily discolored
Wear polish

Dimensions **Loaded** 0.9985
Unloaded 0.9985
Bottom thrust washer (crank side)
Appearance scored/bronze plating/corrosion
Wear slight

Bottom washer (casting side)
Appearance bronze plating/corrosion
Wear polish
Lower bronze bearings
Appearance scored/corrosion
Wear medium
Dimensions **Loaded** 1.0040
Unloaded 1.0040

Shaft in cage bearing
Appearance corrosion/heavily discolored
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear
Varnish ring medium
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 133
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion/heavily discolored	
Wear	slight	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	136
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.049
Number of screens	3
Debris in compressor bottom (g)	0.802

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
black

Discharge reed

Condition	good
Appearance	corrosion/blued/Cu plating
Trepan	very slight
Varnish ring	none

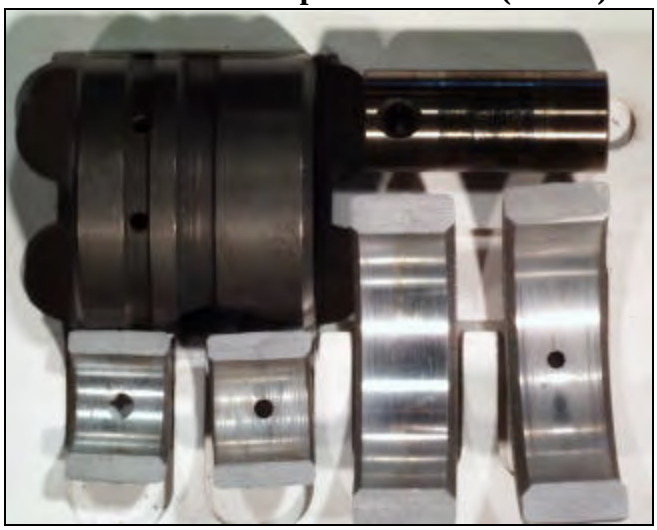
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black, brown	hard, gummy
Spring Seat	medium	brown	gummy
Ball	medium	gray	hard
Front Side	medium	gray	hard

Photographic Documentation of R-134a Compressor with Contaminant Air and Water
145 psig/20 psig

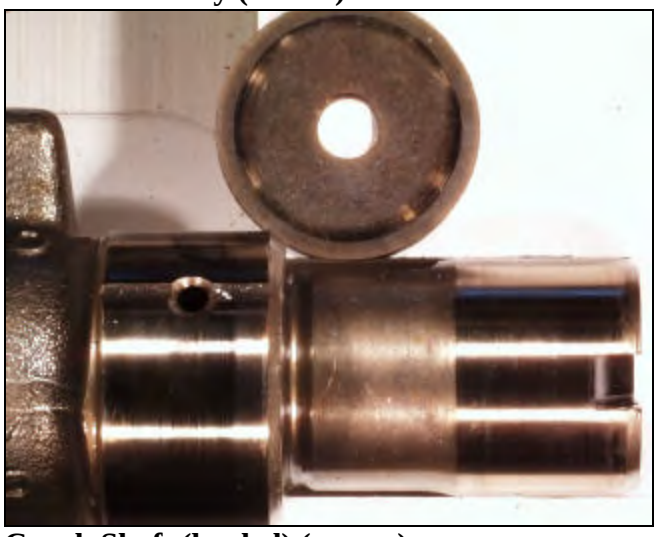
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

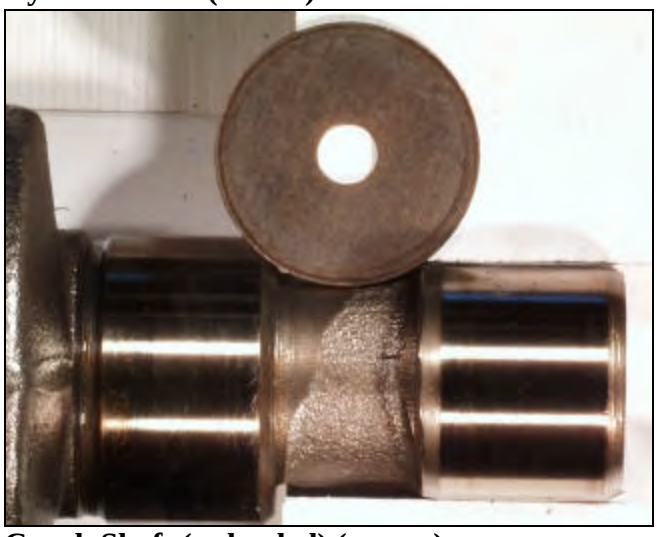


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

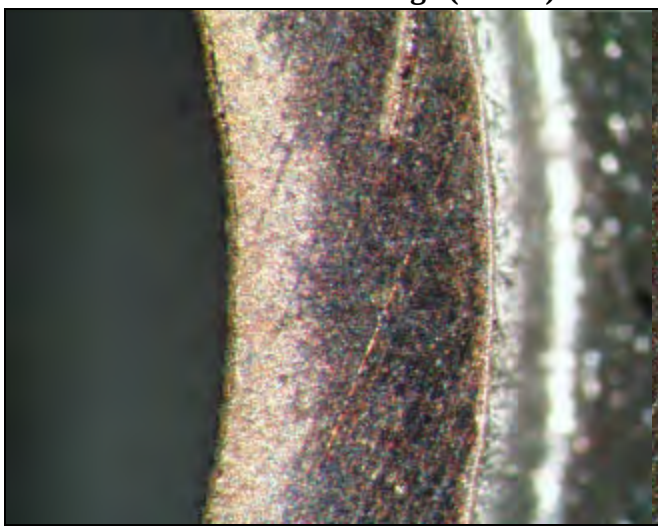


Crank Shaft (unloaded) (macro)

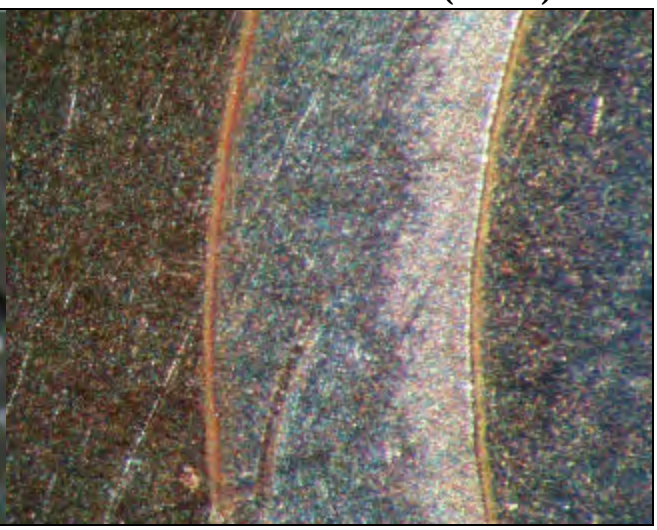
Photographic Documentation of R-134a Compressor with Contaminant Air and Water
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

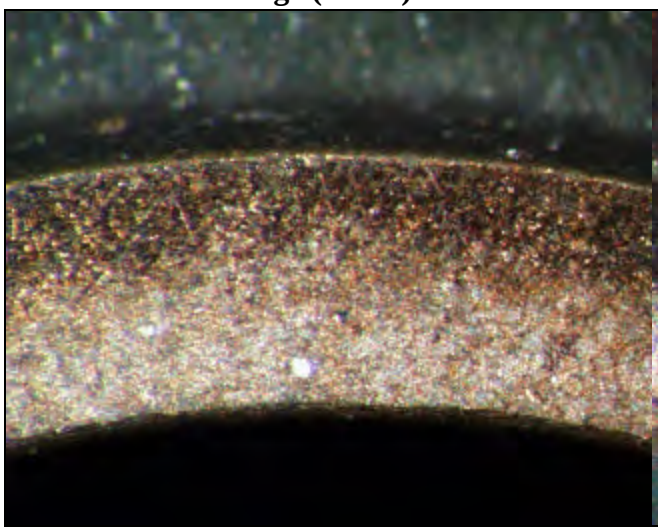
Valve Plate and Reed/Suction (macro)



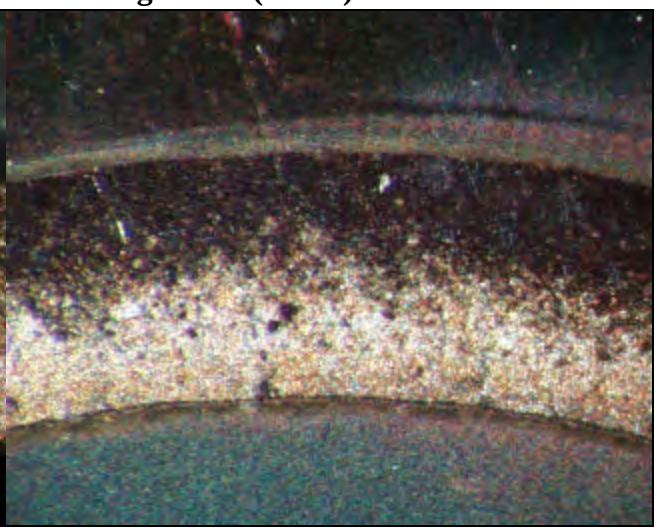
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 134
Model # RS40C1E-IAV-250 **Serial #** 96F16583
Run Time (hr.) 12105 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 145
Suction Pressure (psig) 20
Discharge Temp (°F) 187
Return Gas Temp (°F) 64
SumpTemp (°F) 174

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance black
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 10.4 **(2)** 10.4 **(3)** 10.4 **(4)** 10.4
Suction muffler appearance clean/gray
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray/Cu
Top stator windings appearance black
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance black
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 16.7
Head gasket brittle? yes/bonded
Head suction cavity appearance dirty
Head discharge cavity appearance dirty
Cage bearing top appearance wear metals
Remaining torque of cage bearing bolts
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2

Crank journals
Appearance clean/Cu plating/corrosion
Wear slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance Cu plating
Wear slight
Dimensions **Loaded** 0.9985
Unloaded 0.9985
Bottom thrust washer (crank side)
Appearance clean/scored/Cu plating
Wear slight
Bottom washer (casting side)
Appearance scored
Wear slight
Lower bronze bearings
Appearance clean
Wear slight
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance Cu plating
Wear slight
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3720
Unloaded 1.3720
Cylinder bore
Appearance no wear/Cu plating/corrosion
Varnish ring slight
Dimensions **Loaded** 1.3765
Unloaded 1.3765
Connecting rod (large end)
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 134
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	bronze plating	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	57
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.997

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

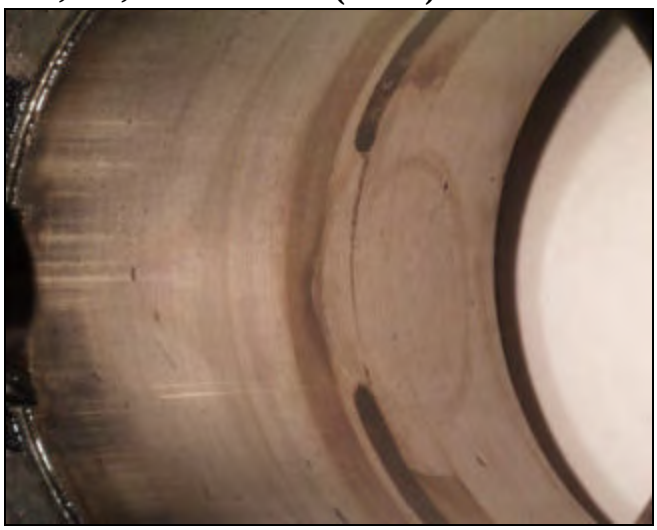
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	none	none	none
Spring Seat	none	none	none
Ball	slight	black	hard
Front Side	slight	black	hard

Photographic Documentation of R-134a Compressor with Contaminant Water
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

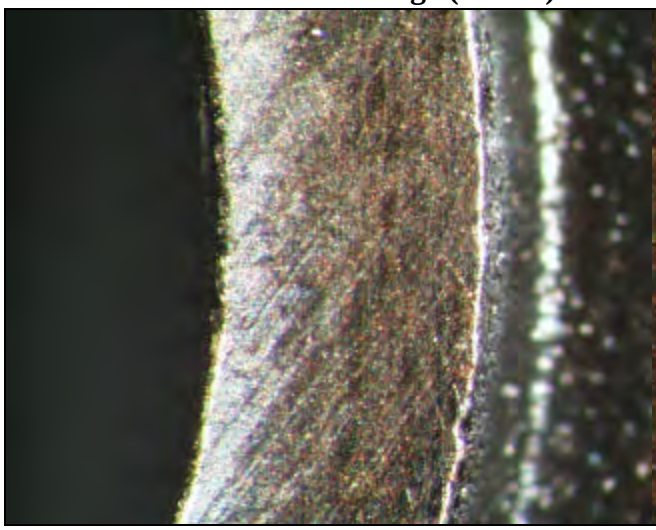
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

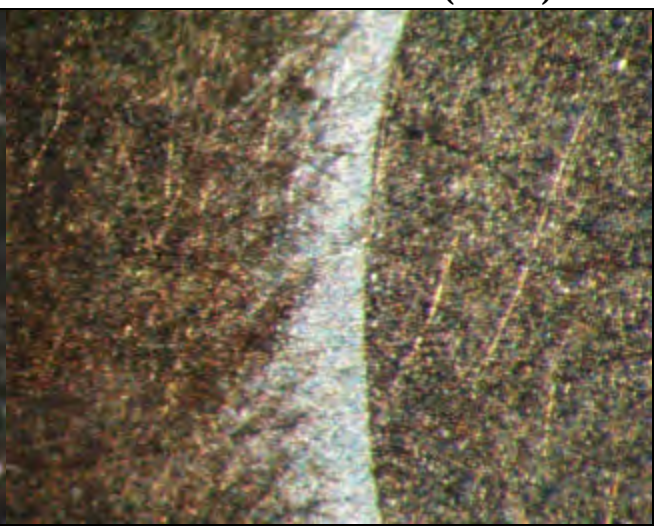
Photographic Documentation of R-134a Compressor with Contaminant Water
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

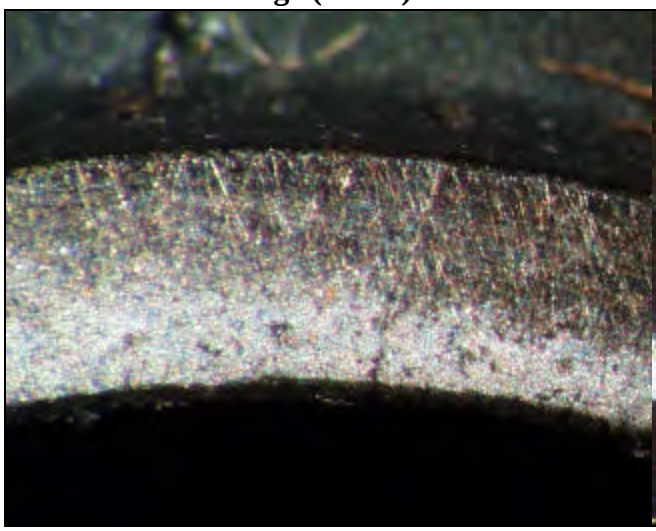
Valve Plate and Reed/Suction (macro)



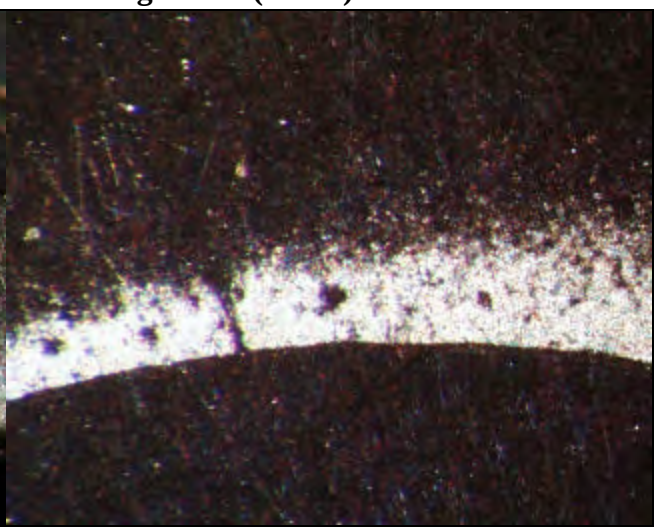
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Water, and R-12

TEST HISTORY OF:

Unit Number 135
Model # RS40C1E-IAV-250 **Serial #** 96F16576
Run Time (hr.) 12009 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 145
Suction Pressure (psig) 20
Discharge Temp (°F) 187
Return Gas Temp (°F) 64
SumpTemp (°F) 174

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance black/Cu
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 2.5
Remaining torque of stator bolts
(1) 12.5 **(2)** 15 **(3)** 10 **(4)** 15
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance clean/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance Cu plate
Quantity of bearing chips heavy
Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 17.5
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance clean
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating/corrosion
Wear slight
Dimensions **Loaded** 1.2465
Unloaded 1.2465
Lower crank bearing journal
Appearance scored
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion
Wear slight
Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish
Lower bronze bearings
Appearance scored/corrosion
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030
Shaft in cage bearing
Appearance Cu plating/corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear medium
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 135
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear/Cu plating

Piston pin

Appearance	Cu plating/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	42
Fluoride ion (ppm)	0.95
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	2
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	2
Zinc (ppm)	3

Trash in liquid screen (g)	0.006
Number of screens	2
Debris in compressor bottom (g)	0.609

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

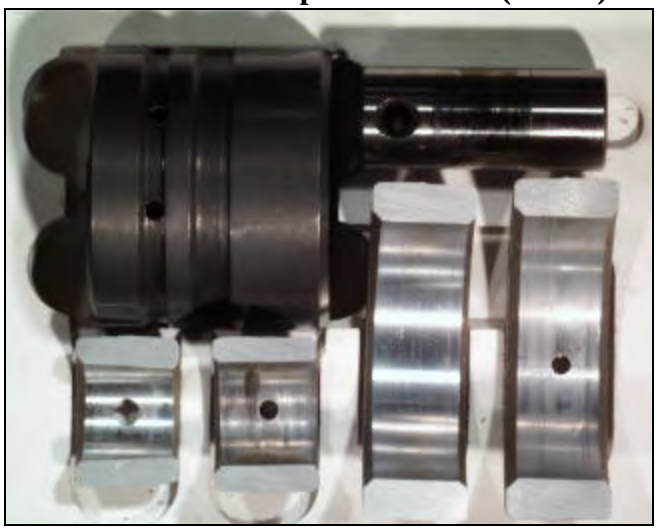
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	medium	black, gray	gummy
Spring Seat	medium	black, gray, brown	hard
Ball	NA	NA	NA
Front Side	heavy	black, brown	hard

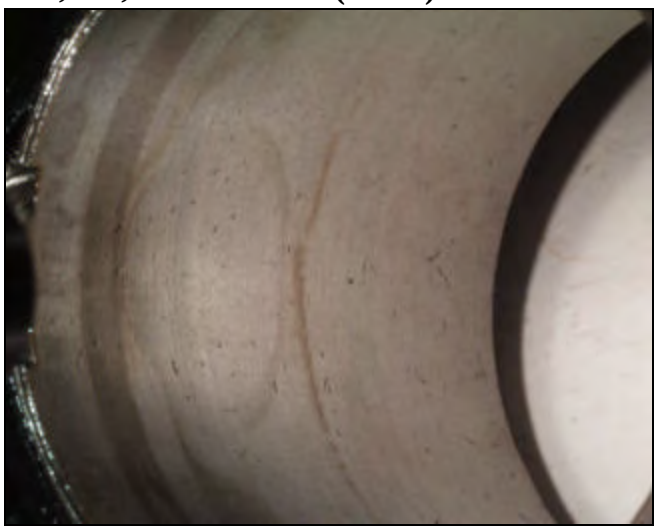
Photographic Documentation of R-134a Compressor with Contaminant Acid, Water, and R-12
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

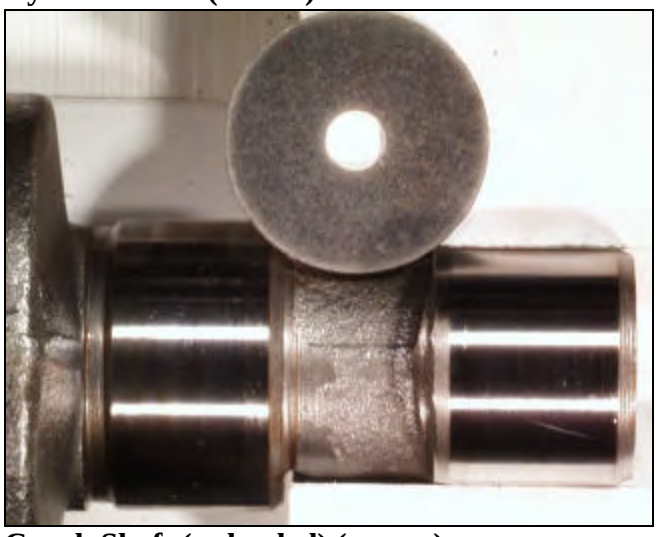


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

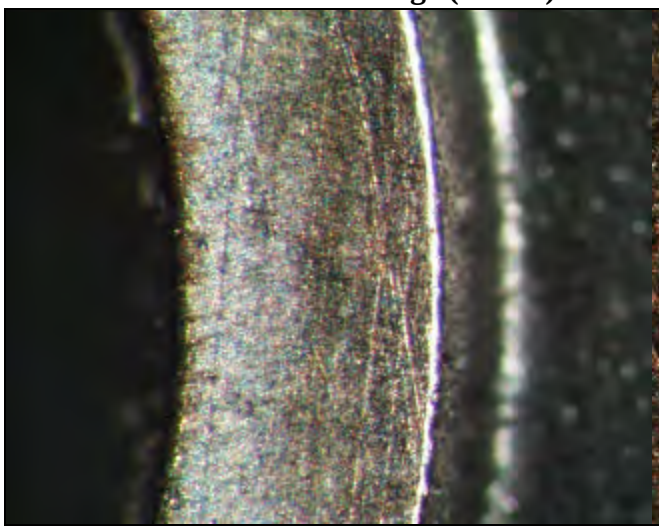


Crank Shaft (unloaded) (macro)

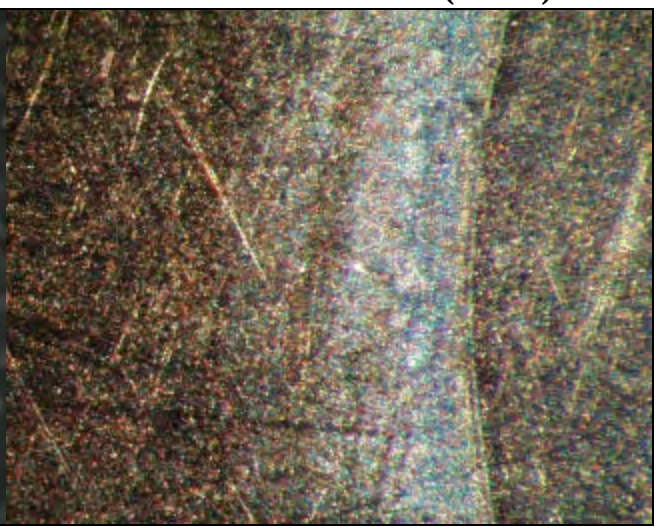
Photographic Documentation of R-134a Compressor with Contaminant Acid, Water, and R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

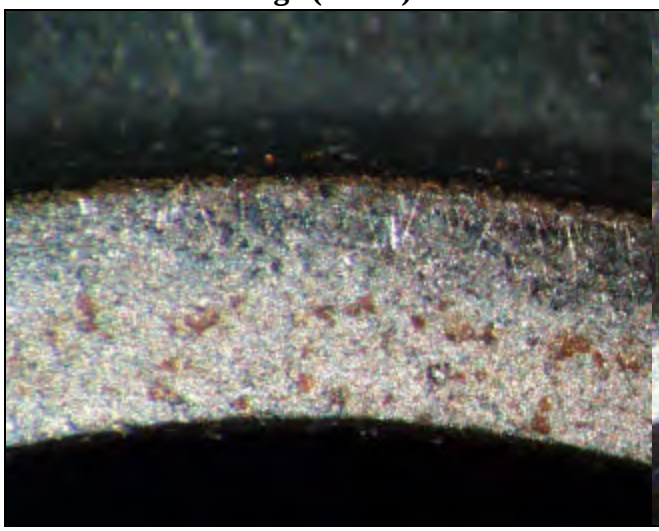
Valve Plate and Reed/Suction (macro)



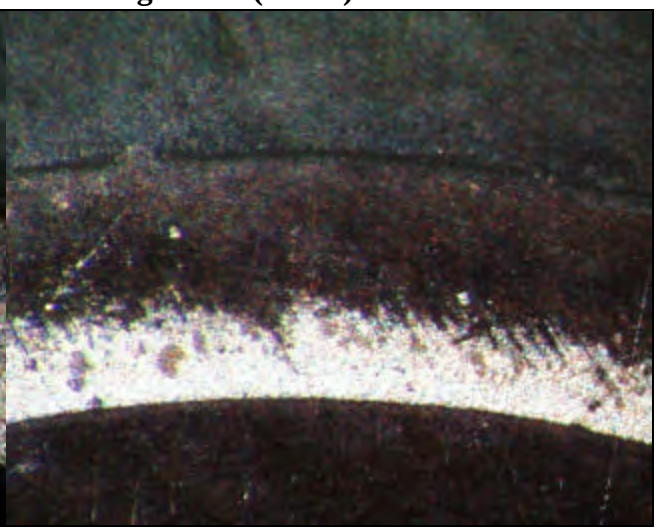
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Air, Water, and R-12

TEST HISTORY OF:

Unit Number 136
Model # RS40C1E-IAV-250 **Serial #** 96F16577
Run Time (hr.) 12004 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	57
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	bright

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 4 **(4)** 3
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 9 **(4)** 9

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 14 **(4)** 14

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 4 **(2)** 5 **(3)** 6 **(4)** 6

Crank journals		
Appearance	clean/corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	1.2445
	Unloaded	1.2445
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9970
	Unloaded	0.9970
Bottom thrust washer (crank side)		
Appearance	scored	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0015
	Unloaded	1.0010
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3700
	Unloaded	1.3700
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2485
	Unloaded	1.2485

TEST HISTORY OF:

Unit Number 136
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.4985
	Unloaded	0.4985

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	slight	
Dimensions	**Loaded**	0.4960
	Unloaded	0.4960

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	81
Fluoride ion (ppm)	0.86
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	2
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.092
Number of screens	3
Debris in compressor bottom (g)	0.362

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	very slight	gray	gummy
Equalizer Hole	none	none	none
Tip of Pin	medium	gray	gummy
Spring	medium	gray	gummy
Spring Seat	slight	gray	gummy
Ball	medium	gray	gummy
Front Side	medium	gray	gummy

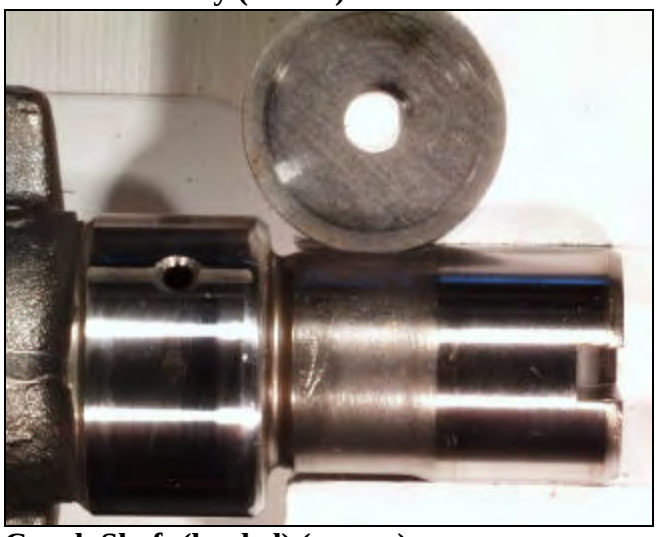
Photographic Documentation of R-134a Compressor with Contaminant
Acid, Air, Water, and R-12
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



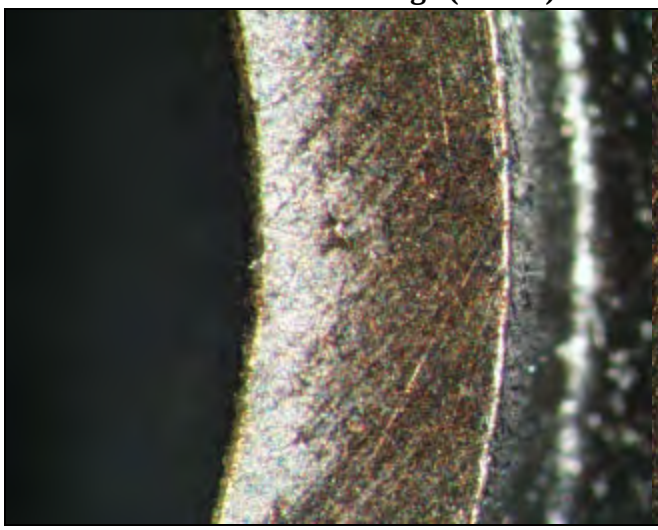
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

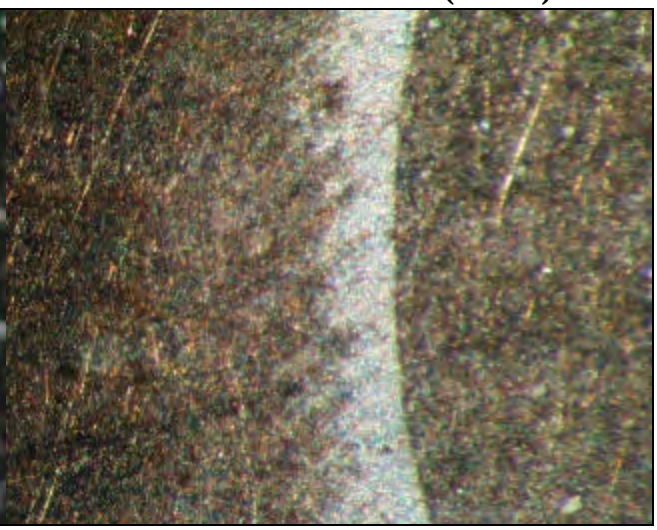
Photographic Documentation of R-134a Compressor with Contaminant
Acid, Air, Water, and R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

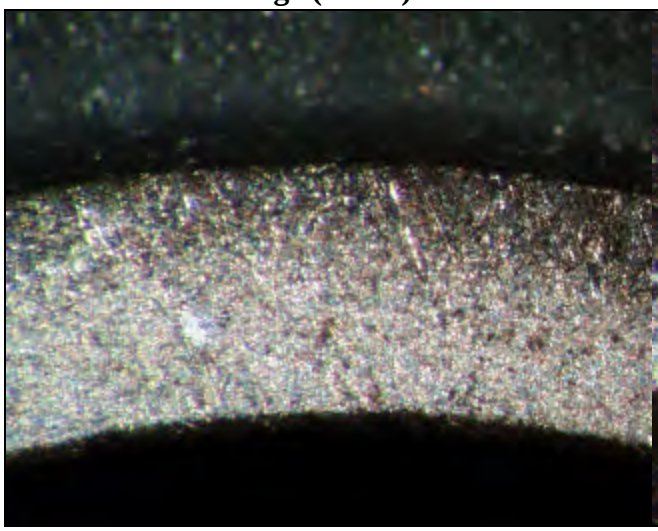
Valve Plate and Reed/Suction (macro)



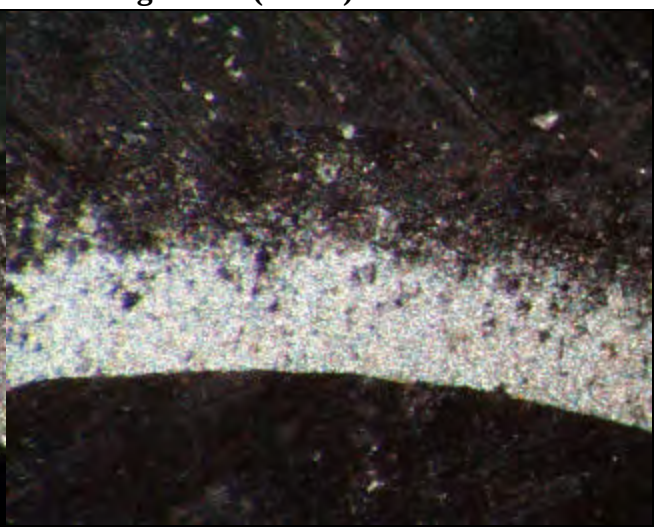
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air, Water, and R-12

TEST HISTORY OF:

Unit Number 137
Model # RS40C1E-IAV-250 **Serial #** 96F16568
Run Time (hr.) 12001 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 10.4 **(2)** 4.2 **(3)** 8.3 **(4)** 4.2
Remaining torque of stator bolts
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 18.8

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 6.3 **(3)** 6.3 **(4)** 6.3

Crank journals		
Appearance	Cu plating/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.0010
	Unloaded	1.0010
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	slight	
Lower bronze bearings		
Appearance	clean	
Wear	slight	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	Cu plating	
Wear	slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3720
	Unloaded	1.3720
Cylinder bore		
Appearance	no wear/corrosion	
Varnish ring	slight	
Dimensions	**Loaded**	1.3765
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	Cu plating	
Wear	slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 137
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.06
Water (ppm)	67
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	2
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.662

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

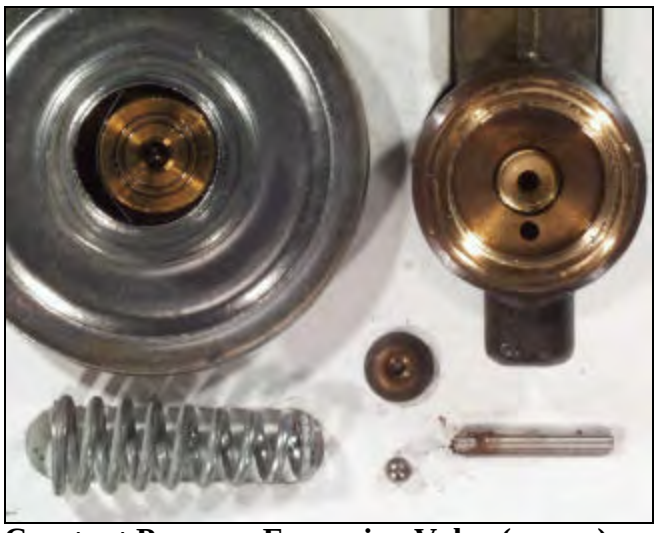
Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	black	hard
Rear Pin	none	none	none
Equalizer Hole	slight	black	gummy
Tip of Pin	medium	black, brown	hard
Spring	slight	gray	hard
Spring Seat	slight	gray	hard
Ball	medium	gray	hard
Front Side	heavy	black	hard

Photographic Documentation of R-134a Compressor with Contaminant Air, Water, and R-12
145 psig/20 psig

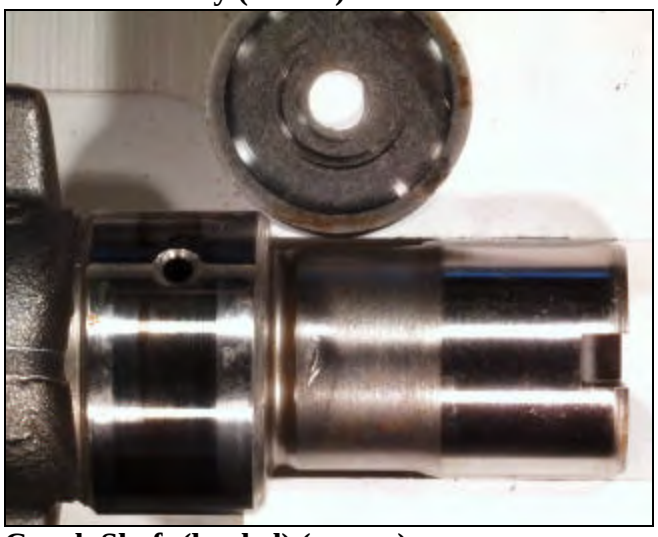


Constant Pressure Expansion Valve (macro)

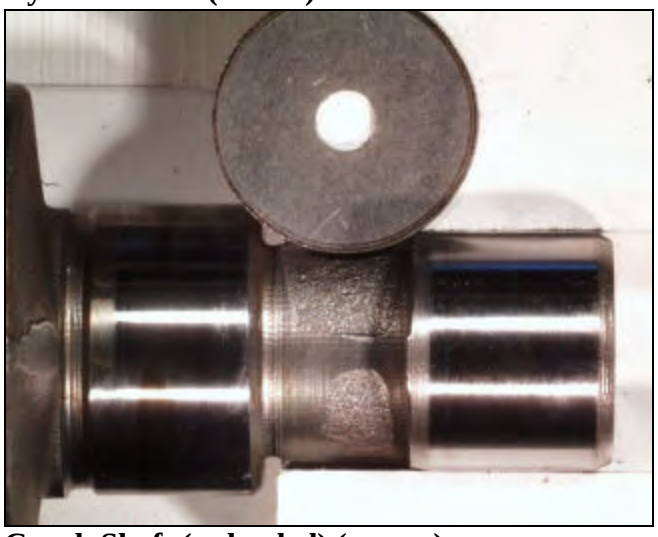
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

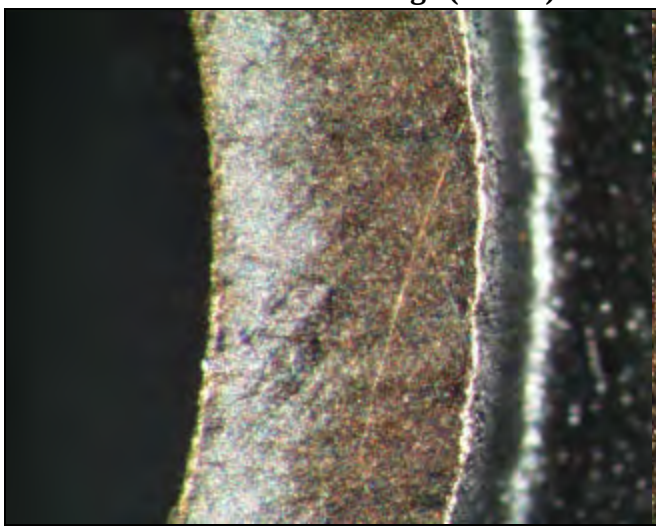


Crank Shaft (unloaded) (macro)

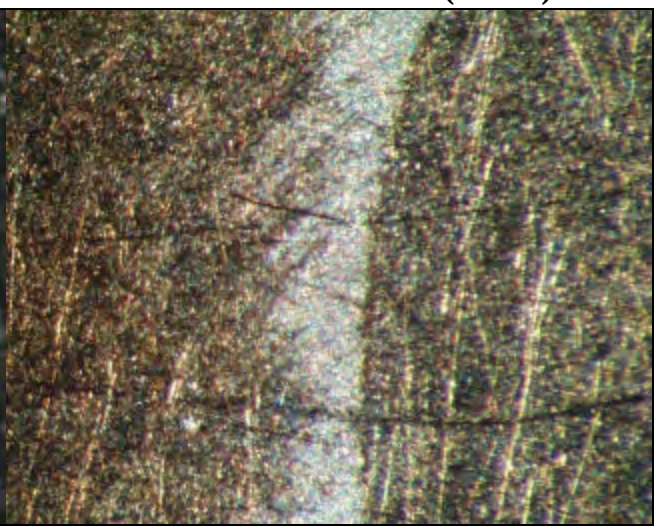
Photographic Documentation of R-134a Compressor with Contaminant Air, Water, and R-12
145 psig/20 psig

Valve Plate and Reed/Discharge (macro)

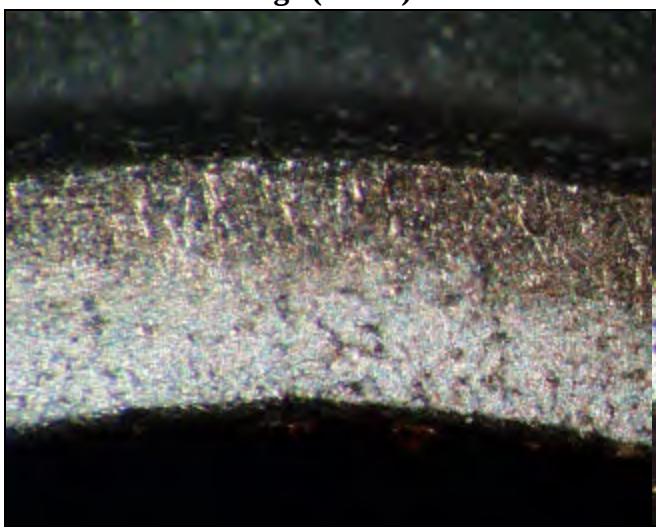
Valve Plate and Reed/Suction (macro)



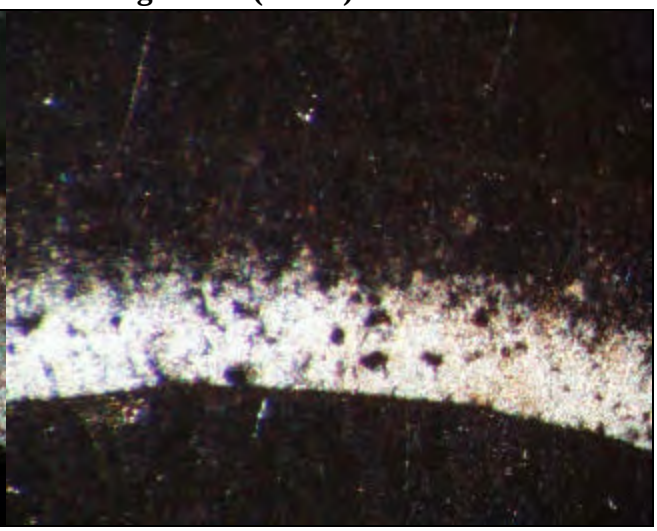
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 138
Model # RS40C1E-IAV-250 **Serial #** 96F16559
Run Time (hr.) 12038 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	64
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 6.3 **(2)** 6.3 **(3)** 6.3 **(4)** 6.3
Remaining torque of stator bolts
(1) 6.3 **(2)** 8.3 **(3)** 8.3 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	Cu
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14.6 **(2)** 14.6 **(3)** 14.6 **(4)** 14.6

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	wear metals

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 6.3 **(3)** 6.3 **(4)** 6.3

Crank journals
Appearance corrosion
Wear slight
Dimensions **Loaded** 1.2475
Unloaded 1.2475

Lower crank bearing journal
Appearance bronze plating
Wear slight
Dimensions **Loaded** 1.0010
Unloaded 1.0010

Bottom thrust washer (crank side)
Appearance scored/bronze plating
Wear slight

Bottom washer (casting side)
Appearance clean
Wear slight

Lower bronze bearings
Appearance corrosion
Wear slight
Dimensions **Loaded** 1.0045
Unloaded 1.0045

Shaft in cage bearing
Appearance clean
Wear slight

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3720
Unloaded 1.3720

Cylinder bore
Appearance no wear/Cu plating
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 138
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)
Appearance contact wear/correct washer
Wear slight
Dimensions **Loaded** 0.5010
Unloaded 0.5010

Piston pin washers appearance
contact wear

Piston pin
Appearance bronze plating/corrosion
Wear slight
Dimensions **Loaded** 0.4980
Unloaded 0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	65
Fluoride ion (ppm)	0.91
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	0
Lead (ppm)	2
Silicon (ppm)	5
Tin (ppm)	0
Zinc (ppm)	1

Trash in liquid screen (g)	0.000
Number of screens	1
Debris in compressor bottom (g)	0.865

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion
Suction surface appearance
corrosion
Suction reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring very slight

Discharge side (reed backer)
Condition good
Appearance corrosion
Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring none

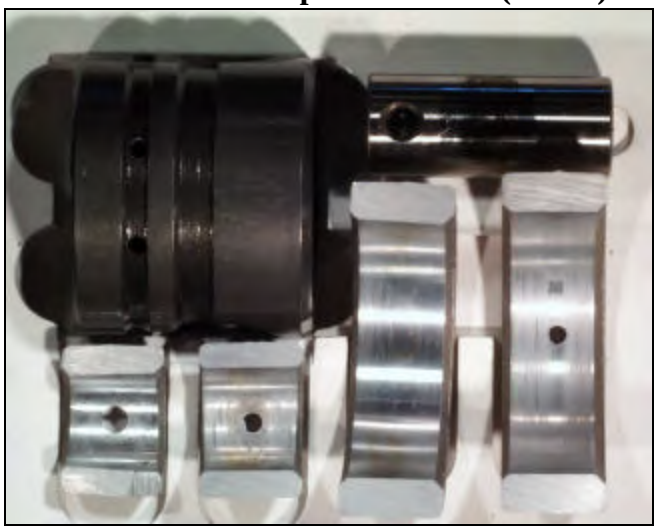
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tan	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	tan	gummy
Spring	slight	black, gray	hard
Spring Seat	very slight	gray	gummy
Ball	very slight	tan	gummy
Front Side	very slight	gray	hard

Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and Water
145 psig/20 psig

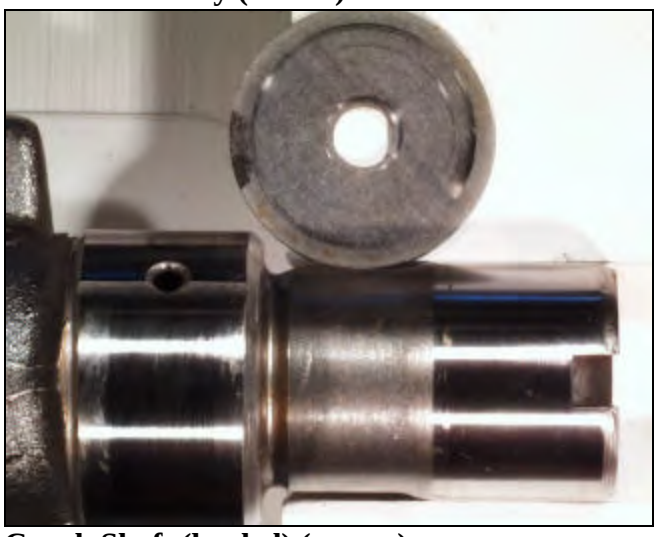
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

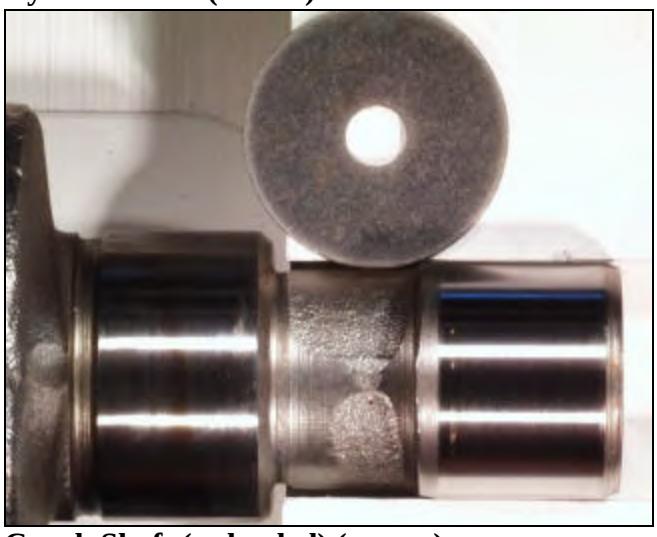


Piston Assembly (macro)

Cylinder Bore (macro)



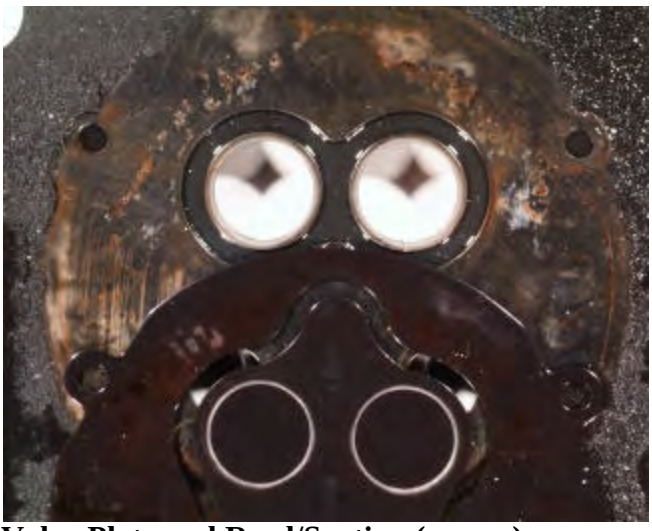
Crank Shaft (loaded) (macro)



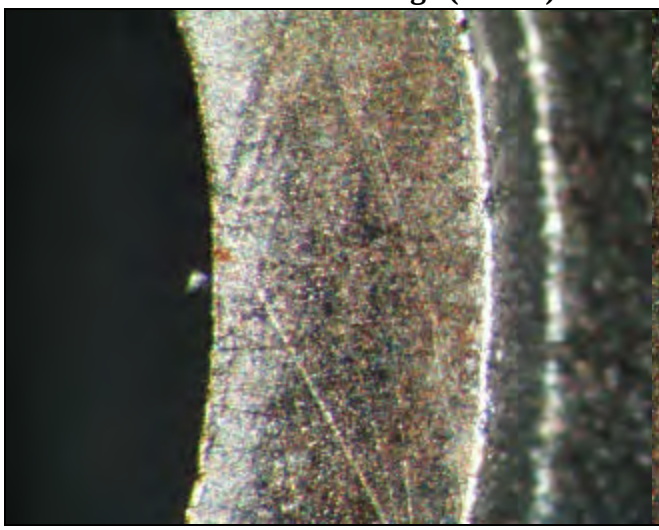
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and Water 145 psig/20 psig

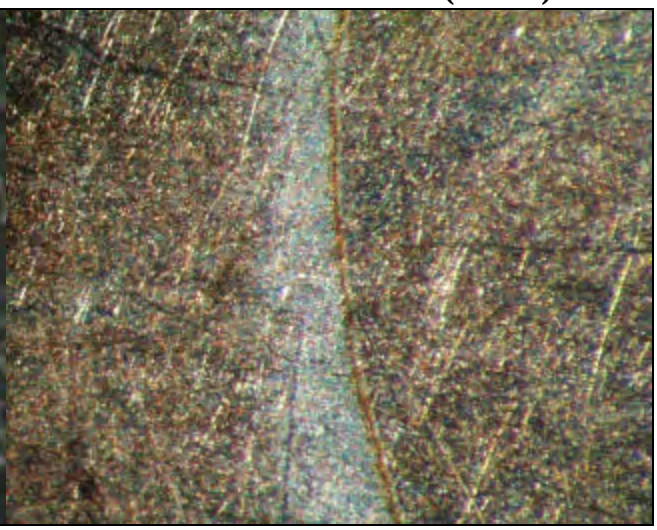
Valve Plate and Reed/Discharge (macro)



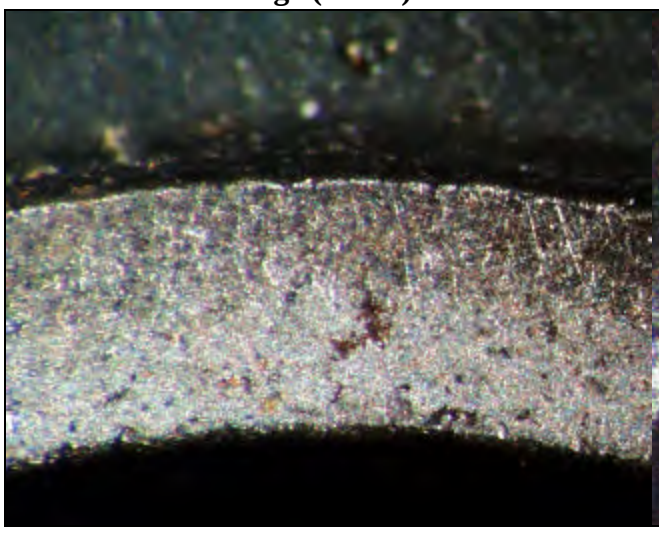
Valve Plate and Reed/Suction (macro)



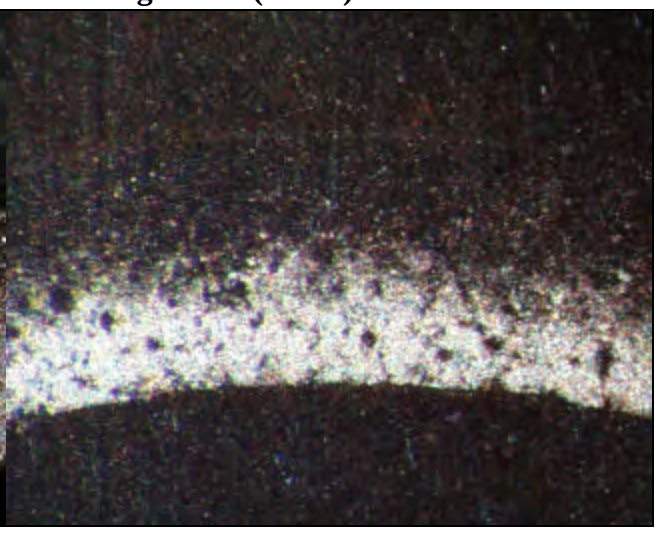
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Control Compressor

TEST HISTORY OF:

Unit Number 139
Model # RS40C1E-IAV-250 **Serial #** 96F16567
Run Time (hr.) 12037 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.6 **(2)** 4.6 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	No
Loose restrictor?	No
Discharge plate appearance	clean
Top stator windings appearance	gray
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 15

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9975
	Unloaded	0.9935
Bottom thrust washer (crank side)		
Appearance	clean	
Wear	polish	
Bottom washer (casting side)		
Appearance	clean/bronze plating	
Wear	polish	
Lower bronze bearings		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 139
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
no wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.19
Water (ppm)	212
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	4
Lead (ppm)	2
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	3

Trash in liquid screen (g)	0.041
Number of screens	3
Debris in compressor bottom (g)	0.513

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion/blued

Discharge reed

Condition	good
Appearance	corrosion/blued/Cu plating
Trepan	very slight
Varnish ring	slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	slight	brown	gummy
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	heavy	black	gummy
Spring Seat	medium	brown	gummy
Ball	medium	brown	gummy
Front Side	none	none	none

Photographic Documentation of R-134a Control Compressor
160 psig/10 psig

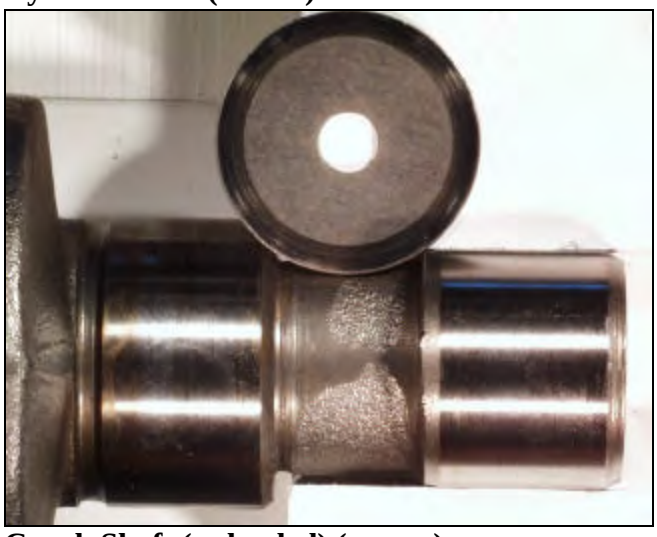
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

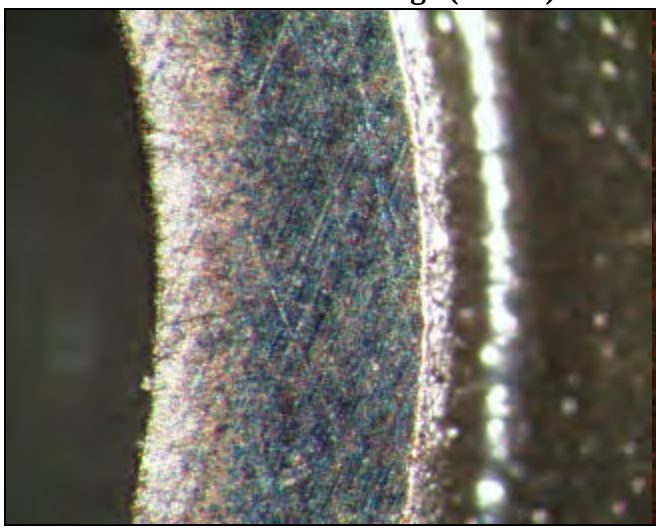


Crank Shaft (unloaded) (macro)

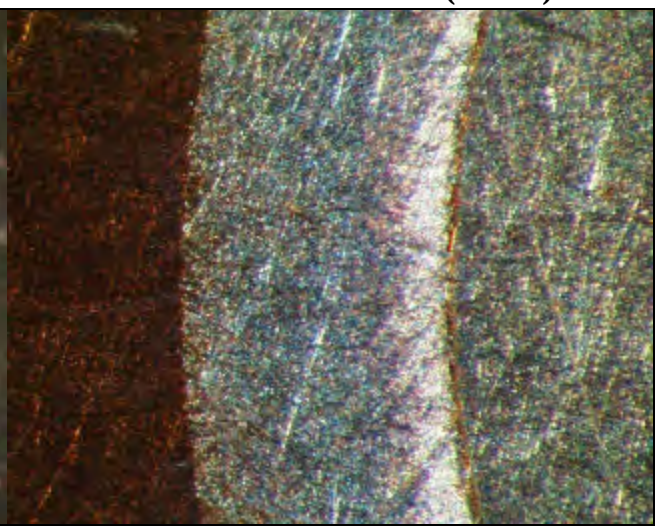
Photographic Documentation of R-134a Control Compressor
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

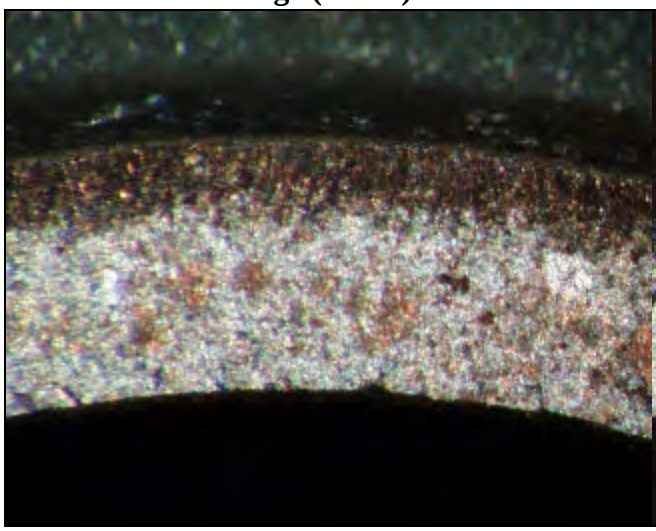
Valve Plate and Reed/Suction (macro)



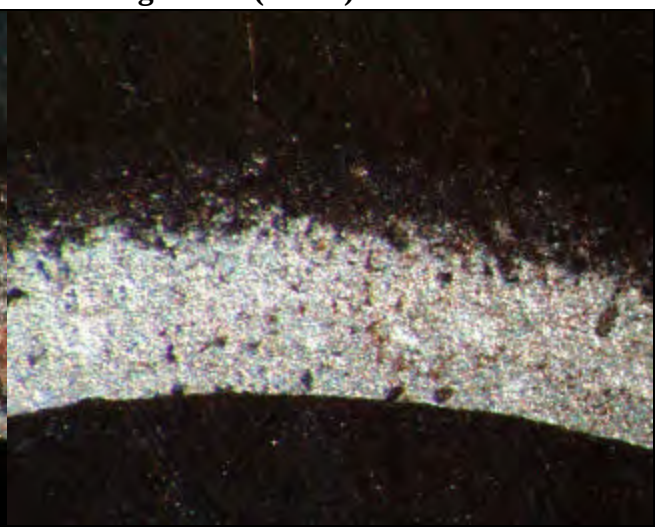
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Control Compressor

TEST HISTORY OF:

Unit Number 140
Model # RS40C1E-IAV-250 **Serial #** 96F16566
Run Time (hr.) 12013 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 160
Suction Pressure (psig) 10
Discharge Temp (°F) 224
Return Gas Temp (°F) 63
SumpTemp (°F) 212

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance none
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 7.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance clean
Top stator windings appearance gray
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 14 **(2)** 14 **(3)** 14 **(4)** 14
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 6 **(2)** 6 **(3)** 6 **(4)** 5

Crank journals
Appearance scored
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980
Bottom thrust washer (crank side)
Appearance clean
Wear polish
Bottom washer (casting side)
Appearance scored
Wear slight
Lower bronze bearings
Appearance clean
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030
Shaft in cage bearing
Appearance clean
Wear polish
Piston top appearance clean
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 140
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)
Appearance correct washer
Wear polish
Dimensions **Loaded** 0.5030
Unloaded 0.5010

Piston pin washers appearance
contact wear

Piston pin
Appearance clean
Wear polish
Dimensions **Loaded** 0.4990
Unloaded 0.4985

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	172
Fluoride ion (ppm)	0.94
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	6
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.081
Number of screens	3
Debris in compressor bottom (g)	0.678

Valve Plate Assembly Inspection

Suction side (reed backer)
Condition good
Appearance corrosion

Suction surface appearance
corrosion

Suction reed
Condition good
Appearance corrosion
Trepan very slight
Varnish ring slight

Discharge side (reed backer)
Condition good
Appearance corrosion/blued

Discharge surface appearance
corrosion

Discharge reed
Condition good
Appearance corrosion/blued
Trepan very slight
Varnish ring none

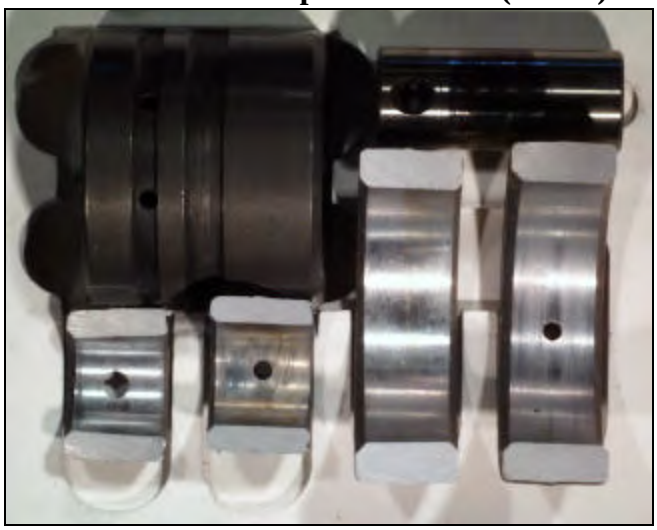
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	black	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black	gummy
Spring Seat	slight	black	hard
Ball	slight	black	gummy
Front Side	none	none	none

Photographic Documentation of R-134a Control Compressor
160 psig/10 psig

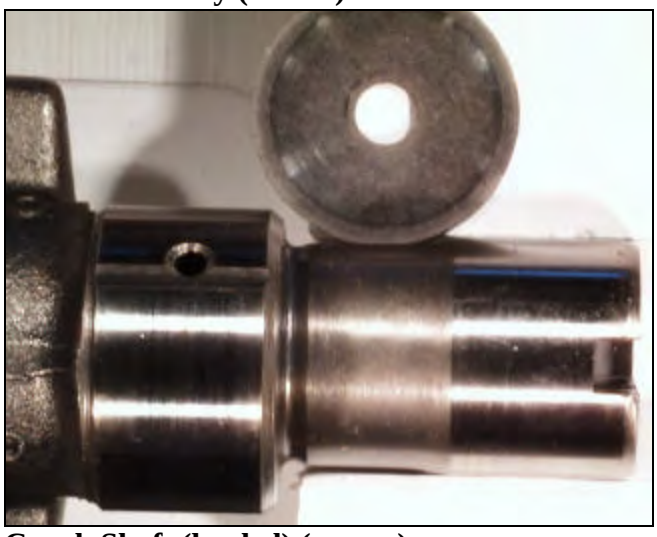
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

Cylinder Bore (macro)



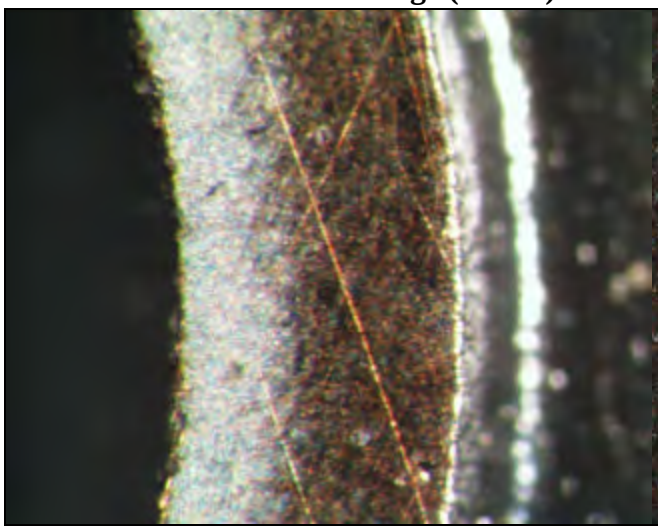
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

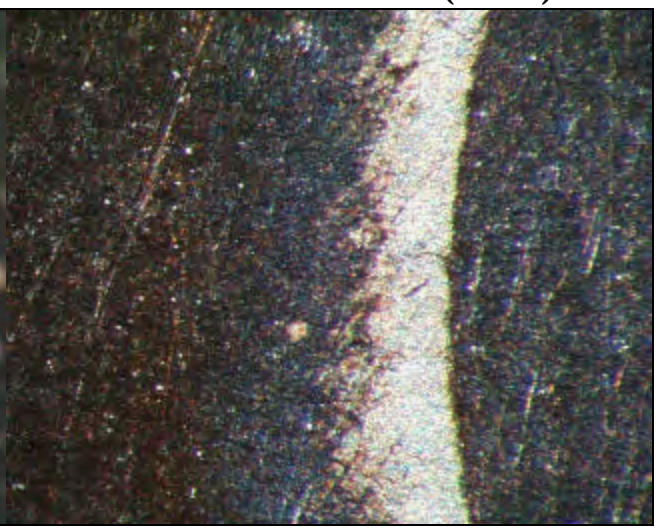
Photographic Documentation of R-134a Control Compressor
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

Valve Plate and Reed/Suction (macro)

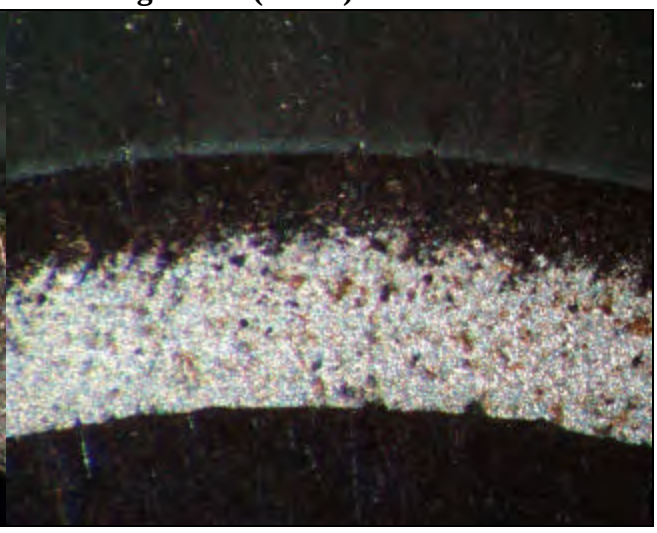


Valve Plate/Discharge (micro)



Discharge Reed (micro)

Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Control Compressor

TEST HISTORY OF:

Unit Number 141
Model # RS40C1E-IAV-250 **Serial #** 96F16564
Run Time (hr.) 12002 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? Yes
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 7 **(3)** 5 **(4)** 7

Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 9 **(4)** 11

Suction muffler appearance	clean/gray
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black/Cu
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	Yes
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 14

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6 **(2)** 5 **(3)** 4 **(4)** 5

Crank journals
Appearance scored
Wear polish
Dimensions **Loaded** 1.2465
Unloaded 1.2465

Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980

Bottom thrust washer (crank side)
Appearance clean
Wear polish

Bottom washer (casting side)
Appearance clean
Wear polish

Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance clean
Wear polish

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear
Varnish ring very slight
Dimensions **Loaded** 1.3746
Unloaded 1.3746

Connecting rod (large end)
Appearance none
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 141
Contaminants:
Control Unit? Yes

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	307
Fluoride ion (ppm)	0.91
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	0
Silicon (ppm)	7
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.073
Number of screens	3
Debris in compressor bottom (g)	0.212

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

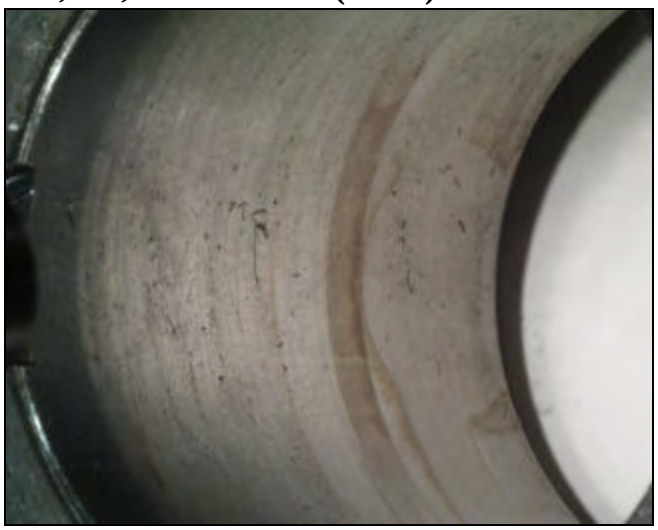
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	very slight	gray	hard
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	medium	black, gray	gummy
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	very slight	gray	hard

Photographic Documentation of R-134a Control Compressor
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

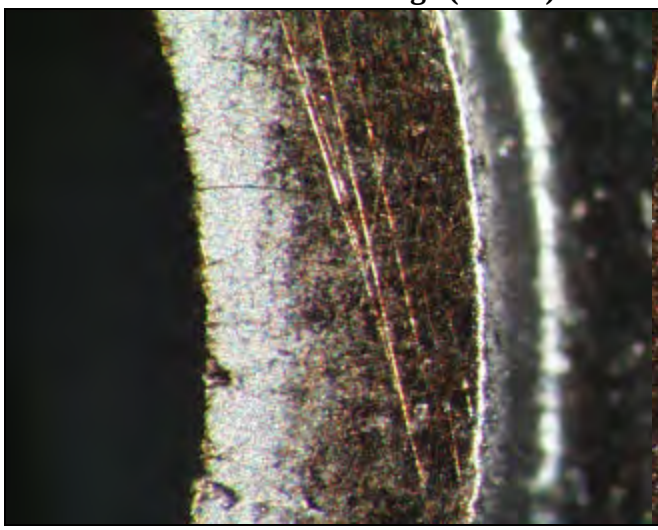
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

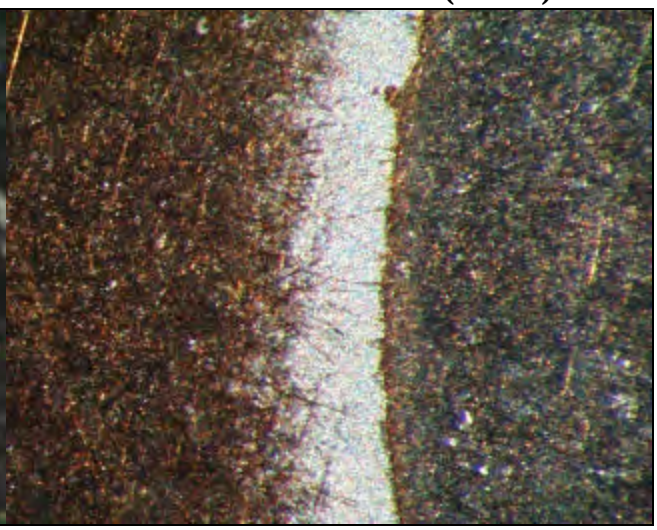
Photographic Documentation of R-134a Control Compressor
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

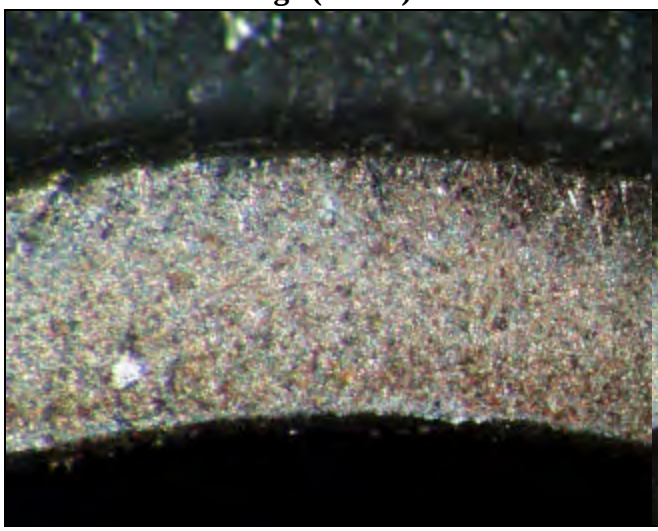
Valve Plate and Reed/Suction (macro)



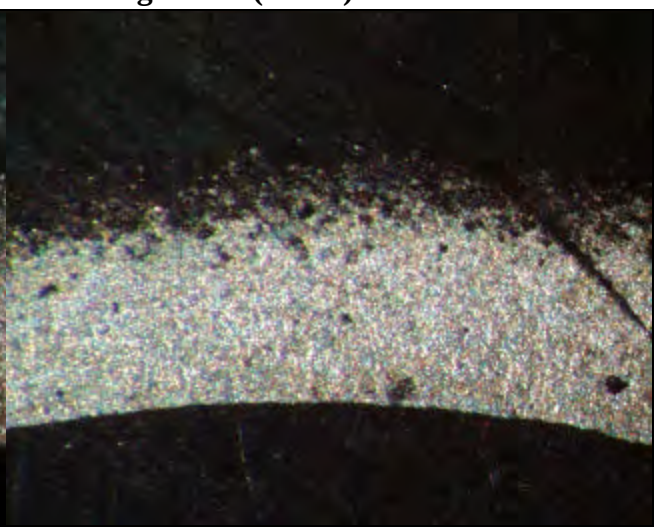
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant R-12

TEST HISTORY OF:

Unit Number 142
Model # RS40C1E-IAV-250 **Serial #** 96F16562
Run Time (hr.) 12015 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** Yes
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 6.3 **(4)** 6.3
Remaining torque of stator bolts
(1) 10.4 **(2)** 10.4 **(3)** 10.4 **(4)** 10.4

Suction muffler appearance	gray
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	Cu trace
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	slight

Remaining torque of discharge muffler removed
(1) 18.8 **(2)** 18.8 **(3)** 18.8 **(4)** 18.8

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty/wear metals

Remaining torque of cage bearing bolts
(1) 8.3 **(2)** 8.3 **(3)** 8.3 **(4)** 6.3

Crank journals
Appearance scored/Cu plating
Wear medium
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance scored/Cu plating
Wear medium
Dimensions **Loaded** 0.9995
Unloaded 0.9995

Bottom thrust washer (crank side)
Appearance scored/bronze plating
Wear medium

Bottom washer (casting side)
Appearance scored/bronze plating
Wear slight

Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0035
Unloaded 1.0035

Shaft in cage bearing
Appearance Cu plating/black
Wear slight

Piston top appearance carbon

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3730
Unloaded 1.3730

Cylinder bore
Appearance low wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 142
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.07
Water (ppm)	40
Fluoride ion (ppm)	0.95
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	5
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	14
Zinc (ppm)	2

Trash in liquid screen (g)	0.061
Number of screens	2
Debris in compressor bottom (g)	0.533

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion/Cu plating

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/black

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	very slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	hard
Spring	very heavy	black	hard
Spring Seat	medium	black	hard
Ball	slight	gray	hard
Front Side	heavy	black, green	hard

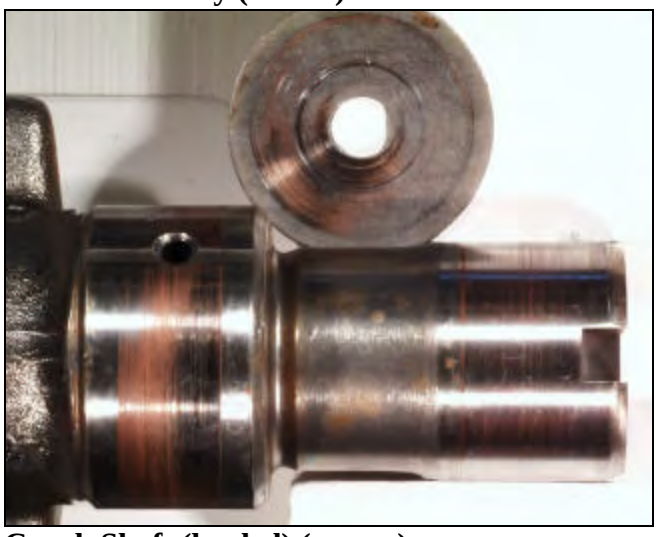
Photographic Documentation of R-134a Compressor with Contaminant R-12
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

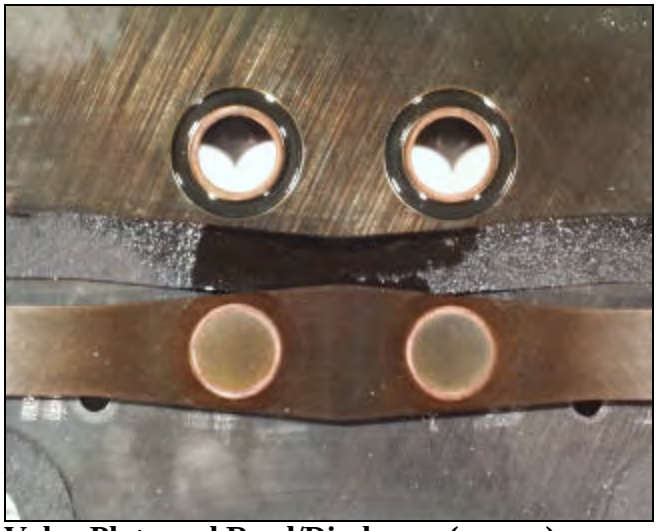
Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

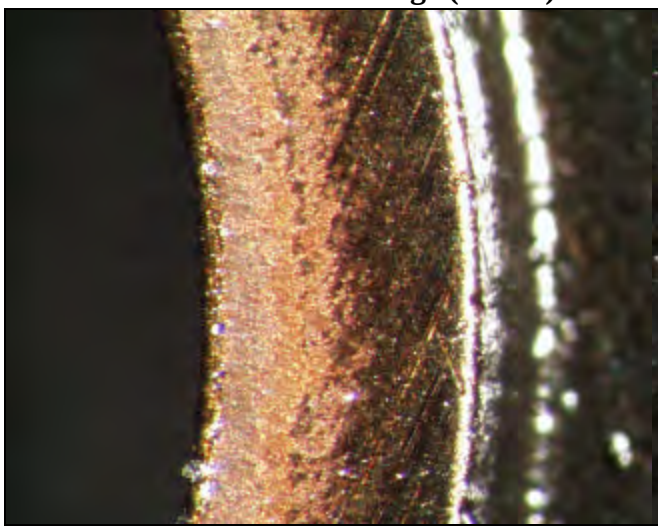
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant R-12
160 psig/10 psig

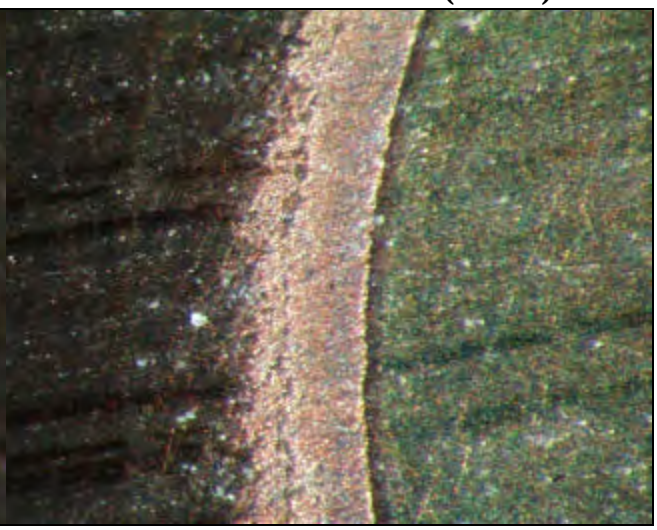


Valve Plate and Reed/Discharge (macro)

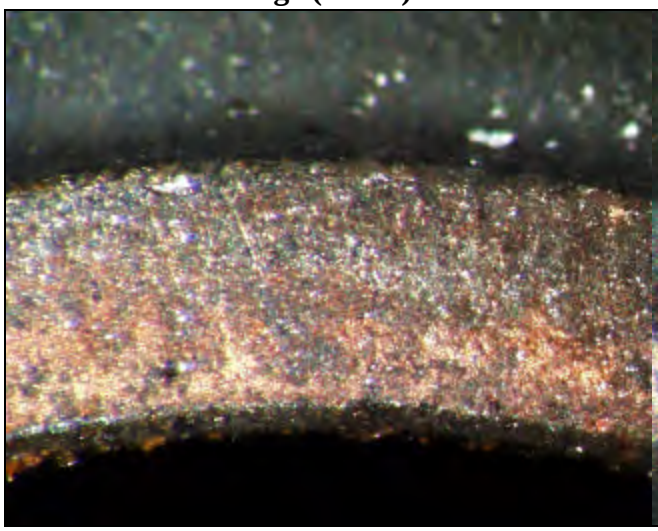
Valve Plate and Reed/Suction (macro)



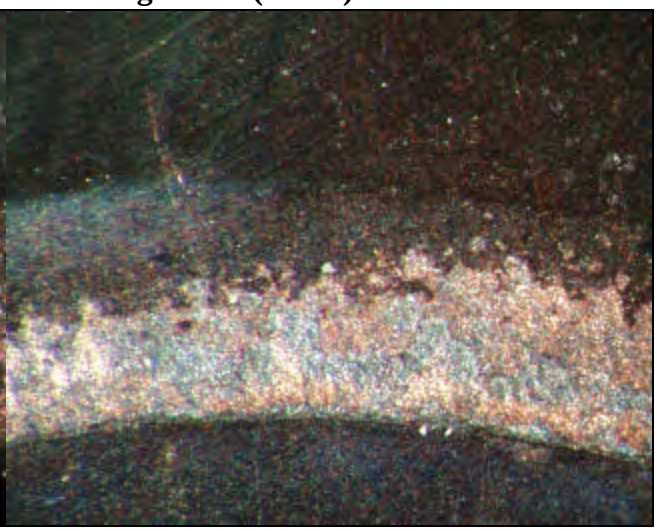
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid

TEST HISTORY OF:

Unit Number 143
Model # RS40C1E-IAV-250 **Serial #** 96F16573
Run Time (hr.) 12011 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 10 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 20 **(3)** 15 **(4)** 17.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 7.5 **(2)** 7.5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	slight	
Bottom washer (casting side)		
Appearance	scored/Cu plating	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	slight	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored/corrosion	
Wear	slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 143
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear/corrosion

Piston pin

Appearance	corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4965
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.21
Water (ppm)	44
Fluoride ion (ppm)	0.81
Chloride ion (ppm)	16
Aluminum (ppm)	0
Copper (ppm)	2
Iron (ppm)	3
Lead (ppm)	2
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	3

Trash in liquid screen (g)	0.000
Number of screens	2
Debris in compressor bottom (g)	0.554

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	slight
Varnish ring	medium

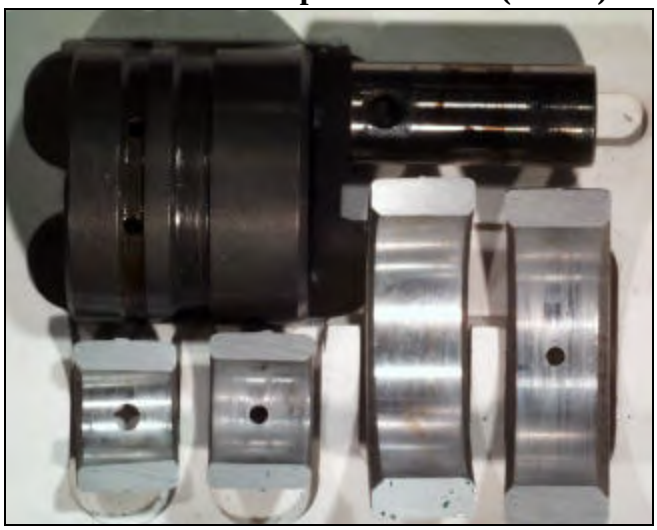
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black, brown	hard, gummy
Spring Seat	none	none	none
Ball	medium	black	hard
Front Side	medium	black	hard

Photographic Documentation of R-134a Compressor with Contaminant Acid
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

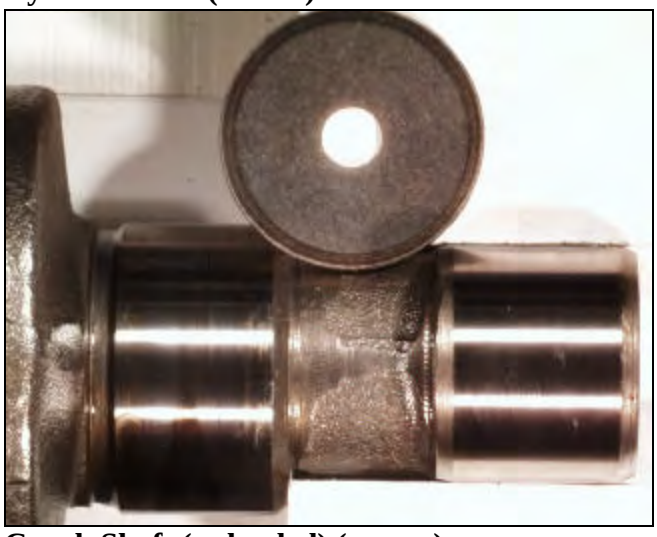
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

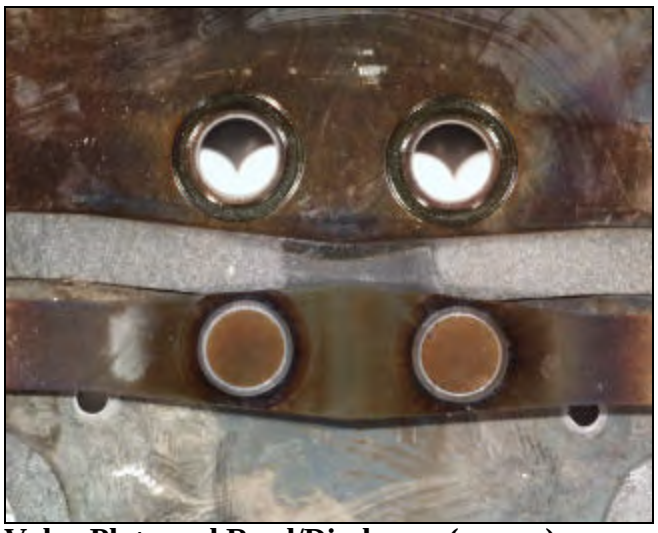
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



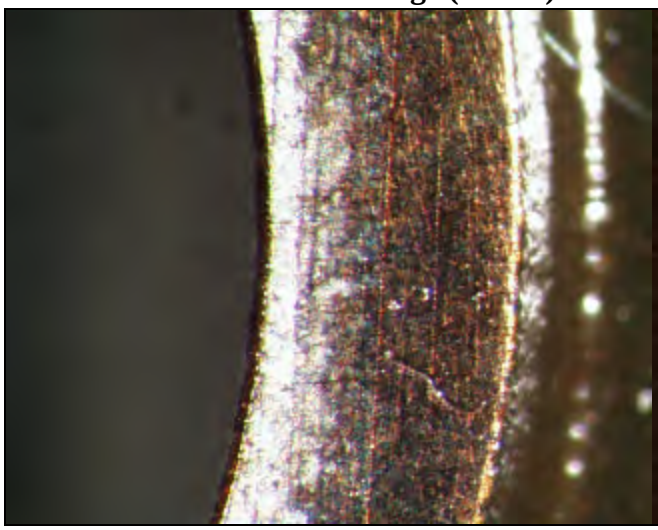
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Acid
160 psig/10 psig

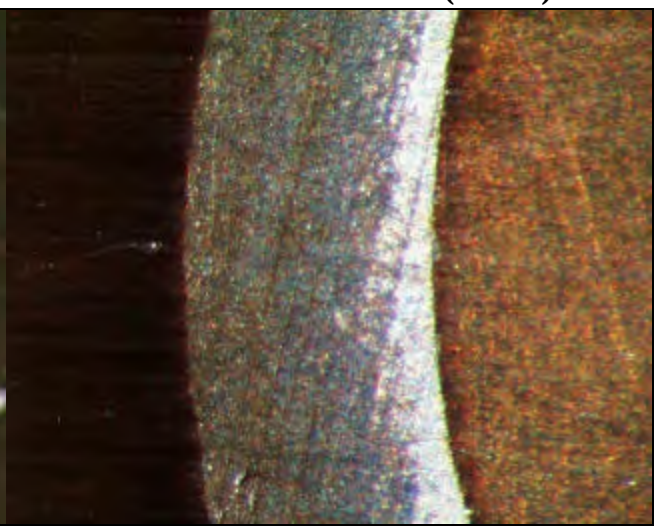


Valve Plate and Reed/Discharge (macro)

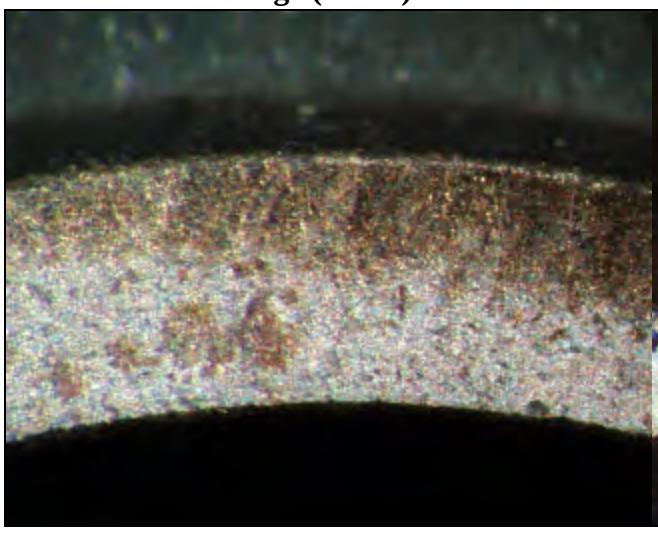
Valve Plate and Reed/Suction (macro)



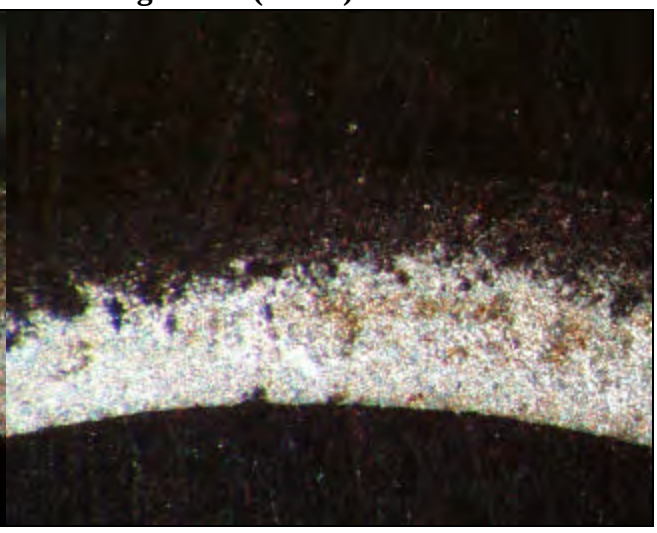
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air

TEST HISTORY OF:

Unit Number 144
Model # RS40C1E-IAV-250 **Serial #** 96F16580
Run Time (hr.) 12156 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 12.5 **(2)** 4.2 **(3)** 12.5 **(4)** 14.6

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray/Cu
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 6.3 **(3)** 6.3 **(4)** 6.3

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2465
	Unloaded	1.2465
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	slight	
Lower bronze bearings		
Appearance	clean/scored	
Wear	polish	
Dimensions	**Loaded**	1.0030
	Unloaded	1.0030
Shaft in cage bearing		
Appearance	corrosion	
Wear	slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear/corrosion	
Varnish ring	medium	
Dimensions	**Loaded**	1.3765
	Unloaded	1.3765
Connecting rod (large end)		
Appearance	Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 144
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	scored/Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4975
	Unloaded	0.4975

Final Lubricant Values

Total Acid Number (TAN)	0.18
Water (ppm)	60
Fluoride ion (ppm)	0.81
Chloride ion (ppm)	22
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.070
Number of screens	3
Debris in compressor bottom (g)	0.613

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	very slight

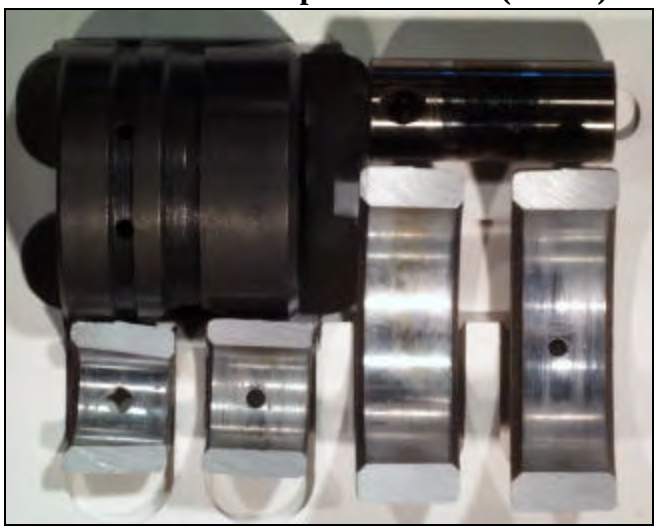
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	hard
Spring	very heavy	black	hard
Spring Seat	heavy	black	hard
Ball	slight	black	gummy
Front Side	heavy	black	hard

Photographic Documentation of R-134a Compressor with Contaminant Air
160 psig/10 psig

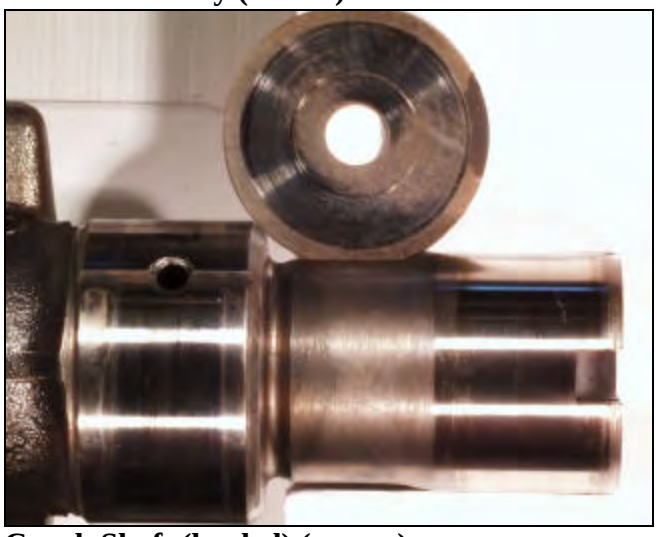
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

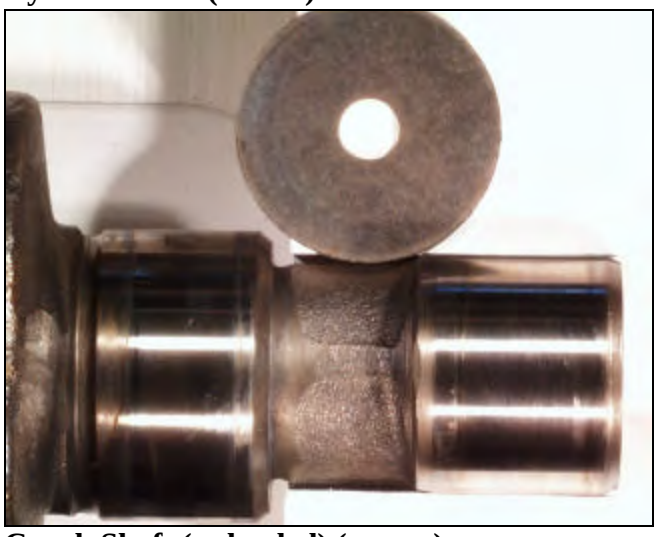


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

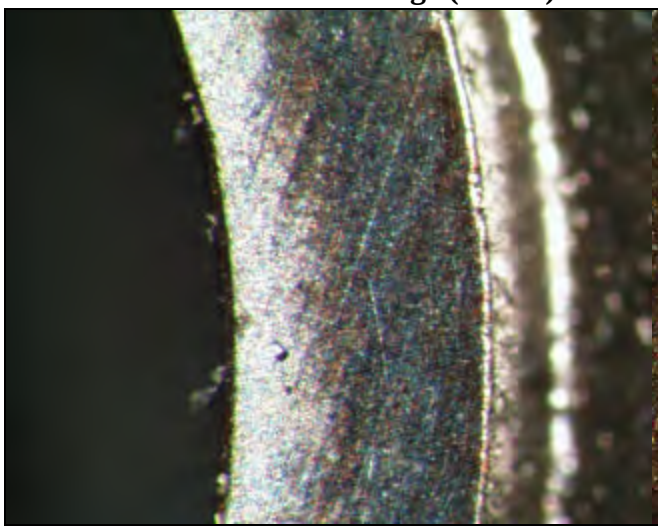


Crank Shaft (unloaded) (macro)

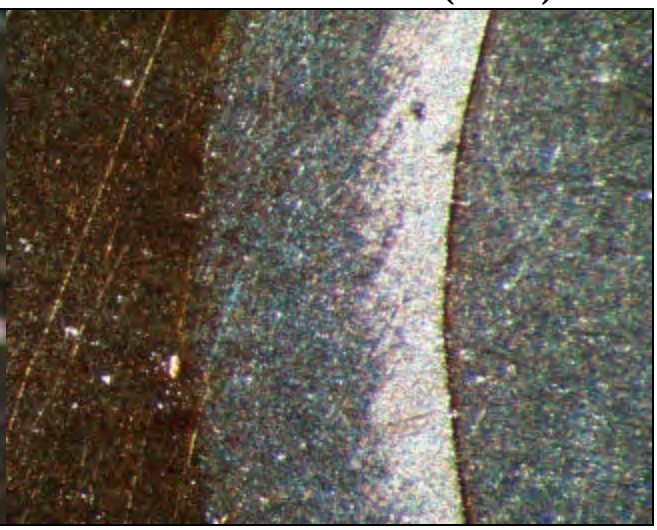
Photographic Documentation of R-134a Compressor with Contaminant Air
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

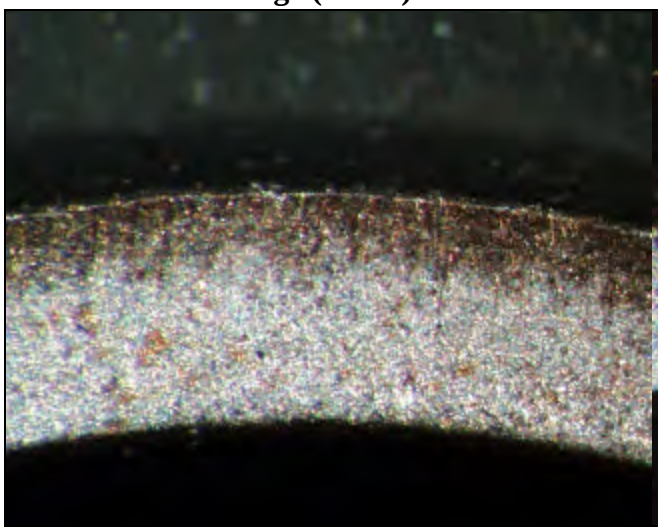
Valve Plate and Reed/Suction (macro)



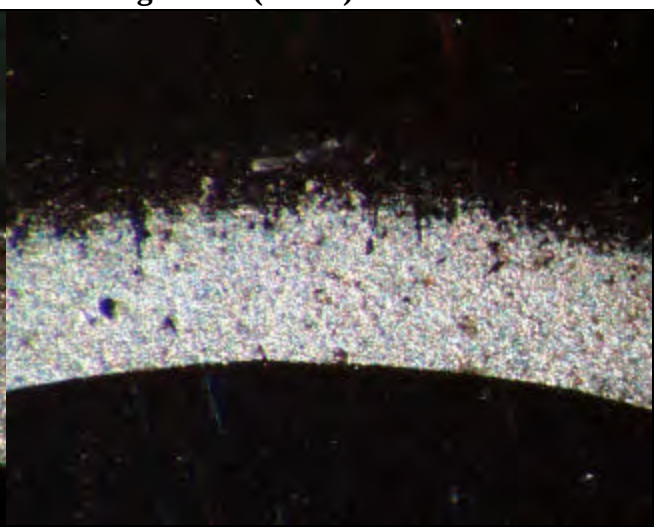
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid and R-12

TEST HISTORY OF:

Unit Number 145
Model # RS40C1E-IAV-250 **Serial #** 96F16584
Run Time (hr.) 12000 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? No **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	gray
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4.2 **(2)** 4.2 **(3)** 4.2 **(4)** 4.2
Remaining torque of stator bolts
(1) 10.4 **(2)** 10.4 **(3)** 10.4 **(4)** 10.4

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	Yes
Was rotor loose?	Yes
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 6.3 **(3)** 6.3 **(4)** 6.3

Crank journals		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	1.2480
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9995
	Unloaded	0.9995
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	slight	
Bottom washer (casting side)		
Appearance	clean/scored	
Wear	slight	
Lower bronze bearings		
Appearance	clean/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3725
	Unloaded	1.3725
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.2520
	Unloaded	1.2520

TEST HISTORY OF:

Unit Number 145
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5020
	Unloaded	0.5020

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	41
Fluoride ion (ppm)	0.77
Chloride ion (ppm)	21
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	1
Silicon (ppm)	3
Tin (ppm)	2
Zinc (ppm)	1

Trash in liquid screen (g)	0.031
Number of screens	2
Debris in compressor bottom (g)	0.673

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

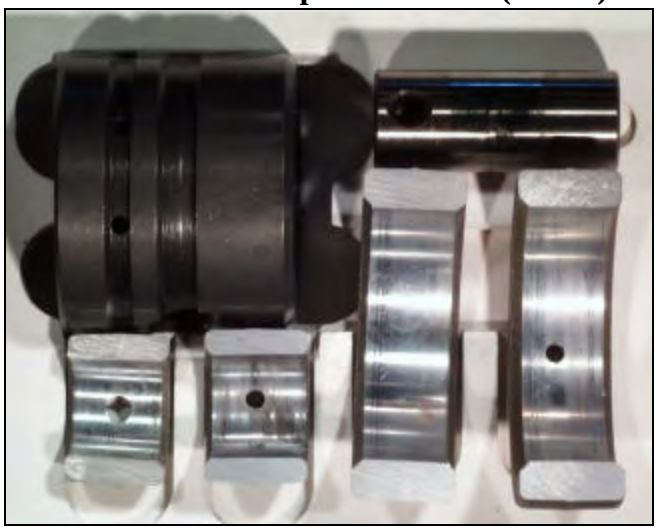
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	hard
Spring	none	none	none
Spring Seat	none	none	none
Ball	very slight	brown	hard
Front Side	very slight	brown	hard

Photographic Documentation of R-134a Compressor with Contaminant Acid and R-12
160 psig/10 psig

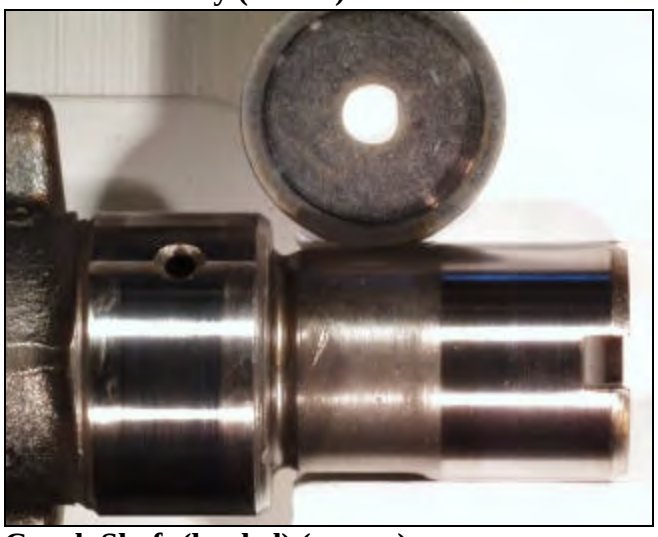
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

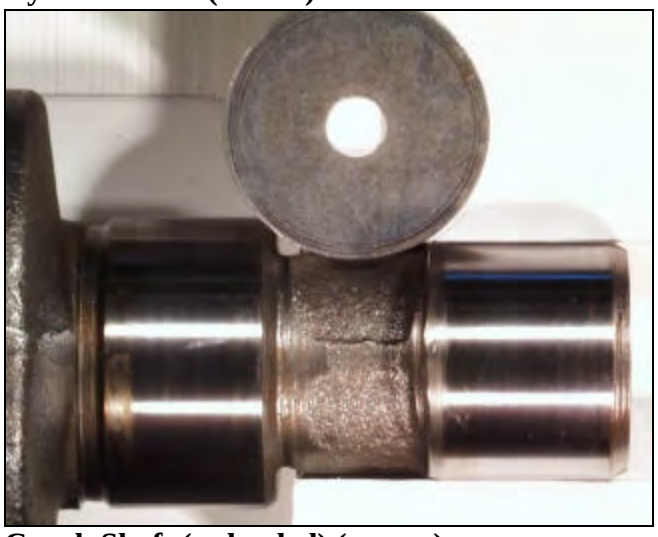


Piston Assembly (macro)

Cylinder Bore (macro)



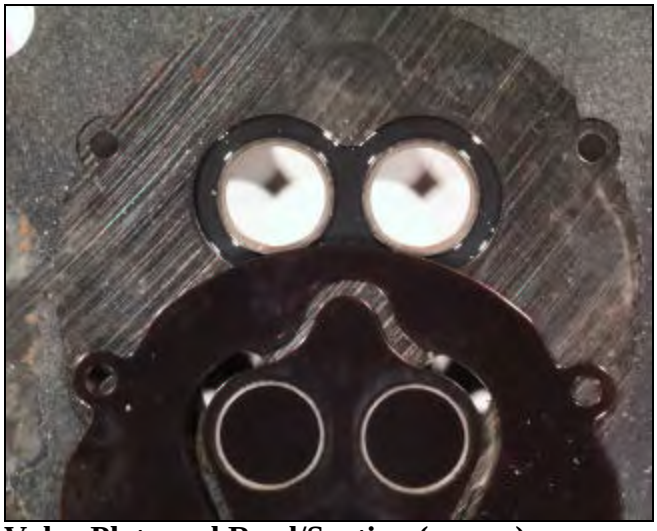
Crank Shaft (loaded) (macro)



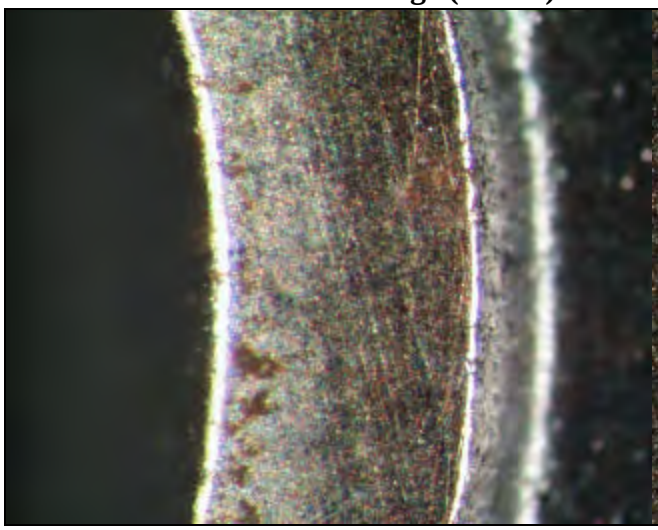
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Acid and R-12
160 psig/10 psig

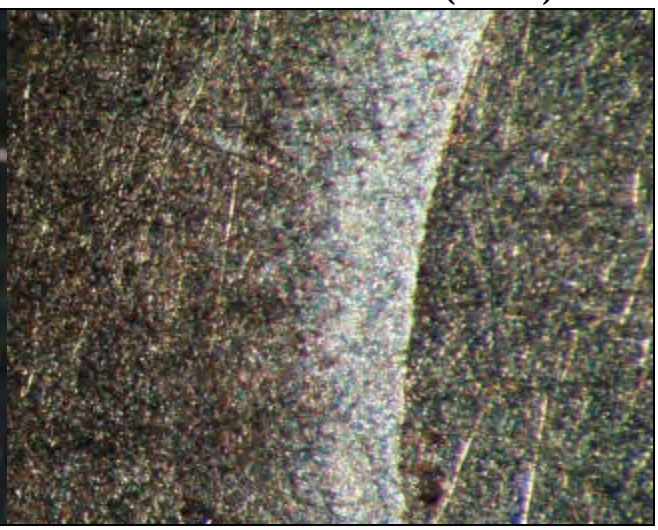
Valve Plate and Reed/Discharge (macro)



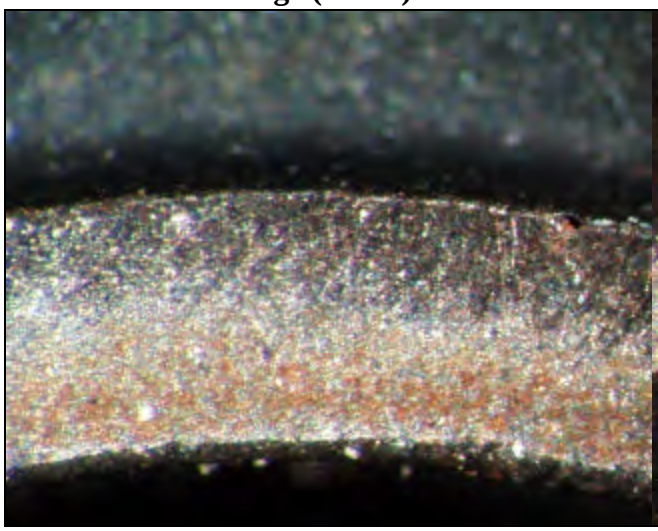
Valve Plate and Reed/Suction (macro)



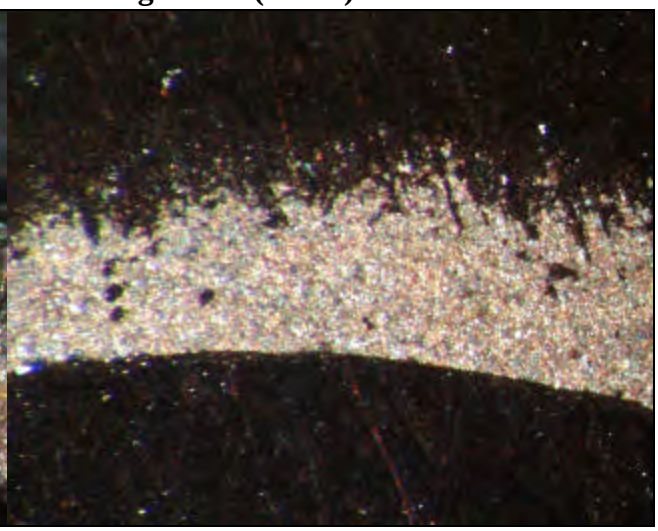
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Air, and R-12

TEST HISTORY OF:

Unit Number 146
Model # RS40C1E-IAV-250 **Serial #** 96F16563
Run Time (hr.) 12101 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig) 160
Suction Pressure (psig) 10
Discharge Temp (°F) 224
Return Gas Temp (°F) 63
SumpTemp (°F) 212

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance black/Cu
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5
Remaining torque of stator bolts
(1) 12.5 **(2)** 17.5 **(3)** 10 **(4)** 10
Suction muffler appearance clean
carbon/corrosion/bronze
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray
Top stator windings appearance gray/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance black
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 20 **(2)** 15 **(3)** 20 **(4)** 22.5
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 7.5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9980
Unloaded 0.9980
Bottom thrust washer (crank side)
Appearance scored/corrosion
Wear slight
Bottom washer (casting side)
Appearance clean
Wear polish
Lower bronze bearings
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance
Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2515
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 146
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear/Cu plating

Piston pin

Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.17
Water (ppm)	78
Fluoride ion (ppm)	0.78
Chloride ion (ppm)	24
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	3
Lead (ppm)	3
Silicon (ppm)	7
Tin (ppm)	0
Zinc (ppm)	7

Trash in liquid screen (g)	0.011
Number of screens	1
Debris in compressor bottom (g)	0.650

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	heavy	black	gummy
Spring Seat	slight	gray	gummy
Ball	slight	gray	gummy
Front Side	slight	gray	gummy

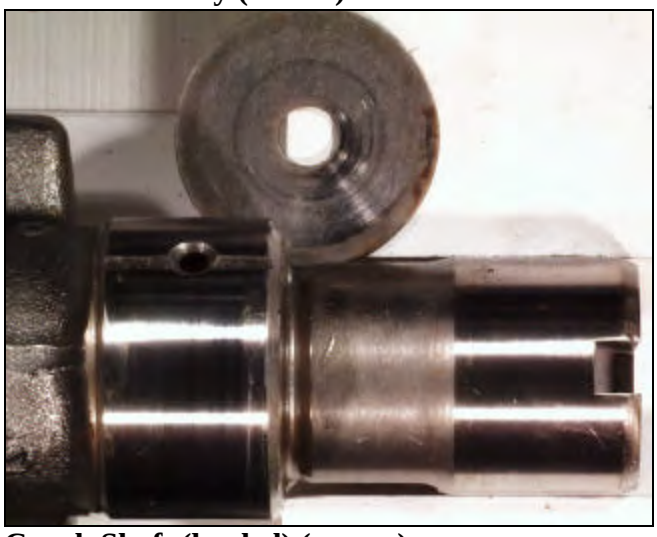
Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and R-12
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

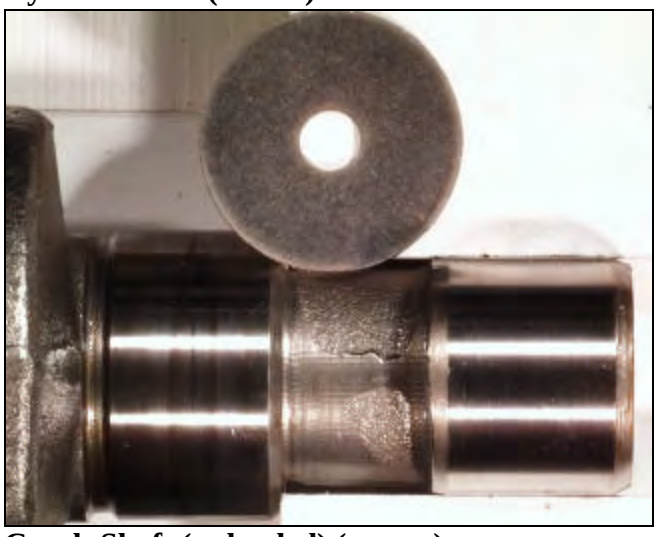
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

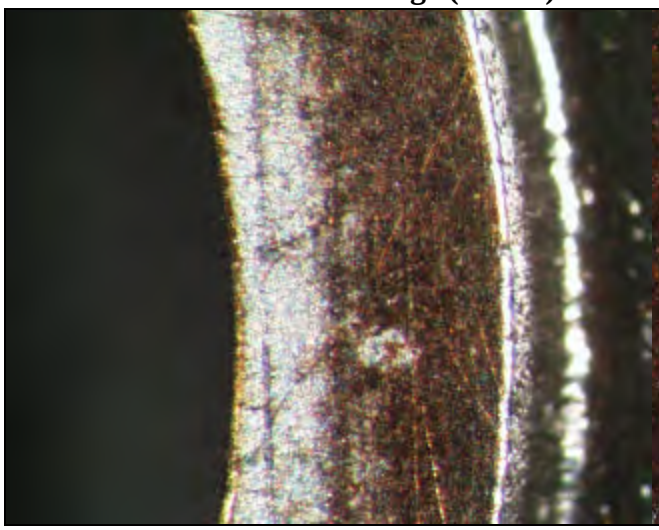


Crank Shaft (unloaded) (macro)

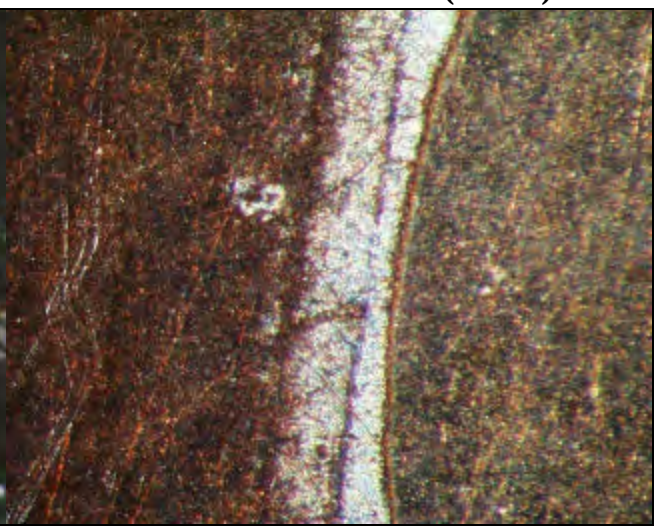
Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and R-12
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

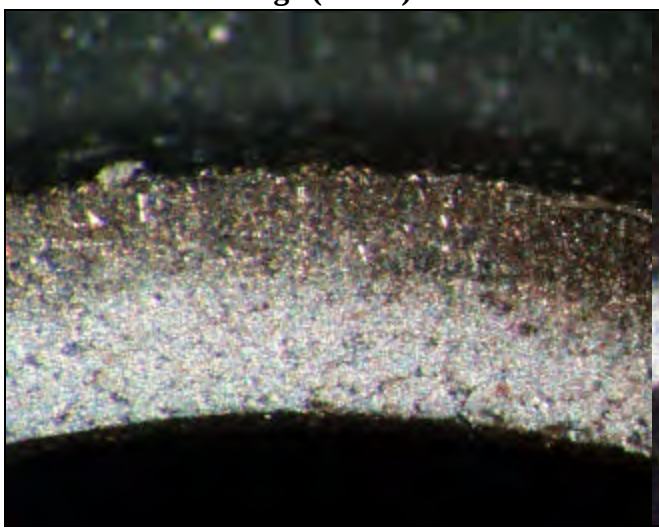
Valve Plate and Reed/Suction (macro)



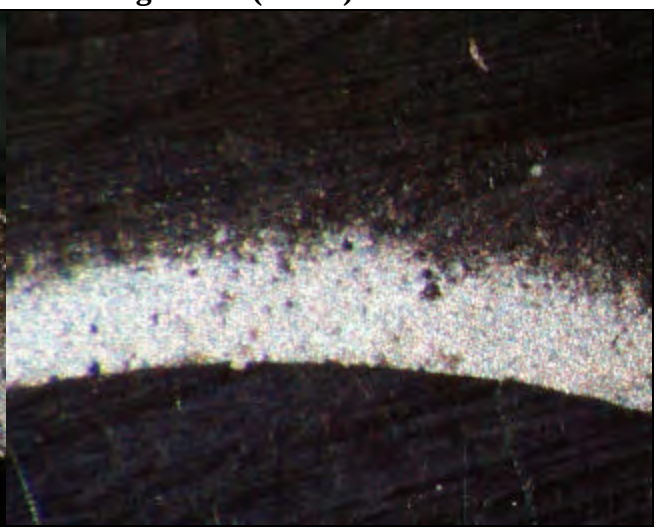
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air and R-12

TEST HISTORY OF:

Unit Number 147
Model # RS40C1E-IAV-250 **Serial #** 96F16586
Run Time (hr.) 12001 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** Yes
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black/Cu
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 2.5 **(4)** 3

Remaining torque of stator bolts
(1) 7.5 **(2)** 12.5 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	gray/stator top green
Rotor rub marks present?	Yes
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 12.5 **(4)** 12.5

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 2.5 **(3)** 7.5 **(4)** 5

Crank journals
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear slight

Bottom washer (casting side)
Appearance scored/Cu plating
Wear slight

Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance corrosion
Wear polish

Piston top appearance clean/bronze

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740

Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear medium
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number	147		
Contaminants:			
Control Unit?	No		
Acid?	No	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Trash in liquid screen (g)	0.041
Number of screens	2
Debris in compressor bottom (g)	0.886

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	clean	
Wear	medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.09
Water (ppm)	39
Fluoride ion (ppm)	0.78
Chloride ion (ppm)	17
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	2
Tin (ppm)	1
Zinc (ppm)	0

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	blued

Discharge surface appearance
corrosion

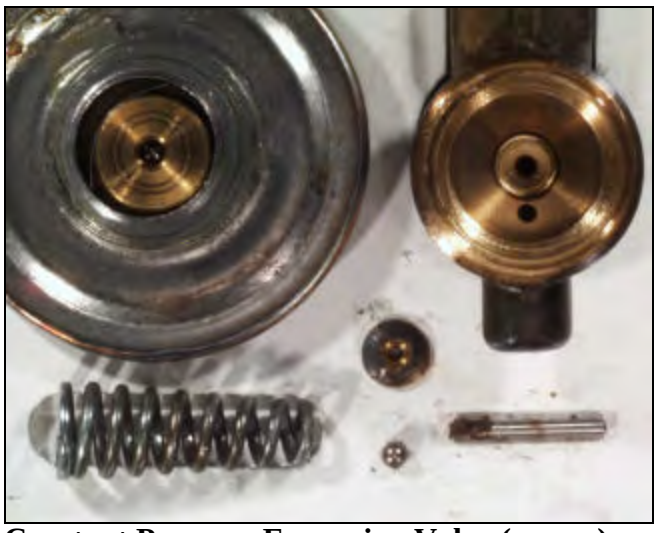
Discharge reed

Condition	good
Appearance	corrosion/blued
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	gray	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	heavy	black	gummy
Spring	medium	black	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

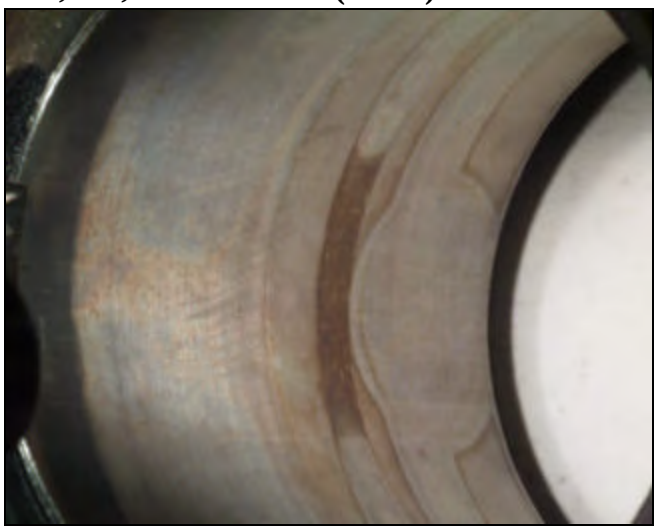
Photographic Documentation of R-134a Compressor with Contaminant Air and R-12
160 psig/10 psig



Constant Pressure Expansion Valve (macro)

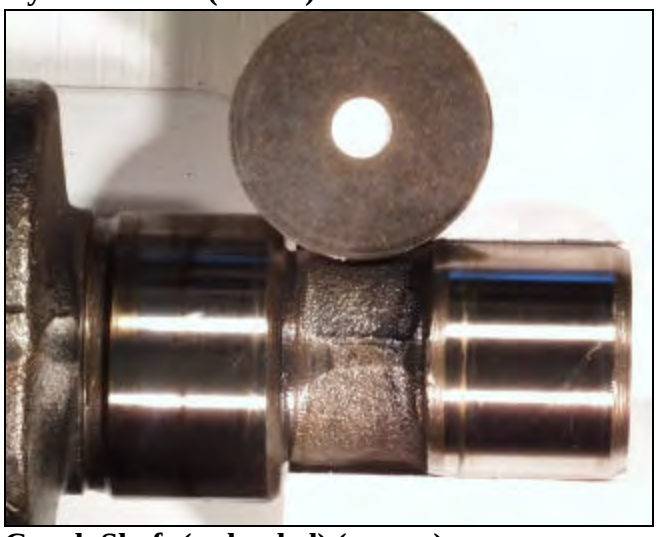
Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

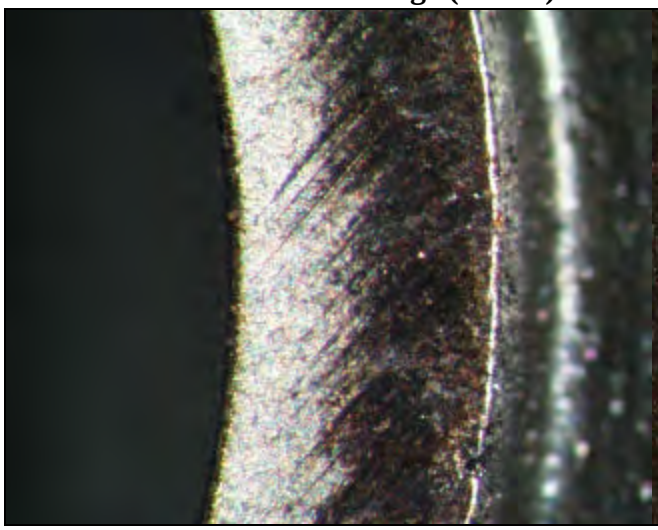


Crank Shaft (unloaded) (macro)

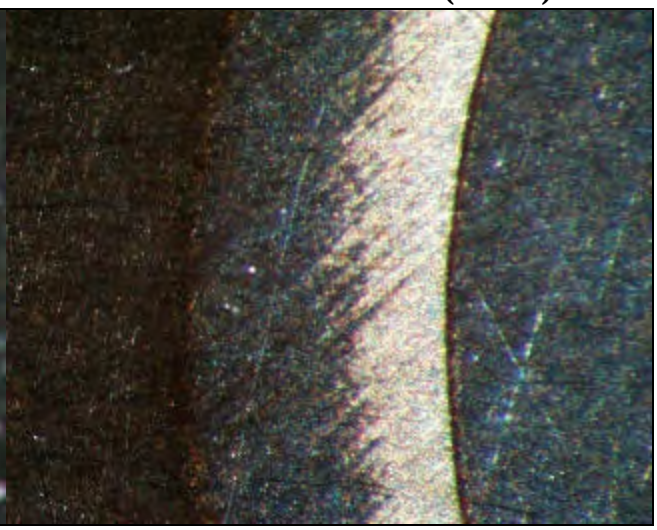
Photographic Documentation of R-134a Compressor with Contaminant Air and R-12
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

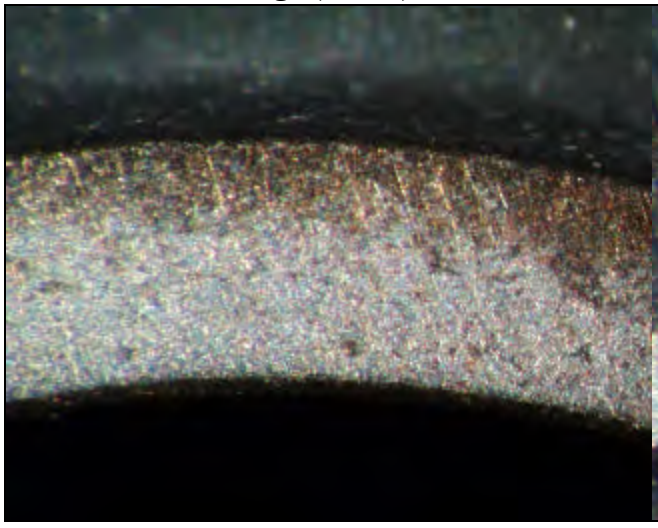
Valve Plate and Reed/Suction (macro)



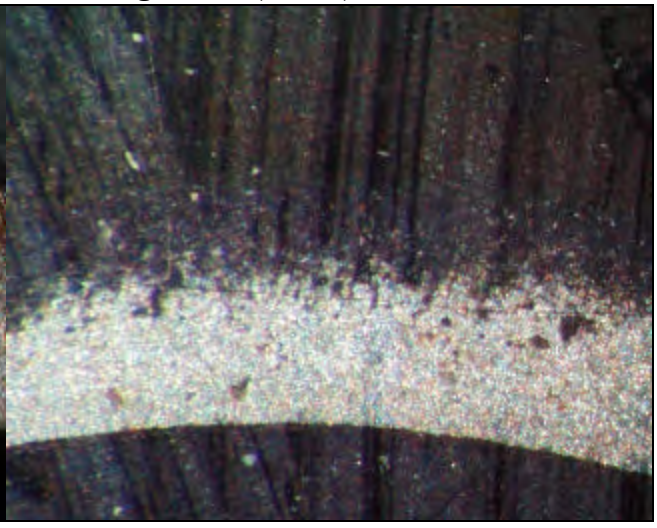
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid and Air

TEST HISTORY OF:

Unit Number 148
Model # RS40C1E-IAV-250 **Serial #** 96F16587
Run Time (hr.) 12035 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? No **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 6.3 **(2)** 4.2 **(3)** 4.2 **(4)** 2.1
Remaining torque of stator bolts
(1) 12.5 **(2)** 12.5 **(3)** 12.5 **(4)** 12.5

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	black
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16.7 **(2)** 16.7 **(3)** 16.7 **(4)** 16.7

Head gasket brittle?	yes/bonded
Head suction cavity appearance	clean
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 6.3 **(2)** 4.2 **(3)** 6.3 **(4)** 4.2

Crank journals
Appearance clean/corrosion
Wear polish
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance clean
Wear slight
Dimensions **Loaded** 0.9995
Unloaded 0.9995

Bottom thrust washer (crank side)
Appearance scored/bronze plating
Wear slight

Bottom washer (casting side)
Appearance clean
Wear slight

Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance clean
Wear slight

Piston top appearance clean

Piston skirt
Appearance no wear
Dimensions **Loaded** 1.3730
Unloaded 1.3730

Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3765
Unloaded 1.3765

Connecting rod (large end)
Appearance none
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 148
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	No	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5015

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	41
Fluoride ion (ppm)	0.81
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	2
Lead (ppm)	2
Silicon (ppm)	3
Tin (ppm)	15
Zinc (ppm)	1

Trash in liquid screen (g)	0.038
Number of screens	4
Debris in compressor bottom (g)	0.575

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/black

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion/black
Trepan	slight
Varnish ring	slight

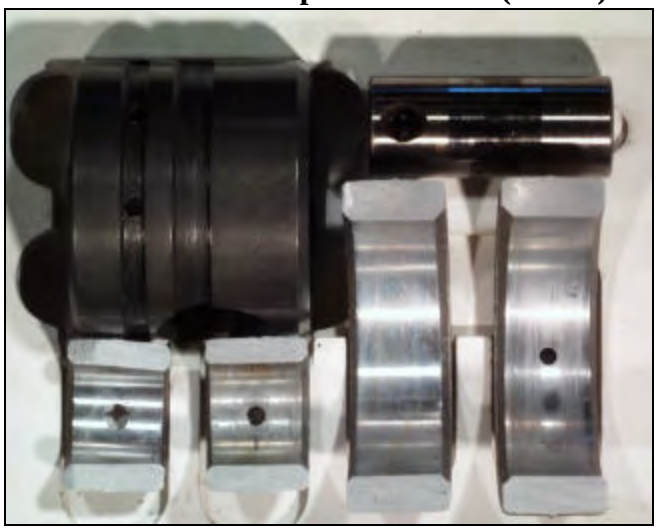
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	black	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	hard
Spring	heavy	black	hard
Spring Seat	medium	black	hard
Ball	slight	gray	hard
Front Side	slight	black	hard

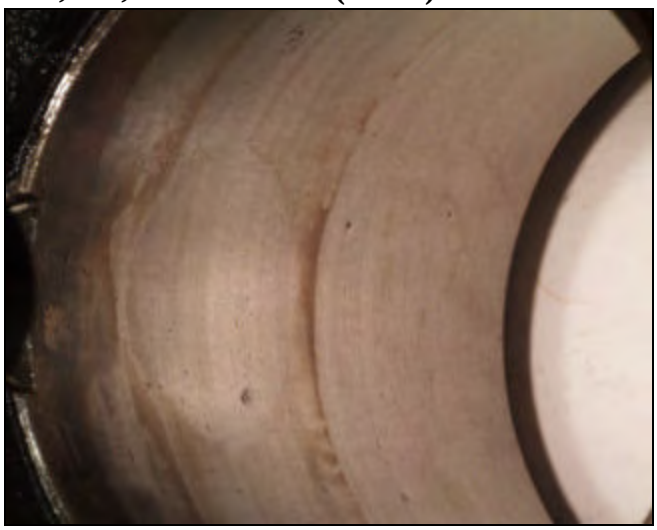
Photographic Documentation of R-134a Compressor with Contaminant Acid and Air 160 psig/10 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

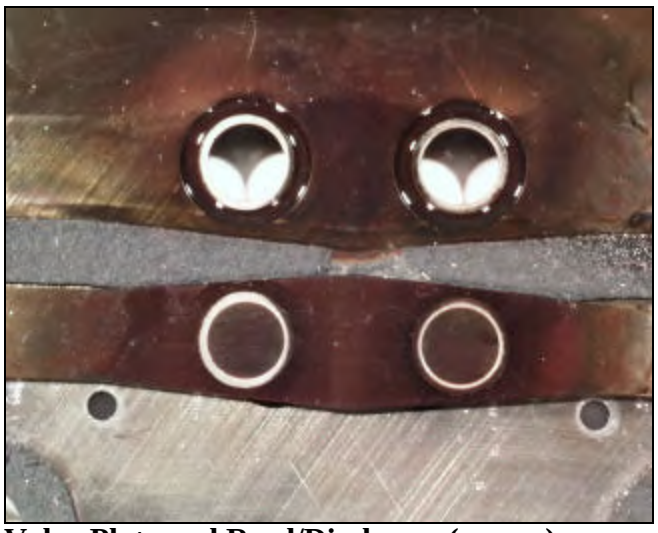


Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

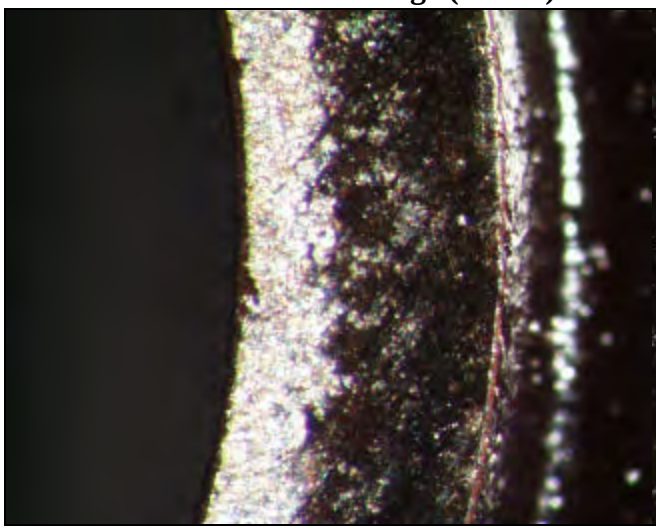
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Acid and Air
160 psig/10 psig

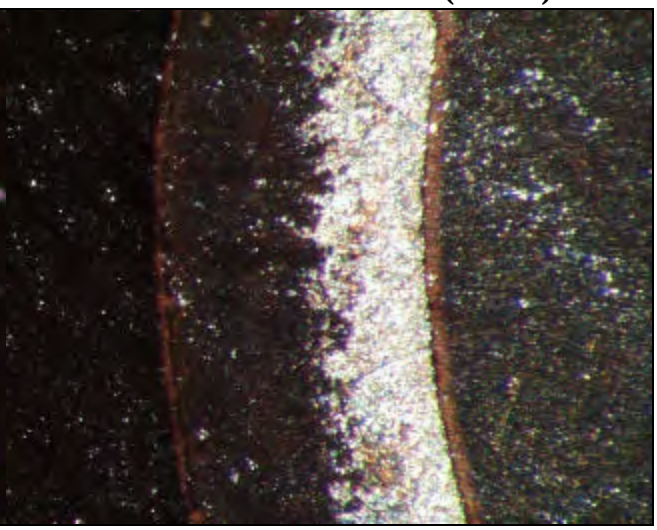


Valve Plate and Reed/Discharge (macro)

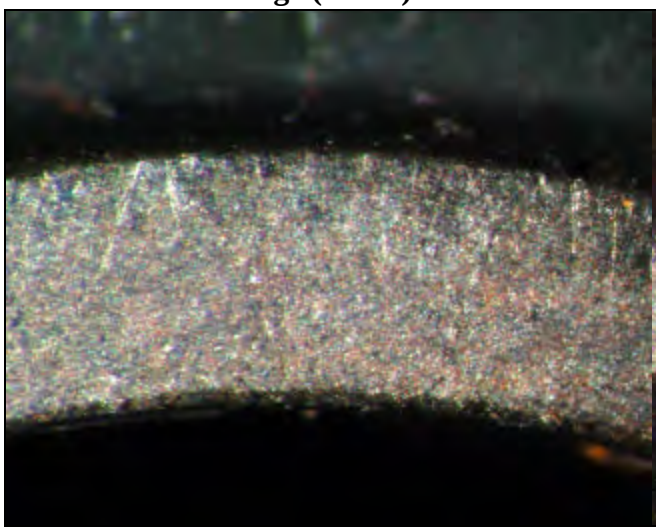
Valve Plate and Reed/Suction (macro)



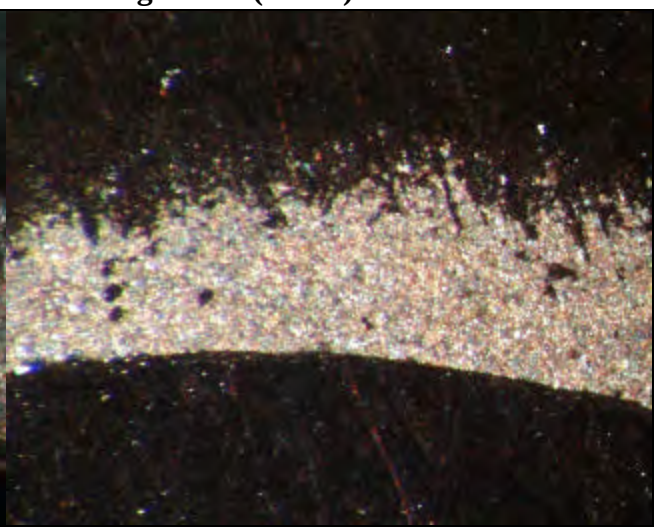
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Water and R-12

TEST HISTORY OF:

Unit Number	149		
Model #	RS40C1E-IAV-250	**Serial #**	96F16581
Run Time (hr.)	2859	**Failed?**	Yes
Refrigerant	R-134a		
Lubricant	RL32S		
Contaminants:			
Control Unit?	No		
Acid?	No	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Discharge Pressure (psig)	145
Suction Pressure (psig)	20
Discharge Temp (°F)	187
Return Gas Temp (°F)	63
SumpTemp (°F)	174
Hi-Pot	pass
High-low leak	NA
Top shell appearance	gray
Suction exit trail appearance	black
Cluster block condition	good
Wire to cluster block appearance	gray
Suction ring top appearance	gray

Remaining torque of discharge muffler

(1) ND **(2)** ND **(3)** ND **(4)** ND

Remaining torque of stator bolts

(1) ND **(2)** ND **(3)** ND **(4)** ND

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	black
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed

(1) ND **(2)** ND **(3)** ND **(4)** ND

Head gasket brittle?	no/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts

(1) ND **(2)** ND **(3)** ND **(4)** ND

Crank journals		
Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2470
	Unloaded	1.2470
Lower crank bearing journal		
Appearance	clean/Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.9980
	Unloaded	0.9980
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	scored	
Wear	slight	
Lower bronze bearings		
Appearance	scored	
Wear	polish	
Dimensions	**Loaded**	1.0035
	Unloaded	1.0035
Shaft in cage bearing		
Appearance	clean	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	corrosion	
Wear	polish	
Dimensions	**Loaded**	1.2510
	Unloaded	1.2510

TEST HISTORY OF:

Unit Number 149
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear/Cu plating

Piston pin

Appearance	Cu plating/corrosion	
Wear	polish	
Dimensions	**Loaded**	0.4970
	Unloaded	0.4970

Final Lubricant Values

Total Acid Number (TAN)	0.08
Water (ppm)	70
Fluoride ion (ppm)	0.85
Chloride ion (ppm)	14
Aluminum (ppm)	1
Copper (ppm)	0
Iron (ppm)	33
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	21
Zinc (ppm)	1

Trash in liquid screen (g)	0.153
Number of screens	3
Debris in compressor bottom (g)	0.550

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/black

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

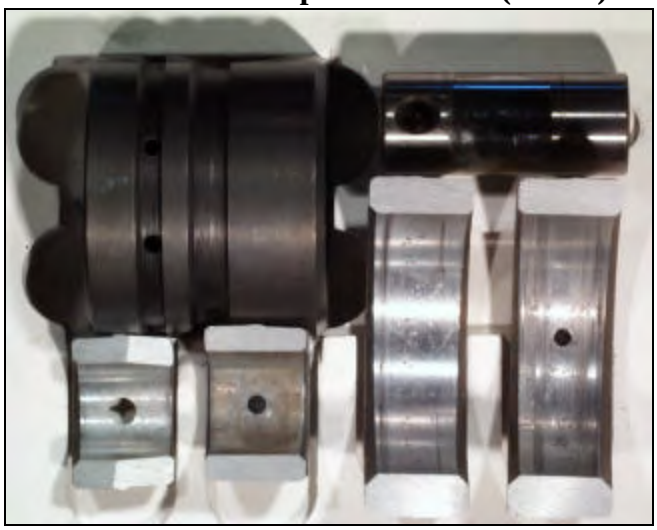
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	medium	black	gummy
Rear Pin	none	none	none
Equalizer Hole	slight	black	gummy
Tip of Pin	medium	black	gummy
Spring	heavy	black	very gummy
Spring Seat	medium	black	gummy
Ball	none	none	none
Front Side	none	none	none

Photographic Documentation of R-134a Compressor with Contaminant Water and R-12
145 psig/20 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

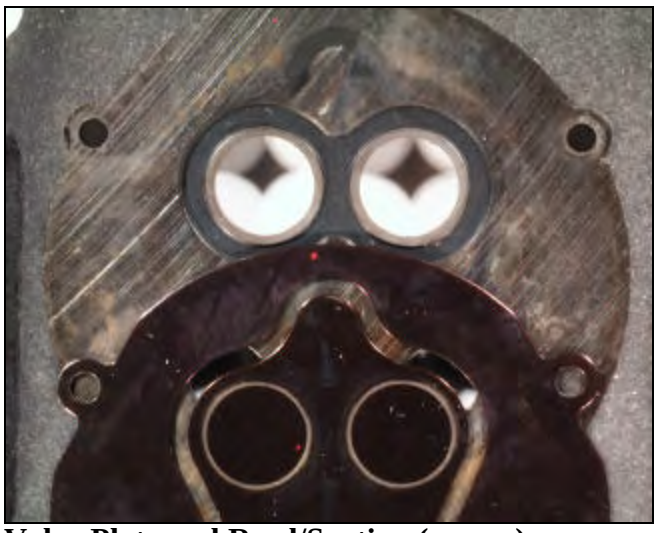
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

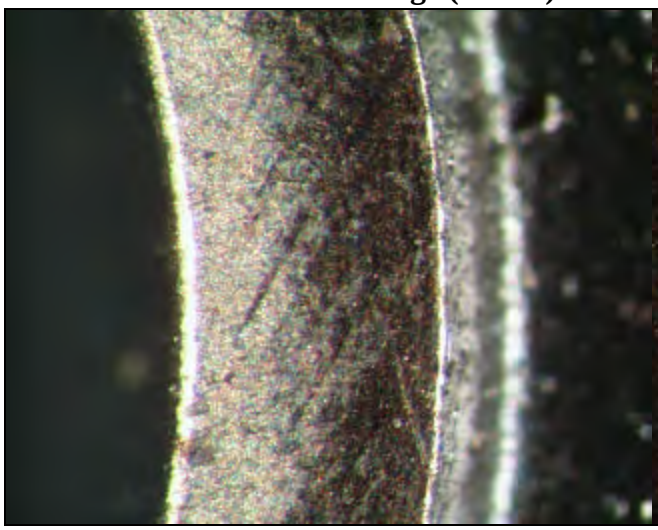
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Water and R-12
145 psig/20 psig

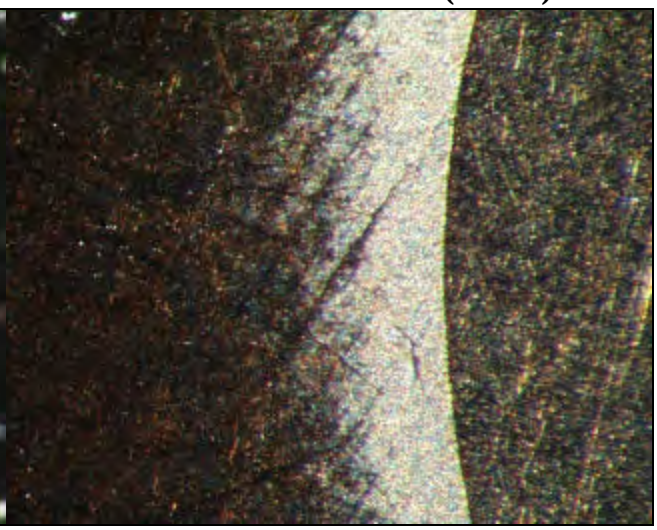
Valve Plate and Reed/Discharge (macro)



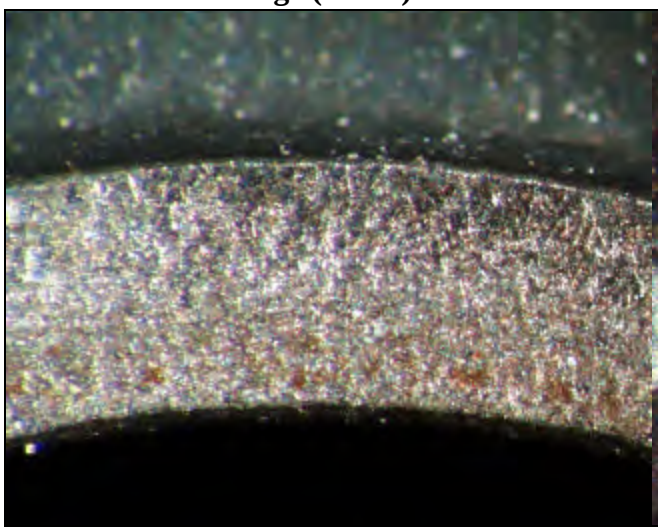
Valve Plate and Reed/Suction (macro)



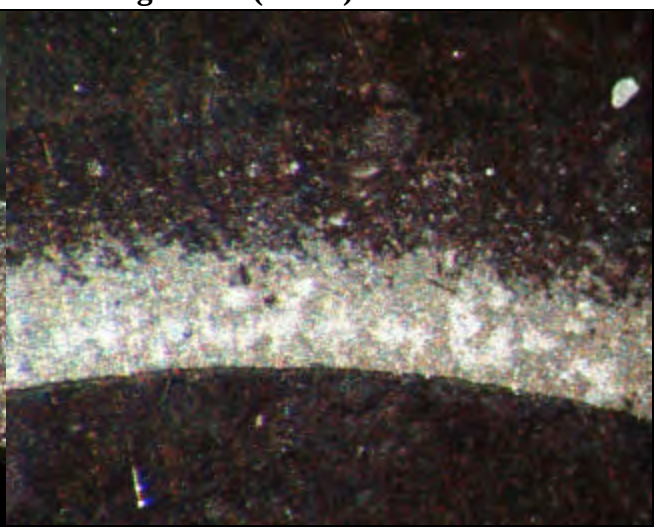
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid and Water

TEST HISTORY OF:

Unit Number 150
Model # RS40C1E-IAV-250 **Serial #** 96F16560
Run Time (hr.) 12003 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 160
Suction Pressure (psig) 10
Discharge Temp (°F) 224
Return Gas Temp (°F) 63
SumpTemp (°F) 212

Hi-Pot pass
High-low leak pass
Top shell appearance gray
Suction exit trail appearance gray
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 6 **(2)** 5 **(3)** 4 **(4)** 5
Remaining torque of stator bolts
(1) 9 **(2)** 9 **(3)** 9 **(4)** 8
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance black
Top stator windings appearance gray
Rotor rub marks present? No
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 15 **(4)** 14
Head gasket brittle? yes
Head suction cavity appearance clean
Head discharge cavity appearance dirty
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 4 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating
Wear polish, slight
Dimensions **Loaded** 1.2465
Unloaded 1.2465
Lower crank bearing journal
Appearance Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear slight
Bottom washer (casting side)
Appearance scored
Wear polish
Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0020
Unloaded 1.0025
Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3720
Unloaded 1.3720
Cylinder bore
Appearance no wear
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored
Wear polish
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 150
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)

Piston pin

Appearance	Cu plating	
Wear	polish	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.67
Water (ppm)	58
Fluoride ion (ppm)	0.78
Chloride ion (ppm)	12
Aluminum (ppm)	3
Copper (ppm)	6
Iron (ppm)	21
Lead (ppm)	3
Silicon (ppm)	2
Tin (ppm)	20
Zinc (ppm)	7

Trash in liquid screen (g)	0.159
Number of screens	7
Debris in compressor bottom (g)	1.025

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion/Cu plating

Suction reed

Condition	good
Appearance	Cu plating
Trepan	medium
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	Cu plating/soot

Discharge surface appearance
corrosion/Cu plating

Discharge reed

Condition	good
Appearance	corrosion/Cu plating
Trepan	slight
Varnish ring	none

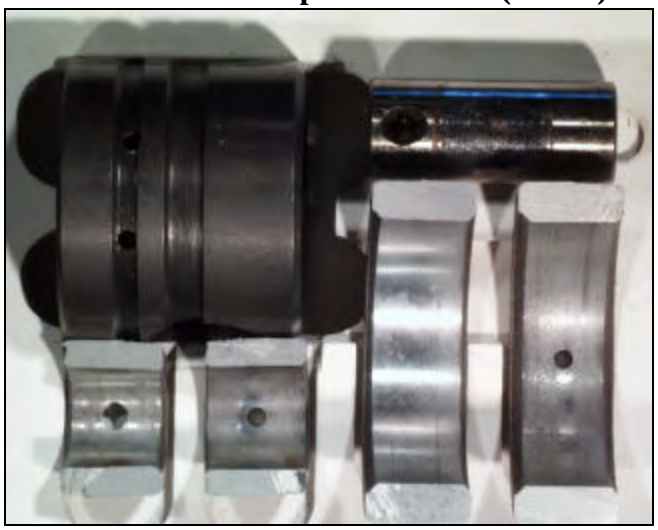
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	heavy	black	gummy
Equalizer Hole	medium	black	gummy
Tip of Pin	heavy	black	gummy
Spring	very heavy	black	gummy
Spring Seat	heavy	black	gummy
Ball	heavy	black	gummy
Front Side	heavy	black	gummy

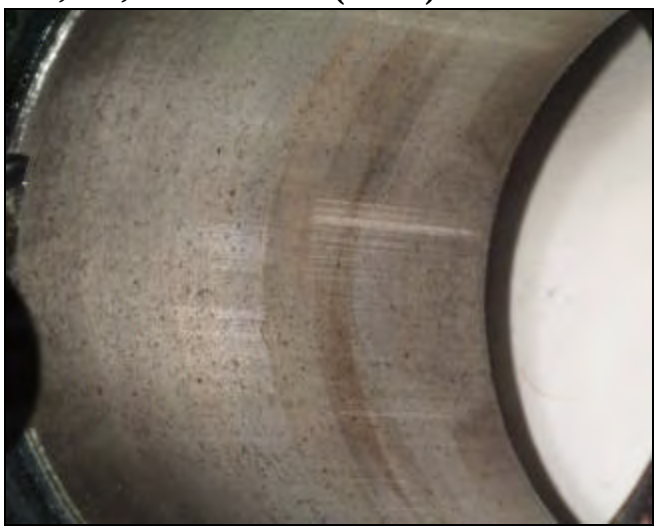
Photographic Documentation of R-134a Compressor with Contaminant Acid and Water
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

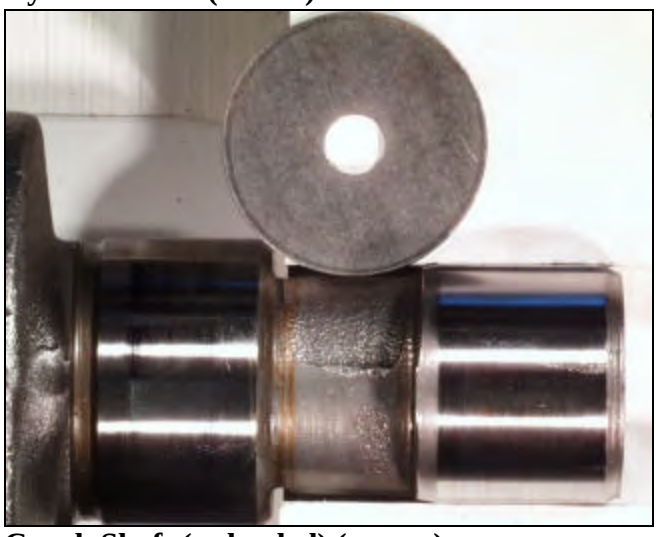


Piston Assembly (macro)



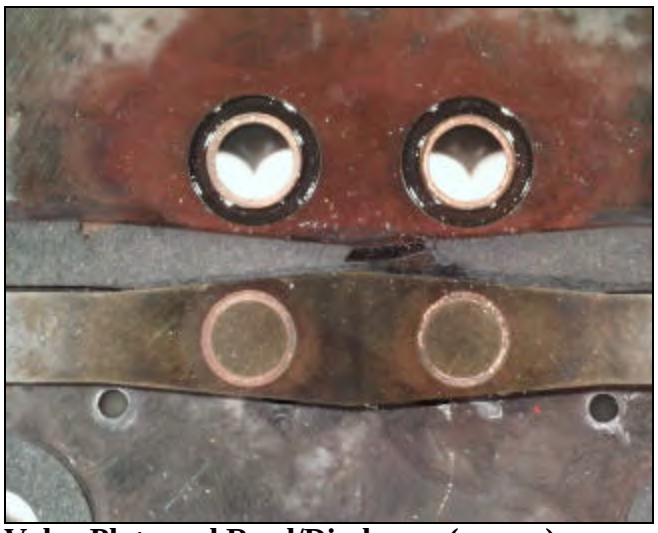
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



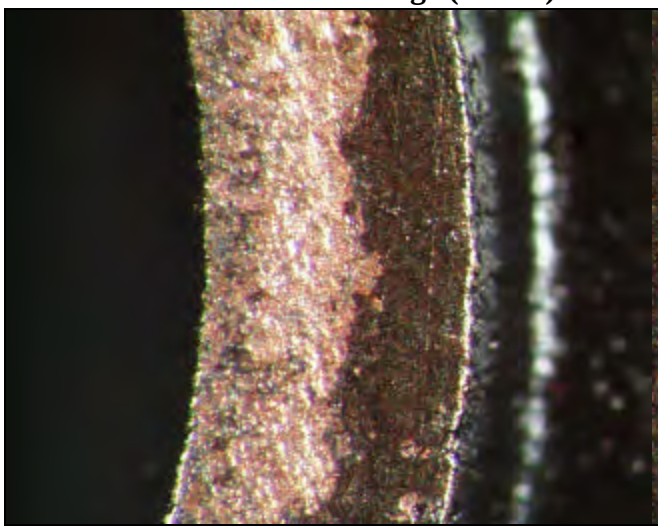
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant Acid and Water
160 psig/10 psig

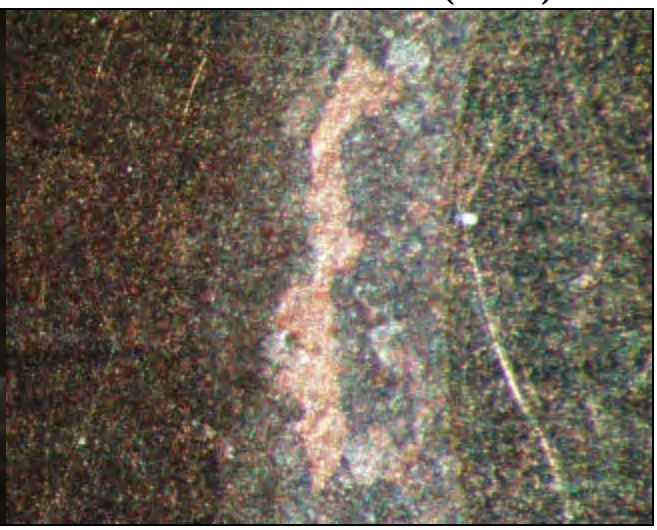


Valve Plate and Reed/Discharge (macro)

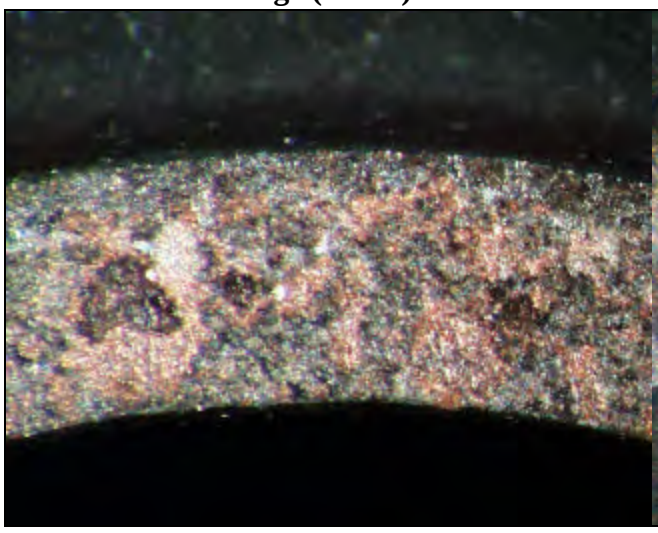
Valve Plate and Reed/Suction (macro)



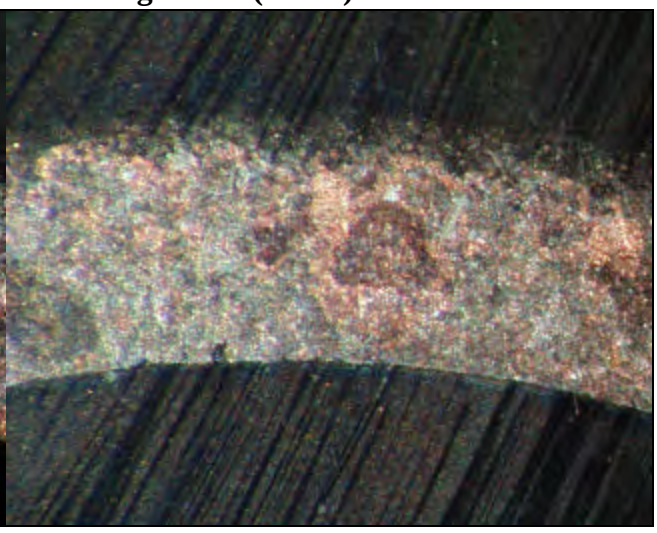
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air and Water

TEST HISTORY OF:

Unit Number 151
Model # RS40C1E-IAV-250 **Serial #** 96F16585
Run Time (hr.) 12000 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 160
Suction Pressure (psig) 10
Discharge Temp (°F) 224
Return Gas Temp (°F) 63
SumpTemp (°F) 212

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance black/Cu
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 2.5 **(4)** 2.5
Remaining torque of stator bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 7.5
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray/Cu
Top stator windings appearance gray/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance clean
Quantity of bearing chips trace
Remaining torque of discharge muffler removed
(1) 17.5 **(2)** 17.5 **(3)** 12.5 **(4)** 15
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance dirty
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/corrosion
Wear medium
Dimensions **Loaded** 1.2460
Unloaded 1.2460
Lower crank bearing journal
Appearance scored
Wear slight
Dimensions **Loaded** 0.9985
Unloaded 0.9985
Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion
Wear medium
Bottom washer (casting side)
Appearance corrosion
Wear polish
Lower bronze bearings
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.0030
Unloaded 1.0030
Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored
Wear medium
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 151
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/scored	
Wear	medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.12
Water (ppm)	60
Fluoride ion (ppm)	0.88
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	1

Trash in liquid screen (g)	0.085
Number of screens	2
Debris in compressor bottom (g)	0.690

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	clean

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	blued
Trepan	very slight
Varnish ring	none

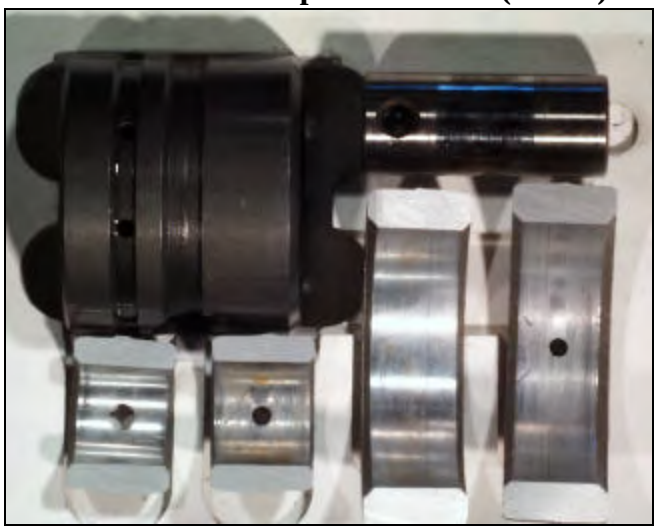
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, brown	gummy
Spring	heavy	black, brown	hard, gummy
Spring Seat	heavy	brown	gummy
Ball	medium	black, gray	gummy
Front Side	medium	black, brown	hard, gummy

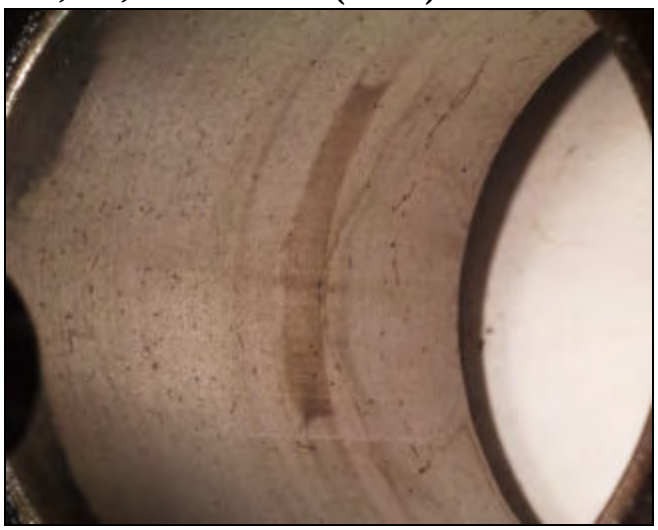
Photographic Documentation of R-134a Compressor with Contaminant Air and Water
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

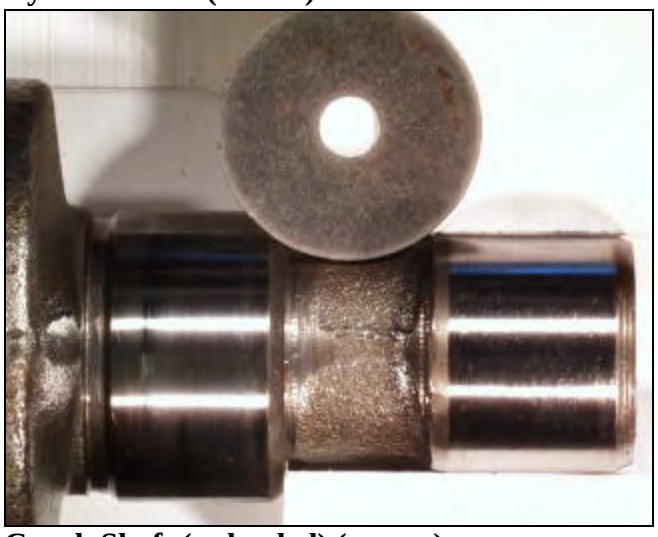


Piston Assembly (macro)



Cylinder Bore (macro)

Crank Shaft (loaded) (macro)

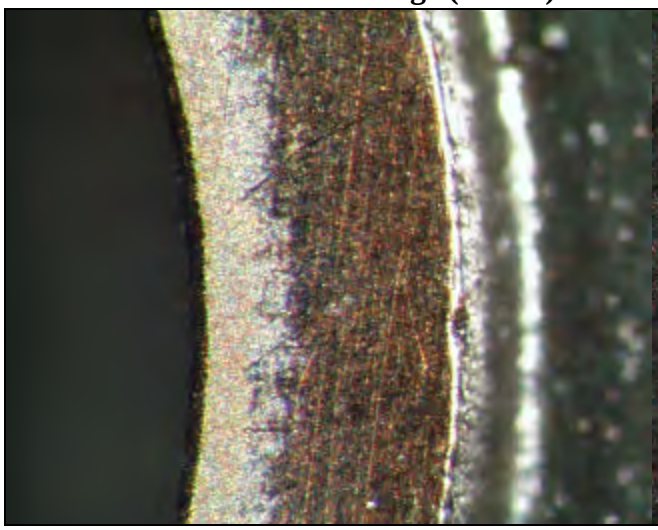


Crank Shaft (unloaded) (macro)

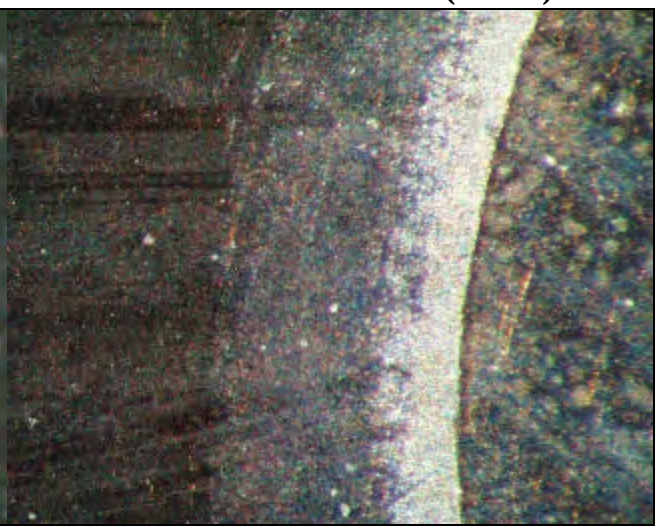
Photographic Documentation of R-134a Compressor with Contaminant Air and Water
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

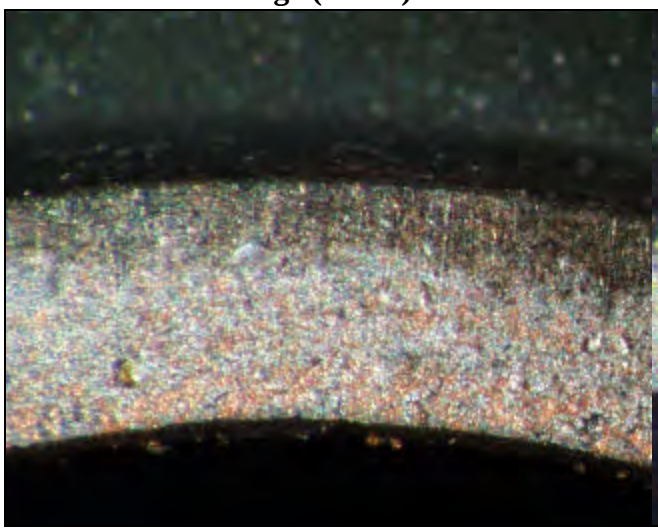
Valve Plate and Reed/Suction (macro)



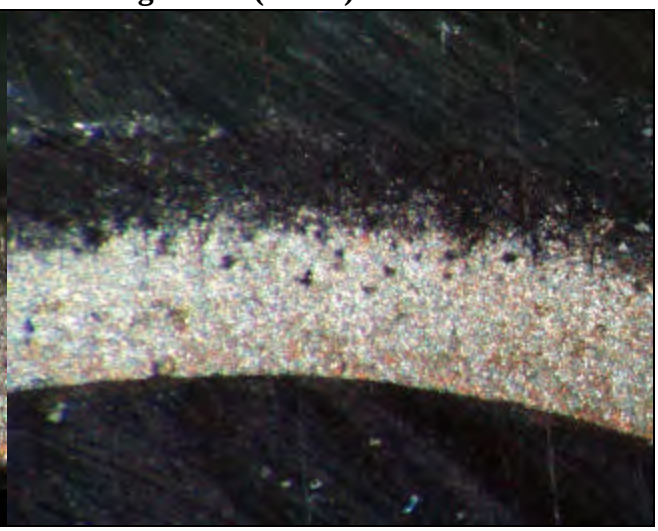
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Water

TEST HISTORY OF:

Unit Number 152
Model # RS40C1E-IAV-250 **Serial #** 96F16549
Run Time (hr.) 12029 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** No
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 4 **(2)** 5 **(3)** 6 **(4)** 4
Remaining torque of stator bolts
(1) 10 **(2)** 11 **(3)** 11 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 16 **(2)** 15 **(3)** 16 **(4)** 15

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 7 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored/Cu plating	
Wear	polish	
Dimensions	**Loaded**	1.2460
	Unloaded	1.2460
Lower crank bearing journal		
Appearance	clean	
Wear	polish	
Dimensions	**Loaded**	0.9990
	Unloaded	0.9990
Bottom thrust washer (crank side)		
Appearance	scored/Cu plating	
Wear	polish	
Bottom washer (casting side)		
Appearance	scored/Cu plating	
Wear	polish	
Lower bronze bearings		
Appearance	scored/corrosion	
Wear	polish	
Dimensions	**Loaded**	1.0040
	Unloaded	1.0040
Shaft in cage bearing		
Appearance	corrosion	
Wear	polish	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3730
	Unloaded	1.3730
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3760
	Unloaded	1.3760
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2515
	Unloaded	1.2515

TEST HISTORY OF:

Unit Number 152
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	No
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.4990
	Unloaded	0.4990

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	0.4960
	Unloaded	0.4960

Final Lubricant Values

Total Acid Number (TAN)	0.32
Water (ppm)	38
Fluoride ion (ppm)	0.82
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	4
Tin (ppm)	1
Zinc (ppm)	0

Trash in liquid screen (g)	0.025
Number of screens	2
Debris in compressor bottom (g)	0.675

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	clean
Trepan	slight
Varnish ring	none

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	none

Expansion Valve Inspection Observations

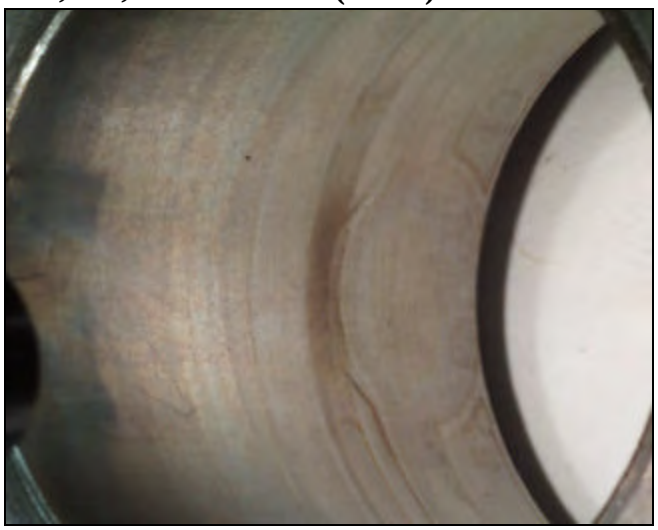
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	very slight	black	gummy
Spring	slight	gray	gummy
Spring Seat	medium	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-134a Compressor with Contaminant Water
160 psig/10 psig

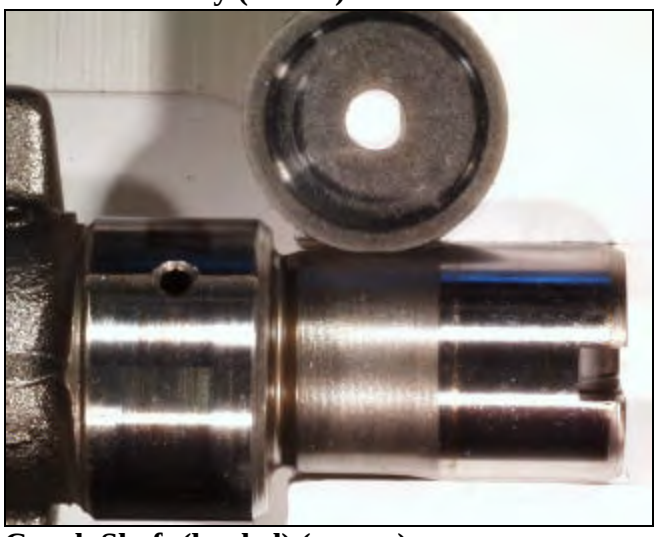
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)



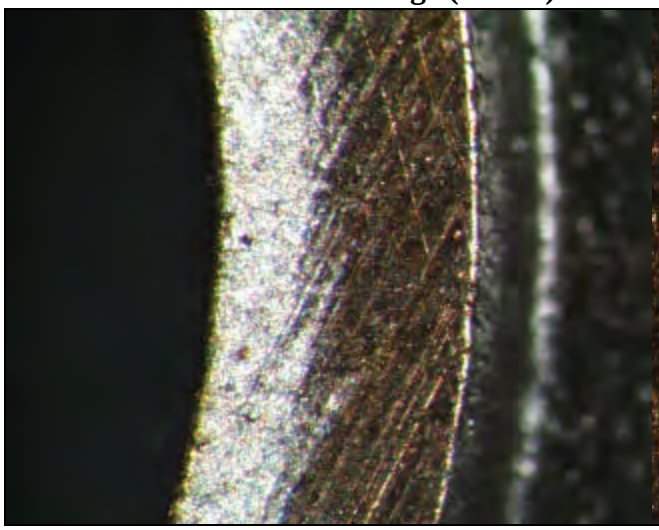
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

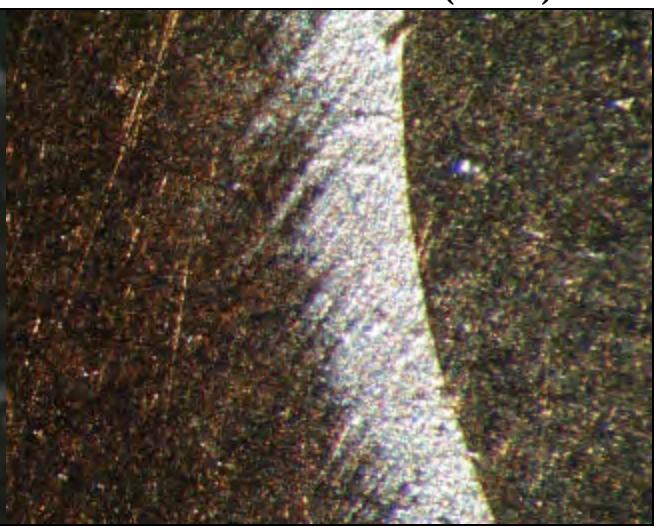
Photographic Documentation of R-134a Compressor with Contaminant Water
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

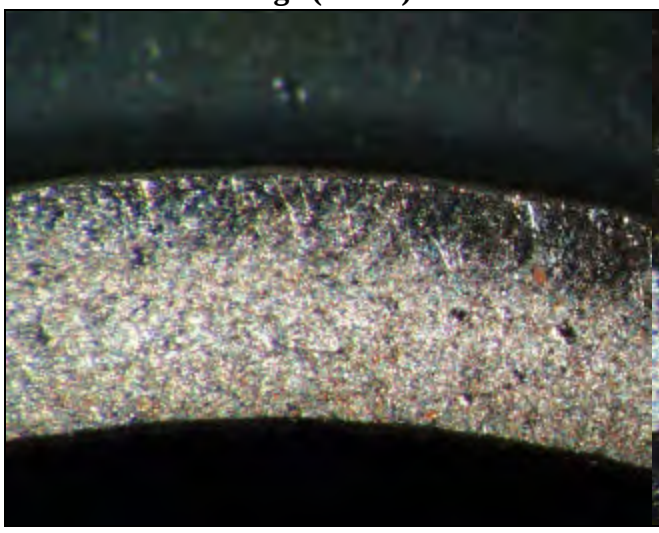
Valve Plate and Reed/Suction (macro)



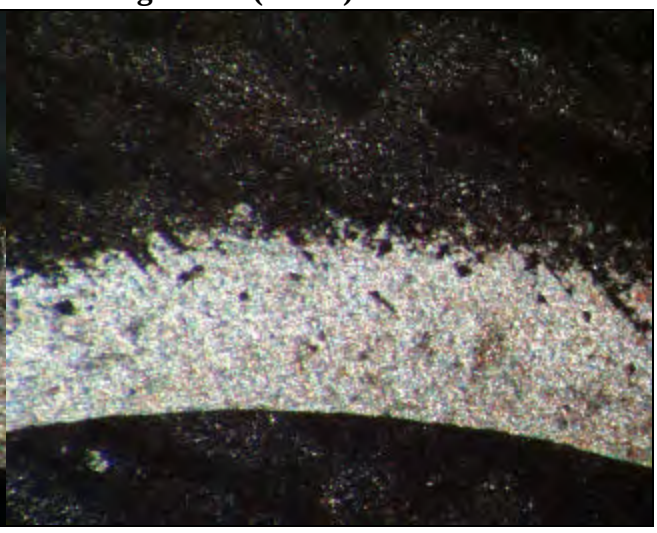
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Water, and R-12

TEST HISTORY OF:

Unit Number 153
Model # RS40C1E-IAV-250 **Serial #** 96F16565
Run Time (hr.) 12032 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? No **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 160
Suction Pressure (psig) 10
Discharge Temp (°F) 224
Return Gas Temp (°F) 63
SumpTemp (°F) 212

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance clean
Suction ring top appearance clean
Remaining torque of discharge muffler
(1) 7.5 **(2)** 7.5 **(3)** 5 **(4)** 2.5
Remaining torque of stator bolts
(1) 10 **(2)** 15 **(3)** 7.5 **(4)** 10
Suction muffler appearance clean
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance gray/Cu
Top stator windings appearance clean/stator top green
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance oxidized
Quantity of bearing chips slight
Remaining torque of discharge muffler removed
(1) 15 **(2)** 20 **(3)** 15 **(4)** 12.5
Head gasket brittle? yes/bonded
Head suction cavity appearance clean
Head discharge cavity appearance clean
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 5 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals
Appearance Cu plating
Wear slight
Dimensions **Loaded** 1.2475
Unloaded 1.2475
Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990
Bottom thrust washer (crank side)
Appearance scored/Cu plating/corrosion
Wear medium
Bottom washer (casting side)
Appearance scored/Cu plating/corrosion
Wear polish
Lower bronze bearings
Appearance clean/scored
Wear medium
Dimensions **Loaded** 1.0040
Unloaded 1.0040
Shaft in cage bearing
Appearance corrosion
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/scored/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance low wear/scored
Varnish ring slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/Cu plating
Wear medium
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 153
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	No	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
contact wear/Cu plating

Piston pin

Appearance	scored/Cu plating/corrosion	
Wear	medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.80
Water (ppm)	69
Fluoride ion (ppm)	0.91
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	1
Lead (ppm)	1
Silicon (ppm)	1
Tin (ppm)	9
Zinc (ppm)	2

Trash in liquid screen (g)	0.000
Number of screens	2
Debris in compressor bottom (g)	1.369

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	clean

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	clean
Trepan	very slight
Varnish ring	none

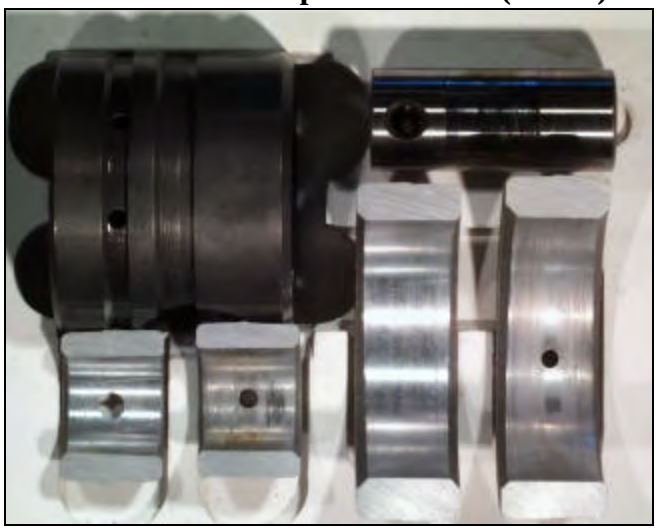
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black	gummy
Spring	medium	black, brown	gummy
Spring Seat	medium	black	gummy
Ball	medium	black, gray	gummy
Front Side	heavy	green, white, Cu	hard, not bonded

Photographic Documentation of R-134a Compressor with Contaminant Acid, Water, and R-12
160 psig/10 psig

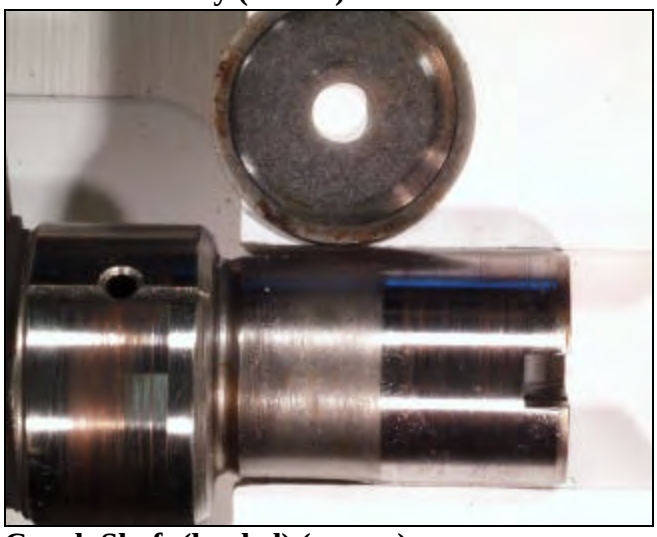
Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

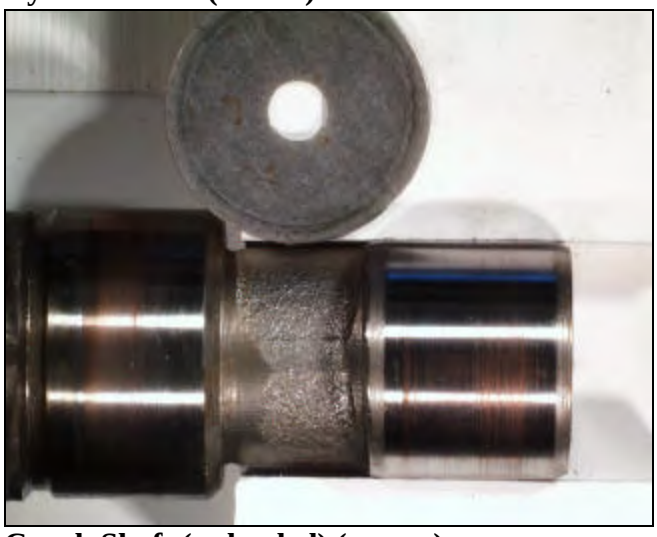


Piston Assembly (macro)

Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

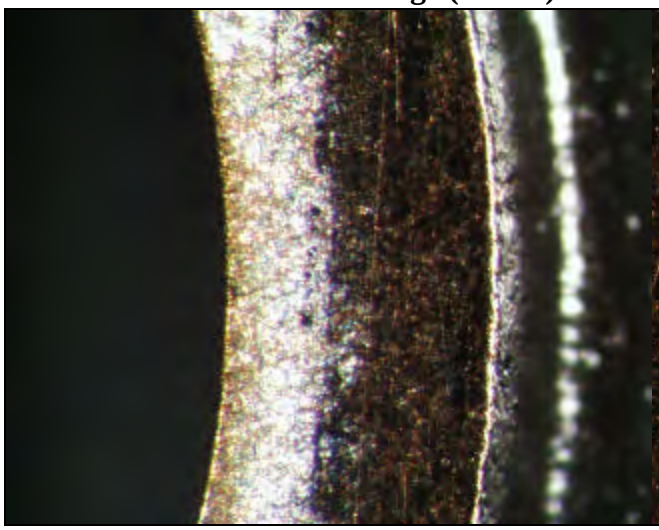


Crank Shaft (unloaded) (macro)

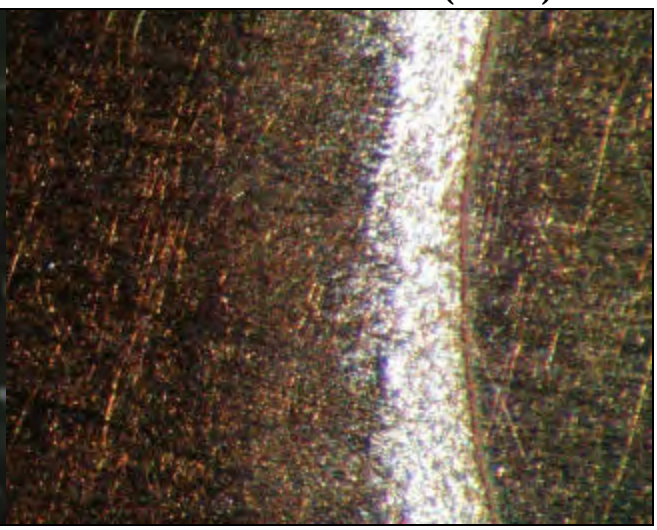
Photographic Documentation of R-134a Compressor with Contaminant Acid, Water, and R-12
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

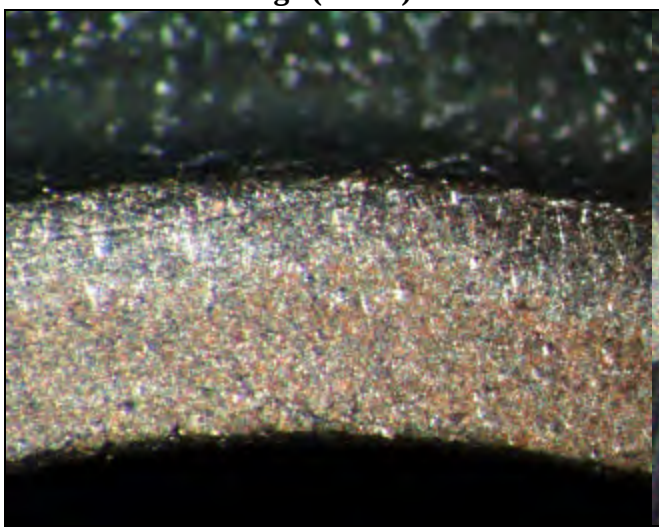
Valve Plate and Reed/Suction (macro)



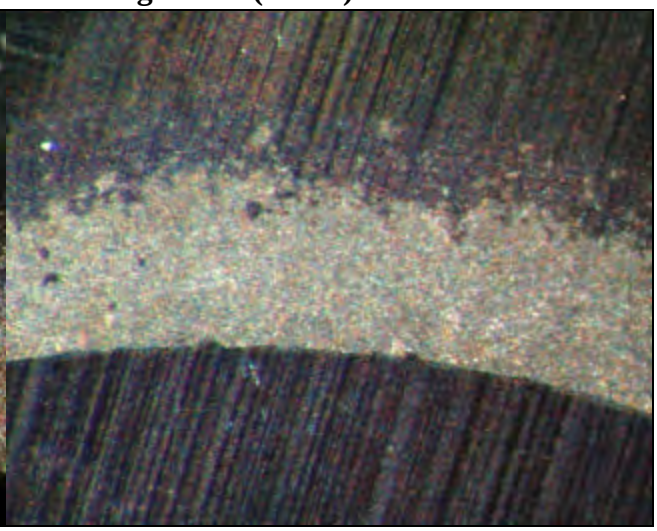
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Air, Water, and R-12

TEST HISTORY OF:

Unit Number 154
Model # RS40C1E-IAV-250 **Serial #** 96F16548
Run Time (hr.) 12023 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** Yes
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray/Cu
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	gray

Remaining torque of discharge muffler
(1) 7 **(2)** 2.5 **(3)** 2.5 **(4)** 5

Remaining torque of stator bolts
(1) 7.5 **(2)** 10 **(3)** 7.5 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean/stator top green
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	black/Cu plate
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 17 **(2)** 17 **(3)** 15 **(4)** 17

Head gasket brittle?	yes/bonded
Head suction cavity appearance	dirty
Head discharge cavity appearance	dirty
Cage bearing top appearance	dirty

Remaining torque of cage bearing bolts
(1) 5 **(2)** 7.5 **(3)** 5 **(4)** 5

Crank journals
Appearance scored/Cu plating/corrosion
Wear medium
Dimensions **Loaded** 1.2470
Unloaded 1.2470

Lower crank bearing journal
Appearance scored/Cu plating
Wear polish
Dimensions **Loaded** 0.9990
Unloaded 0.9990

Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear medium

Bottom washer (casting side)
Appearance scored/Cu plating
Wear medium

Lower bronze bearings
Appearance scored
Wear polish
Dimensions **Loaded** 1.0030
Unloaded 1.0030

Shaft in cage bearing
Appearance Cu plating/corrosion
Wear polish

Piston top appearance clean

Piston skirt
Appearance low wear/scored
Dimensions **Loaded** 1.3745
Unloaded 1.3745

Cylinder bore
Appearance no wear
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760

Connecting rod (large end)
Appearance scored/corrosion
Wear slight
Dimensions **Loaded** 1.2510
Unloaded 1.2510

TEST HISTORY OF:

Unit Number 154
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion/Cu	
Wear	medium	
Dimensions	**Loaded**	0.5010
	Unloaded	0.5010

Piston pin washers appearance
contact wear/Cu plating

Piston pin

Appearance	scored/Cu plating	
Wear	medium	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Final Lubricant Values

Total Acid Number (TAN)	0.52
Water (ppm)	32
Fluoride ion (ppm)	0.81
Chloride ion (ppm)	14
Aluminum (ppm)	0
Copper (ppm)	1
Iron (ppm)	4
Lead (ppm)	0
Silicon (ppm)	4
Tin (ppm)	11
Zinc (ppm)	2

Trash in liquid screen (g)	0.019
Number of screens	2
Debris in compressor bottom (g)	0.382

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion/blued

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

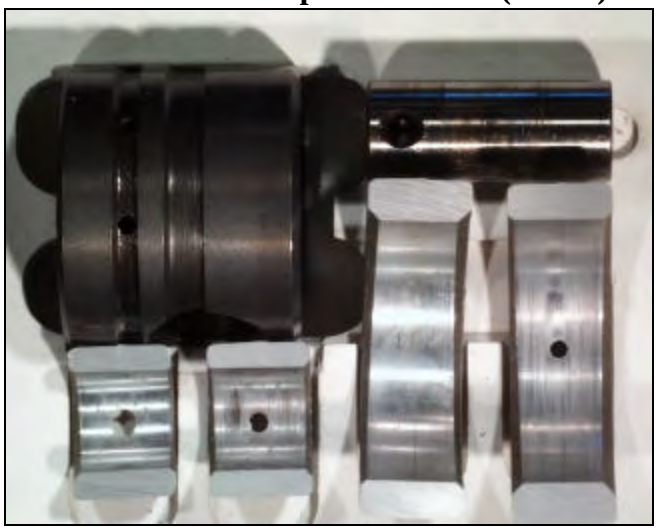
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	very slight	tarnished	hard
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	slight	black	gummy
Spring	heavy	black, gray	hard
Spring Seat	heavy	black	gummy
Ball	medium	black, gray, brown	gummy
Front Side	heavy	black, gray	gummy

Photographic Documentation of R-134a Compressor with Contaminant
Acid, Air, Water, and R-12
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

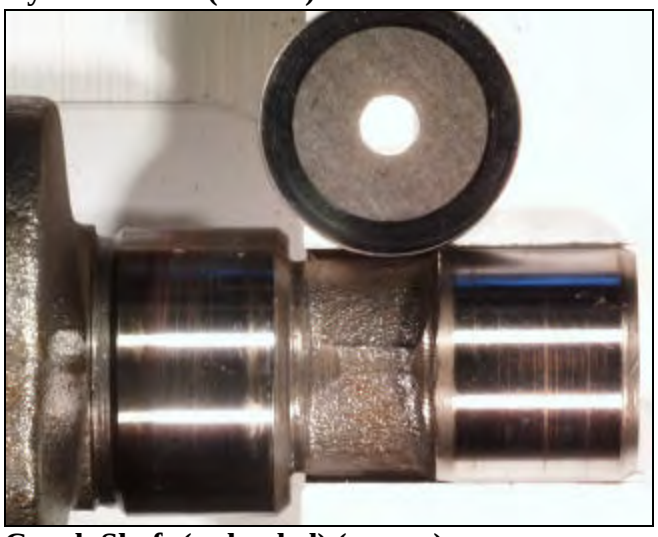
Ball, Pin, Seat of CPEV (micro)



Piston Assembly (macro)

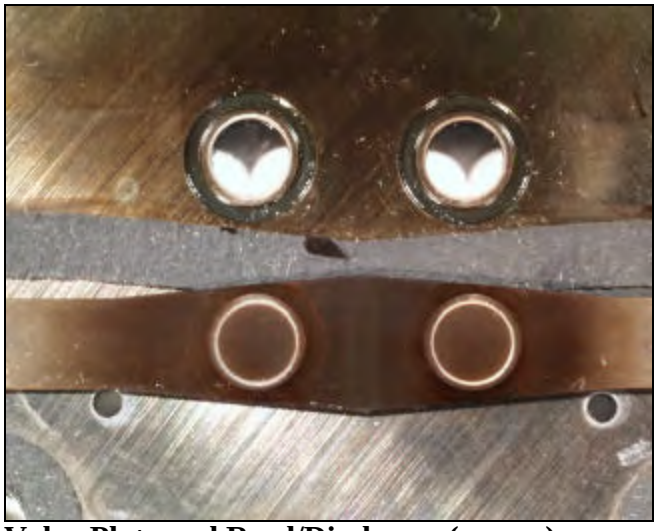
Cylinder Bore (macro)

Crank Shaft (loaded) (macro)



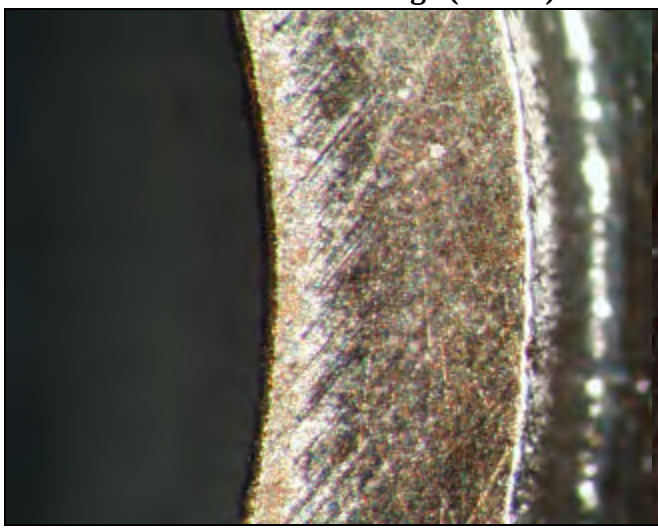
Crank Shaft (unloaded) (macro)

Photographic Documentation of R-134a Compressor with Contaminant
Acid, Air, Water, and R-12
160 psig/10 psig

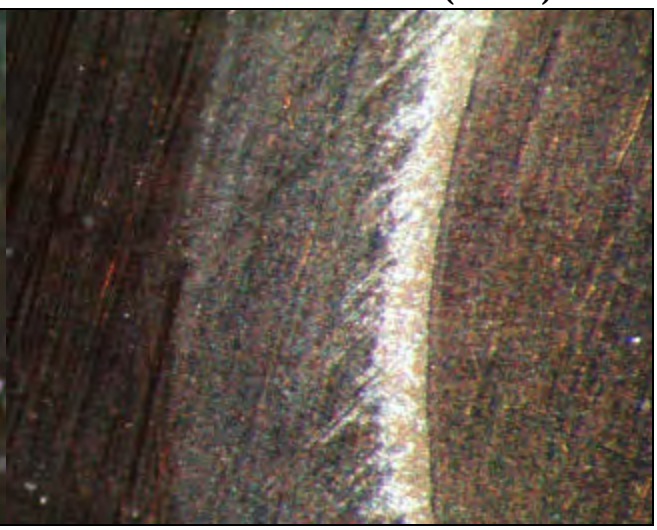


Valve Plate and Reed/Discharge (macro)

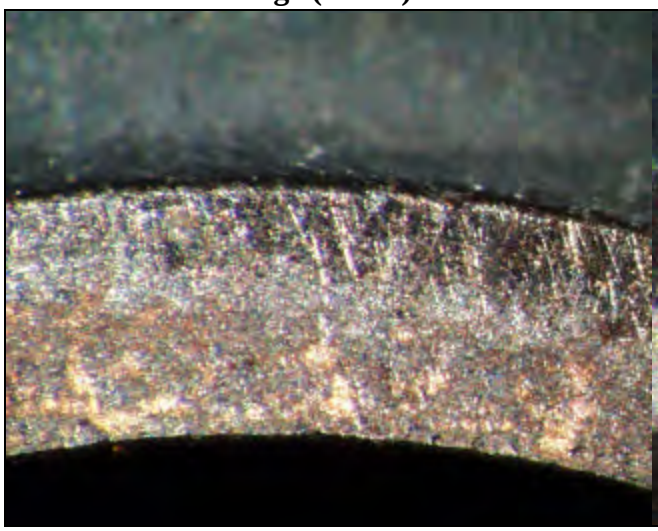
Valve Plate and Reed/Suction (macro)



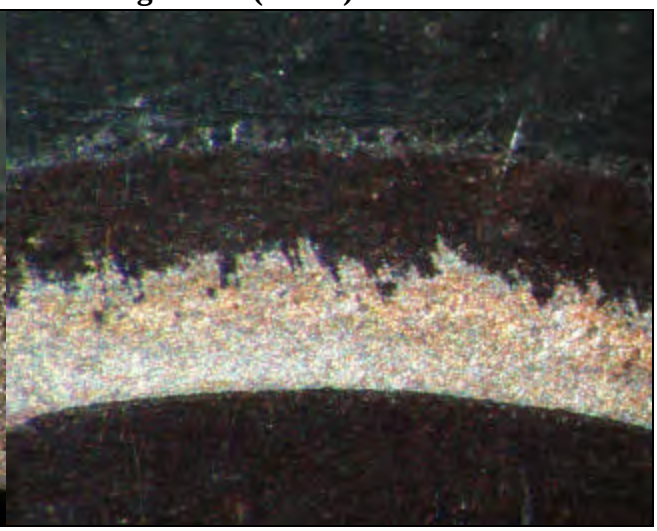
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Air, Water, and R-12

TEST HISTORY OF:

Unit Number 155
Model # RS40C1E-IAV-250 **Serial #** 96F16550
Run Time (hr.) 12109 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? No **R-12?** Yes
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig)	160
Suction Pressure (psig)	10
Discharge Temp (°F)	224
Return Gas Temp (°F)	63
SumpTemp (°F)	212
Hi-Pot	pass
High-low leak	pass
Top shell appearance	clean
Suction exit trail appearance	gray
Cluster block condition	good
Wire to cluster block appearance	clean
Suction ring top appearance	clean

Remaining torque of discharge muffler
(1) 5 **(2)** 5 **(3)** 4 **(4)** 4

Remaining torque of stator bolts
(1) 11 **(2)** 10 **(3)** 10 **(4)** 10

Suction muffler appearance	clean
OEM flux?	Yes
Loose restrictor?	No
Discharge plate appearance	gray
Top stator windings appearance	clean
Rotor rub marks present?	No
Was rotor loose?	No
Shell bottom appearance	clean
Quantity of bearing chips	trace

Remaining torque of discharge muffler removed
(1) 14 **(2)** 15 **(3)** 14 **(4)** 14

Head gasket brittle?	yes
Head suction cavity appearance	clean
Head discharge cavity appearance	clean
Cage bearing top appearance	clean

Remaining torque of cage bearing bolts
(1) 6 **(2)** 5 **(3)** 5 **(4)** 5

Crank journals		
Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	1.2450
	Unloaded	1.2450
Lower crank bearing journal		
Appearance	clean	
Wear	polish, slight	
Dimensions	**Loaded**	0.9970
	Unloaded	0.9970
Bottom thrust washer (crank side)		
Appearance	scored/corrosion	
Wear	polish, slight	
Bottom washer (casting side)		
Appearance	clean	
Wear	polish	
Lower bronze bearings		
Appearance	scored	
Wear	polish, slight	
Dimensions	**Loaded**	1.0020
	Unloaded	1.0020
Shaft in cage bearing		
Appearance	clean	
Wear	polish, slight	
Piston top appearance	clean	
Piston skirt		
Appearance	no wear	
Dimensions	**Loaded**	1.3705
	Unloaded	1.3705
Cylinder bore		
Appearance	no wear	
Varnish ring	very slight	
Dimensions	**Loaded**	1.3740
	Unloaded	1.3740
Connecting rod (large end)		
Appearance	none	
Wear	polish, slight	
Dimensions	**Loaded**	1.2480
	Unloaded	1.2480

TEST HISTORY OF:

Unit Number 155
Contaminants:
Control Unit? No

Acid?	No	**R-12?**	Yes
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer	
Wear	polish, slight	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4980

Piston pin washers appearance
contact wear

Piston pin

Appearance	corrosion	
Wear	polish, slight	
Dimensions	**Loaded**	0.4955
	Unloaded	0.4955

Final Lubricant Values

Total Acid Number (TAN)	0.16
Water (ppm)	88
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	13
Aluminum (ppm)	0
Copper (ppm)	0
Iron (ppm)	0
Lead (ppm)	1
Silicon (ppm)	1
Tin (ppm)	0
Zinc (ppm)	0

Trash in liquid screen (g)	0.053
Number of screens	2
Debris in compressor bottom (g)	0.817

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

Expansion Valve Inspection Observations

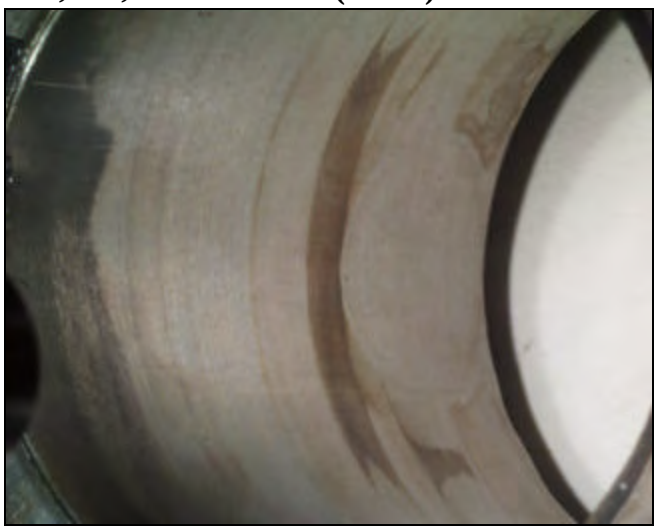
Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	none	none	none
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	brown	gummy
Spring	heavy	black, gray	gummy
Spring Seat	heavy	black	gummy
Ball	medium	black	gummy
Front Side	heavy	black	gummy

Photographic Documentation of R-134a Compressor with Contaminant Air, Water, and R-12
160 psig/10 psig

Constant Pressure Expansion Valve (macro)

Ball, Pin, Seat of CPEV (micro)

Piston Assembly (macro)



Cylinder Bore (macro)

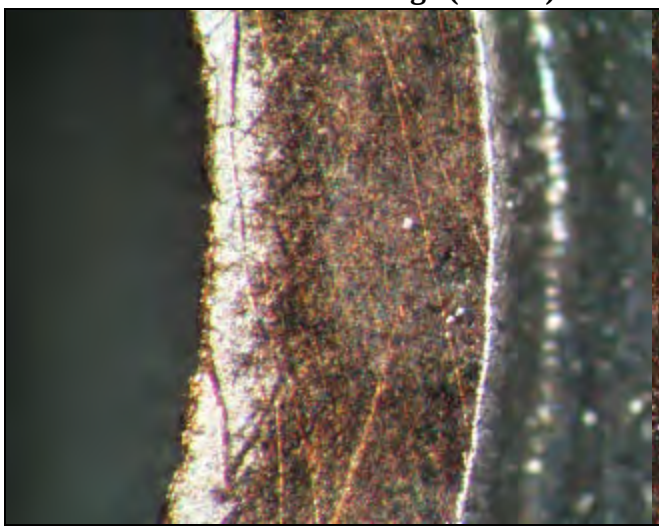
Crank Shaft (loaded) (macro)

Crank Shaft (unloaded) (macro)

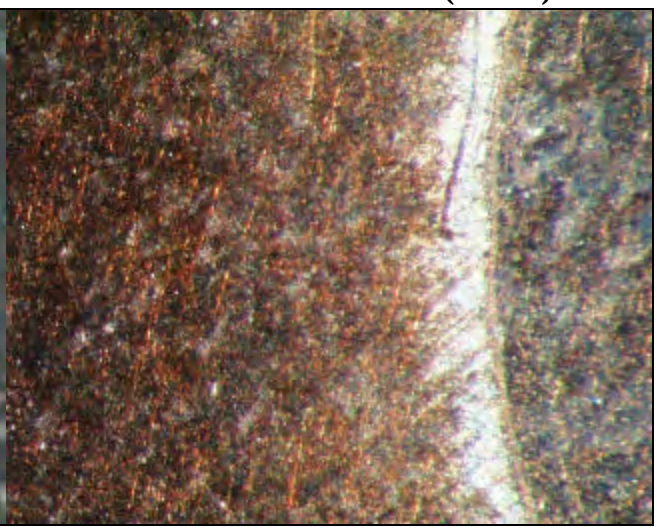
Photographic Documentation of R-134a Compressor with Contaminant Air, Water, and R-12
160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

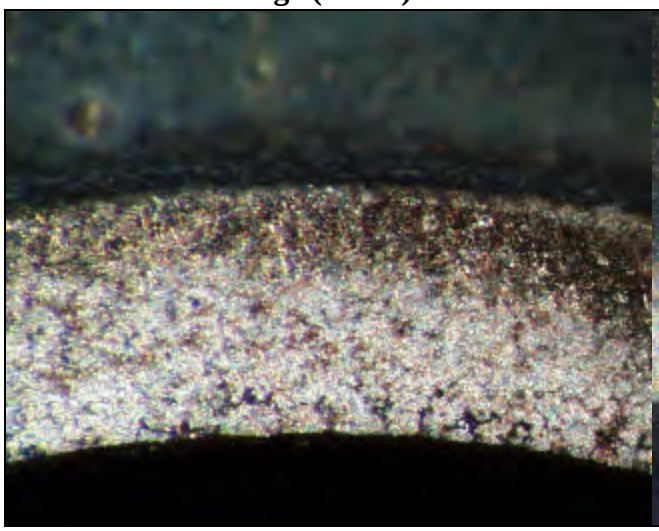
Valve Plate and Reed/Suction (macro)



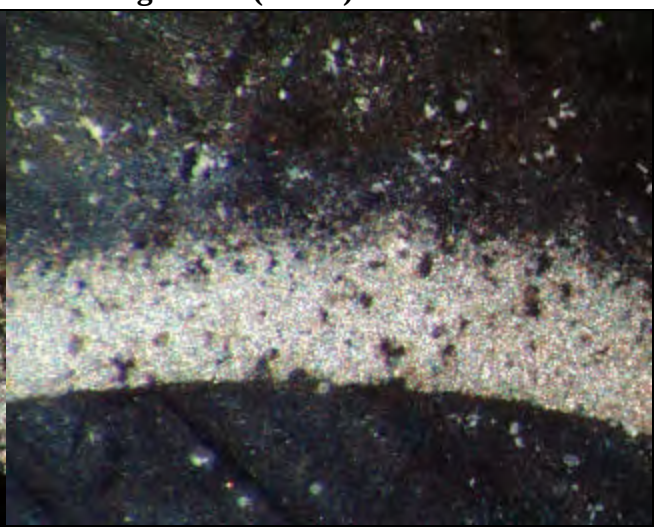
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Report for R-134a Compressor with Contaminant Acid, Air, and Water

TEST HISTORY OF:

Unit Number 156
Model # RS40C1E-IAV-250 **Serial #** 96F16551
Run Time (hr.) 12007 **Failed?** No
Refrigerant R-134a
Lubricant RL32S
Contaminants:
Control Unit? No
Acid? Yes **R-12?** No
Air? Yes **R-22?** No
H_2O? Yes **R-502?** No

Discharge Pressure (psig) 160
Suction Pressure (psig) 10
Discharge Temp (°F) 224
Return Gas Temp (°F) 63
SumpTemp (°F) 212

Hi-Pot pass
High-low leak pass
Top shell appearance clean
Suction exit trail appearance gray/Cu
Cluster block condition good
Wire to cluster block appearance gray
Suction ring top appearance gray
Remaining torque of discharge muffler
(1) 2 **(2)** 2 **(3)** 2 **(4)** 2.5
Remaining torque of stator bolts
(1) 7.5 **(2)** 12.5 **(3)** 7.5 **(4)** 7.5
Suction muffler appearance gray
OEM flux? Yes
Loose restrictor? No
Discharge plate appearance black/soot/Cu
Top stator windings appearance gray/stator top Cu
Rotor rub marks present? Yes
Was rotor loose? No
Shell bottom appearance black/Cu plate
Quantity of bearing chips heavy
Remaining torque of discharge muffler removed
(1) 15 **(2)** 15 **(3)** 17.5 **(4)** 12.5
Head gasket brittle? yes/bonded
Head suction cavity appearance dirty
Head discharge cavity appearance dirty/Cu plate
Cage bearing top appearance dirty
Remaining torque of cage bearing bolts
(1) 10 **(2)** 10 **(3)** 10 **(4)** 12

Crank journals
Appearance scored
Wear slight
Dimensions **Loaded** 1.2470
Unloaded 1.2470
Lower crank bearing journal
Appearance clean
Wear polish, slight
Dimensions **Loaded** 0.9975
Unloaded 0.9975
Bottom thrust washer (crank side)
Appearance scored/Cu plating
Wear medium
Bottom washer (casting side)
Appearance clean/Cu plating
Wear polish
Lower bronze bearings
Appearance scored
Wear slight
Dimensions **Loaded** 1.0030
Unloaded 1.0030
Shaft in cage bearing
Appearance Cu plating
Wear polish
Piston top appearance clean
Piston skirt
Appearance low wear/Cu plating
Dimensions **Loaded** 1.3740
Unloaded 1.3740
Cylinder bore
Appearance no wear/soot
Varnish ring very slight
Dimensions **Loaded** 1.3760
Unloaded 1.3760
Connecting rod (large end)
Appearance scored/corrosion
Wear medium
Dimensions **Loaded** 1.2515
Unloaded 1.2515

TEST HISTORY OF:

Unit Number 156
Contaminants:
Control Unit? No

Acid?	Yes	**R-12?**	No
Air?	Yes	**R-22?**	No
H_2O?	Yes	**R-502?**	No

Connecting rod (small end)

Appearance	contact wear/correct washer/corrosion	
Wear	slight	
Dimensions	**Loaded**	0.5015
	Unloaded	0.5010

Piston pin washers appearance
high wear (4 contact points)/Cu plating

Piston pin

Appearance	clean	
Wear	heavy	
Dimensions	**Loaded**	0.4980
	Unloaded	0.4990

Final Lubricant Values

Total Acid Number (TAN)	0.38
Water (ppm)	138
Fluoride ion (ppm)	1.1
Chloride ion (ppm)	13
Aluminum (ppm)	1
Copper (ppm)	0
Iron (ppm)	3
Lead (ppm)	1
Silicon (ppm)	2
Tin (ppm)	5
Zinc (ppm)	7

Trash in liquid screen (g)	0.034
Number of screens	1
Debris in compressor bottom (g)	0.987

Valve Plate Assembly Inspection

Suction side (reed backer)

Condition	good
Appearance	corrosion

Suction surface appearance
corrosion

Suction reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	slight

Discharge side (reed backer)

Condition	good
Appearance	corrosion

Discharge surface appearance
corrosion

Discharge reed

Condition	good
Appearance	corrosion
Trepan	very slight
Varnish ring	very slight

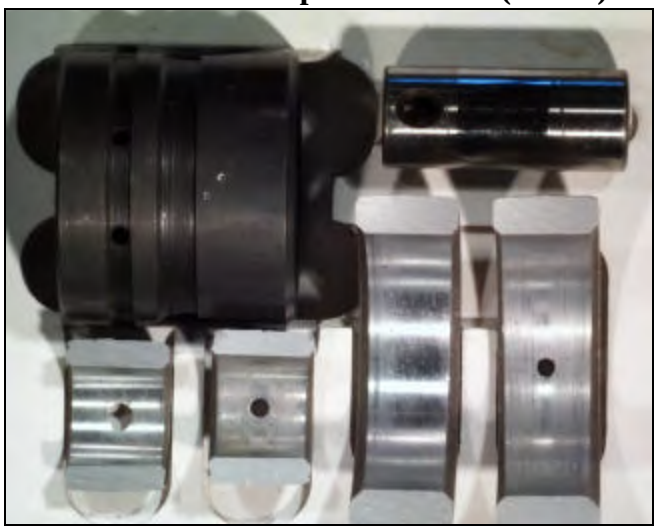
Expansion Valve Inspection Observations

Valve Part	Residue Accumulation	Residue Color	Residue Description
Diaphragm Seat	slight	gray, tarnished	gummy
Rear Pin	none	none	none
Equalizer Hole	none	none	none
Tip of Pin	medium	black, tan	gummy
Spring	medium	black	gummy
Spring Seat	medium	black, tan	gummy
Ball	medium	black, gray	gummy
Front Side	heavy	black	gummy

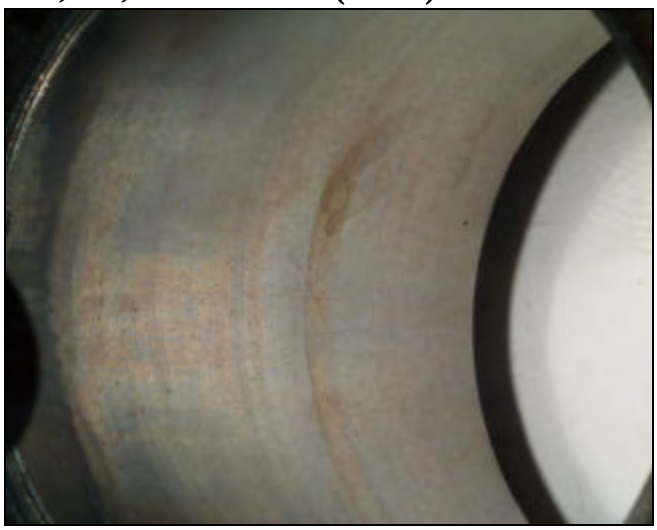
Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and Water 160 psig/10 psig

Constant Pressure Expansion Valve (macro)

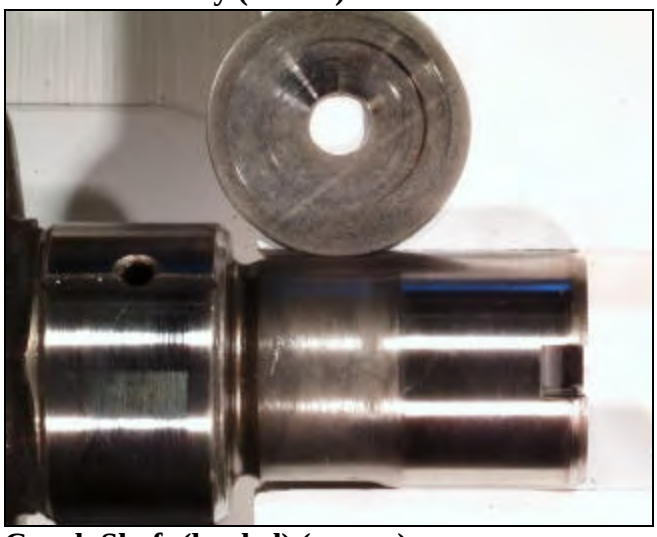
Ball, Pin, Seat of CPEV (micro)



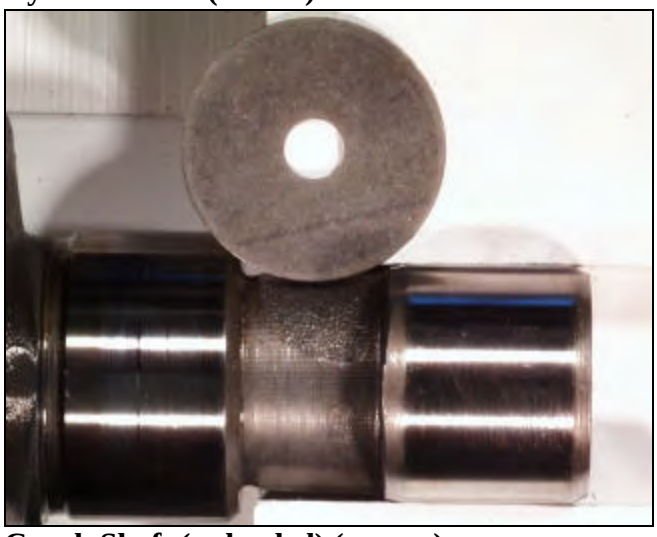
Piston Assembly (macro)



Cylinder Bore (macro)



Crank Shaft (loaded) (macro)

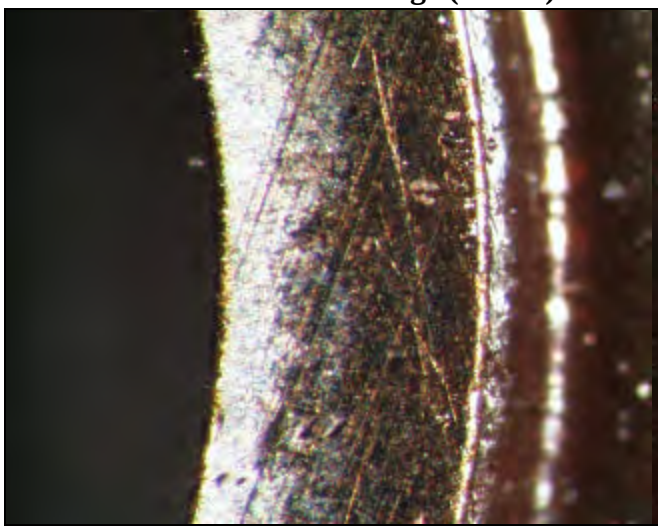


Crank Shaft (unloaded) (ma cro)

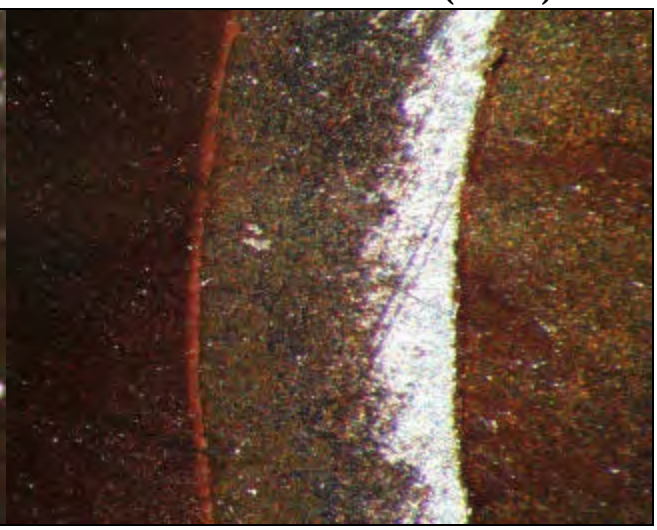
Photographic Documentation of R-134a Compressor with Contaminant Acid, Air, and Water 160 psig/10 psig

Valve Plate and Reed/Discharge (macro)

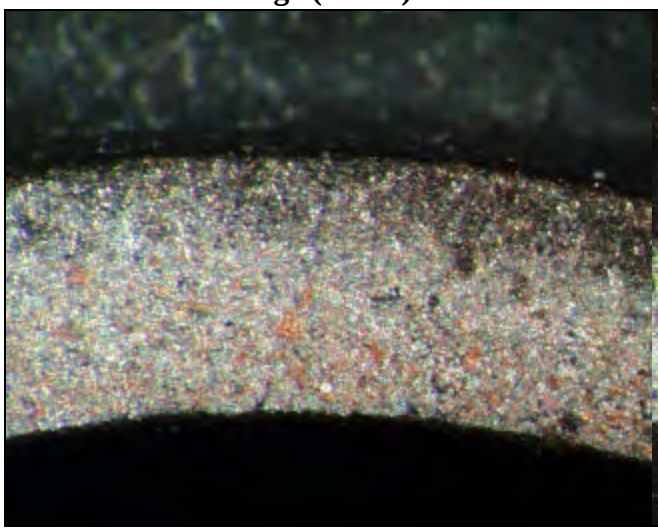
Valve Plate and Reed/Suction (macro)



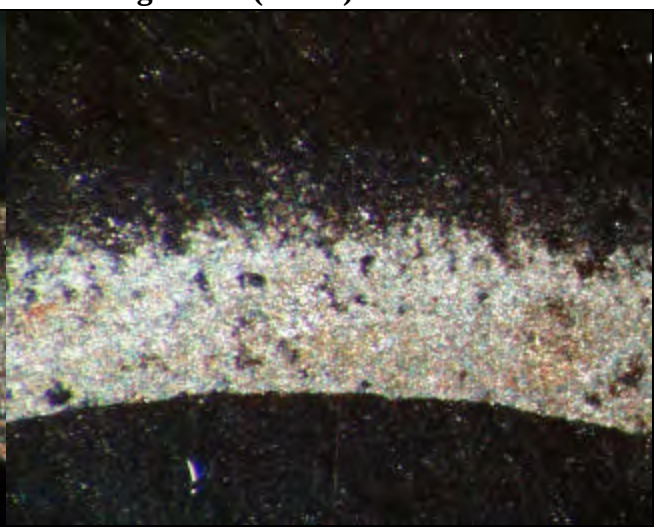
Valve Plate/Discharge (micro)



Discharge Reed (micro)



Valve Plate/Suction (micro)



Suction Reed (micro)

Appendix B
Moisture Analysis of Compressor Lubricants after 72 hour Break-in with Filter Driers Installed
(Compressors remained at static conditions.)

Moisture Analysis after 72 hours at Break-in Conditions with 4AXH-6 Filter Drier Installed in Compressors Containing R-507A and Lubricant RL32S

Table B.1

Stand	Water (ppm)
5	18
6	22
7	25
8	30
9	17
10	11
11	12
12	12
13	13
14	21
15	12
16	17
17	18
18	21
19	12
20	13
21	16
22	15
23	18
24	10
25	17
26	11
27	14
28	12
29	16
30	21
31	10
32	7
33	29
34	12
35	10
36	14
37	29
38	14
39	13
40	9

Moisture Analysis after 72 hours at Break-in Conditions with XH-11 Filter Drier Installed in Compressors Containing R-407C and Lubricant RL32S

Table B.2

Stand	Water (ppm)
41	29
42	12
43	24
44	17
45	21
46	18
47	13
48	13
49	13
50	7
51	18
52	17
53	17
54	14
55	22
56	17
57	12
58	12
59	10
60	10
61	15
62	17
63	15
64	8
65	12
66	14
67	13
68	13
69	19
70	17
71	16
72	12
73	13
74	17
75	15
76	21

Moisture Analysis after 72 hours at Break-in Conditions with 4AXH-6 Filter Drier Installed in Compressors Containing R-22 and Lubricant 3GS

Table B.3

Stand	Water (ppm)
85	8
86	5
87	4
88	28
89	5
90	5
91	3
92	5
93	3
94	5
95	3
96	2
97	3
98	7
99	5
100	5
101	5
102	5
103	8
104	16
105	8
106	16
107	3
108	3
109	2
110	1
111	11
112	12
113	42
114	22
115	40
116	20
117	27
118	33
119	28
120	27

Moisture Analysis after 72 hours at Break-in Conditions with 4AXH-6 Filter Drier Installed in Compressors Containing R-134a and Lubricant RL32S

Table B.4

Stand	Water (ppm)
121	24
122	12
123A*	74
124	19
125	17
126	19
127	13
128	15
129	14
130	37
131	22
132	16
133	23
134	16
135	13
136	16
137	15
138	23
139	18
140	12
141	12
142	21
143	21
144	26
145	11
146	9
147	30
148	11
149	13
150	14
151	31
152	15
153	27
154	24
155	17
156	19

* original ppm water = 21

Appendix C
Moisture and TAN Analysis of Compressor Lubricants after Contaminant Addition and 120 hours Running Drawn with Filter Driers Removed while the System Was Running

Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed after 120 hours while Compressors Were Running (Dynamic) at Test Conditions with R-507A and RL32S

Table C.1

Stand	Water (ppm)	TAN*	Miscellaneous
5	34	0.03	High D Temp
6	31	0.03	High D Temp
7	20	0.01	High D Temp
8	27	0.01	High D Temp
9	15	0.03	High D Temp
10	6	0.02	High D Temp
11	8	0.01	High D Temp
12	7	0.02	High D Temp
13	11	0.03	High D Temp
14	15	0.07	High D Temp
15	9	0.02	High D Temp
16	6	0.08	High D Temp
17	11	0.02	High D Temp
18	21	0.04	High D Temp
19	5	0.04	High D Temp
20	10	0.03	High D Temp
21	17	0.01	High D Temp
22	9	0.02	High D Temp
23	14	0.01	Low D Temp
24	6	0.01	Low D Temp
25	9	0.10	Low D Temp
26	10	0.01	Low D Temp
27	7	0.07	Low D Temp
28	16	0.03	Low D Temp
29	13	0.09	Low D Temp
30	4	0.08	Low D Temp
31	11	0.03	Low D Temp
32	4	0.08	Low D Temp
33	11	0.06	Low D Temp
34	23	0.08	Low D Temp
35	26	0.05	Low D Temp
36	15	0.07	Low D Temp
37	22	0.08	Low D Temp
38	21	0.04	Low D Temp
39	14	0.08	Low D Temp
40	18	0.03	Low D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/RL32S (g)

Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed after 120 hours while Compressors Were Running (Dynamic) at Test Conditions with R-407C and RL32S

Table C.2

Stand	Water (ppm)	TAN*	Miscellaneous
41	22	0.02	Low D Temp
42	12	0.10	Low D Temp
43	8	0.06	Low D Temp
44	32	0.01	Low D Temp
45	12	0.07	Low D Temp
46	12	0.02	Low D Temp
47	15	0.08	Low D Temp
48	16	0.13	Low D Temp
49	10	0.05	Low D Temp
50	13	0.15	Low D Temp
51	64	0.08	Low D Temp
52	62	0.01	Low D Temp
53	22	0.01	Low D Temp
54	49	0.10	Low D Temp
55	60	0.10	Low D Temp
56	99	0.07	Low D Temp
57	47	0.01	Low D Temp
58	68	0.01	Low D Temp
59	21	0.01	High D Temp
60	32	0.01	High D Temp
61	34	0.01	High D Temp
62	58	0.02	High D Temp
63	30	0.09	High D Temp
64	18	0.01	High D Temp
65	26	0.08	High D Temp
66	30	0.05	High D Temp
67	40	-	High D Temp
68	24	0.09	High D Temp
69	36	0.02	High D Temp
70	53	0.08	High D Temp
71	48	0.04	High D Temp
72	42	0.03	High D Temp
73	43	0.07	High D Temp
74	47	0.08	High D Temp
75	36	0.05	High D Temp
76	316	0.08	High D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/RL32S (g)

Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed after 120 hours while Compressors Were Running (Dynamic) at Test Conditions with R-22 and 3GS

Table C.3

Stand	Water (ppm)	TAN*	Miscellaneous
85	0	0.01	Low D Temp
86	12	0.01	Low D Temp
87	0	0.03	Low D Temp
88	29	0.06	Low D Temp
89	32	0.04	Low D Temp
90	2	0.01	Low D Temp
91	6	0.10	Low D Temp
92	2	<0.01	Low D Temp
93	2	0.01	Low D Temp
94	0	0.01	Low D Temp
95	0	0.06	Low D Temp
96	2	0.06	Low D Temp
97	0	0.05	Low D Temp
98	34	0.06	Low D Temp
99	64	0.01	Low D Temp
100	3	0.01	Low D Temp
101	2	0.06	Low D Temp
102	2	0.07	Low D Temp
103	4	0.02	High D Temp
104	9	0.01	High D Temp
105	9	0.03	High D Temp
106	1	0.02	High D Temp
107	2	0.01	High D Temp
108	4	0.04	High D Temp
109	3	0.02	High D Temp
110	8	0.03	High D Temp
111	11	0.01	High D Temp
112	2	0.02	High D Temp
113	1	0.04	High D Temp
114	2	0.03	High D Temp
115	7	0.03	High D Temp
116	4	0.03	High D Temp
117	2	0.02	High D Temp
118	0	0.03	High D Temp
119	4	0.01	High D Temp
120	4	0.04	High D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/3GS (g)

Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed after 120 hours while Compressors Were Running (Dynamic) at Test Conditions with R-134a and RL32S

Table C.4

Refrigerant: R-134a			Lubricant: RL32S
Stand	**Water (ppm)**	**TAN***	**Miscellaneous**
121	40	0.02	Low D Temp
122	31	0.04	Low D Temp
123	0	0.01	Low D Temp
124	29	0.01	Low D Temp
125	28	0.08	Low D Temp
126	31	0.01	Low D Temp
127	31	0.07	Low D Temp
128	27	0.07	Low D Temp
129	21	0.04	Low D Temp
130	29	0.07	Low D Temp
131	29	0.03	Low D Temp
132	57	0.08	Low D Temp
133	51	0.07	Low D Temp
134	51	0.02	Low D Temp
135	36	0.11	Low D Temp
136	41	0.13	Low D Temp
137	38	0.03	Low D Temp
138	50	0.10	Low D Temp
139	19	0.02	High D Temp
140	15	0.02	High D Temp
141	25	0.03	High D Temp
142	15	0.03	High D Temp
143	12	0.07	High D Temp
144	16	0.03	High D Temp
145	23	0.05	High D Temp
146	18	0.04	High D Temp
147	27	0.09	High D Temp
148	34	0.12	High D Temp
149	44	0.01	High D Temp
150	25	0.05	High D Temp
151	35	0.01	High D Temp
152	27	0.04	High D Temp
153	32	0.09	High D Temp
154	30	0.08	High D Temp
155	29	0.08	High D Temp
156	35	0.08	High D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/RL32S (g)

Appendix D
Moisture and TAN Analysis of Compressor Lubricants after Contaminant Addition and 120 hours Running Drawn with Filter Driers Removed while the System Was Static

Moisture and TAN Analysis of Lubricant Samples Drawn at Ambient Conditions with Filter Driers Removed after Compressors Were Static for 20 days after 120 hours at Test Conditions with R-507A and RL32S

Table D.1

Stand	Water (ppm)	TAN*	Miscellaneous
5	35	0.07	High D Temp
6	28	0.03	High D Temp
7	23	0.03	High D Temp
8	57	0.01	High D Temp
9	16	0.08	High D Temp
10	19	0.02	High D Temp
11	16	0.05	High D Temp
12	11	0.08	High D Temp
13	25	0.03	High D Temp
14	11	0.07	High D Temp
15	55	0.03	High D Temp
16	48	0.03	High D Temp
17	5	0.04	High D Temp
18	57	0.03	High D Temp
19	48	0.07	High D Temp
20	57	0.08	High D Temp
21	81	0.04	High D Temp
22	62	0.05	High D Temp
23	15	0.03	Low D Temp
24	7	0.01	Low D Temp
25	7	0.02	Low D Temp
26	15	0.02	Low D Temp
27	24	0.10	Low D Temp
28	16	0.02	Low D Temp
29	12	0.10	Low D Temp
30	5	0.10	Low D Temp
31	11	0.02	Low D Temp
32	3	0.09	Low D Temp
33	25	0.01	Low D Temp
34	52	0.10	Low D Temp
35	56	0.02	Low D Temp
36	51	0.03	Low D Temp
37	55	0.11	Low D Temp
38	51	0.11	Low D Temp
39	52	0.03	Low D Temp
40	56	0.10	Low D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/RL32S (g)

Moisture and TAN Analysis of Lubricant Samples Drawn at Ambient Conditions with Filter Driers Removed after Compressors Were Static for 20 days after 120 hours at Test Conditions with R-407C and RL32S

Table D.2

Stand	Water (ppm)	TAN*	Miscellaneous
41	12	0.04	Low D Temp
42	12	0.01	Low D Temp
43	13	0.03	Low D Temp
44	12	0.01	Low D Temp
45	12	0.14	Low D Temp
46	9	0.02	Low D Temp
47	10	0.10	Low D Temp
48	14	0.11	Low D Temp
49	18	0.03	Low D Temp
50	12	0.09	Low D Temp
51	77	0.02	Low D Temp
52	75	0.10	Low D Temp
53	37	0.02	Low D Temp
54	66	0.02	Low D Temp
55	69	0.11	Low D Temp
56	80	0.13	Low D Temp
57	58	0.03	Low D Temp
58	57	0.08	Low D Temp
59	8	0.05	High D Temp
60	13	0.03	High D Temp
61	28	0.03	High D Temp
62	68	0.03	High D Temp
63	13	0.09	High D Temp
64	8	0.02	High D Temp
65	23	0.09	High D Temp
66	33	0.10	High D Temp
67	5	0.02	High D Temp
68	12	0.09	High D Temp
69	56	0.03	High D Temp
70	56	0.10	High D Temp
71	54	0.03	High D Temp
72	38	0.04	High D Temp
73	42	0.11	High D Temp
74	42	0.09	High D Temp
75	106	0.03	High D Temp
76	48	0.10	High D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/RL32S (g)

Moisture and TAN Analysis of Lubricant Samples Drawn at Ambient Conditions with Filter Driers Removed after Compressors Were Static for 20 days after 120 hours at Test Conditions with R-22 and 3GS

Table D.3

Stand	Water (ppm)	TAN*	Miscellaneous
85	0	0.02	Low D Temp
86	2	0.04	Low D Temp
87	0	0.03	Low D Temp
88	9	0.06	Low D Temp
89	0	0.04	Low D Temp
90	0	0.04	Low D Temp
91	0	0.08	Low D Temp
92	0	0.10	Low D Temp
93	1	0.03	Low D Temp
94	1	0.02	Low D Temp
95	0	0.11	Low D Temp
96	0	0.08	Low D Temp
97	2	0.11	Low D Temp
98	2	0.06	Low D Temp
99	20	0.02	Low D Temp
100	2	0.03	Low D Temp
101	0	0.10	Low D Temp
102	0	0.13	Low D Temp
103	0	0.03	High D Temp
104	0	0.02	High D Temp
105	8	0.09	High D Temp
106	0	0.01	High D Temp
107	0	0.02	High D Temp
108	0	0.07	High D Temp
109	0	0.16	High D Temp
110	0	0.11	High D Temp
111	2	0.05	High D Temp
112	0	0.03	High D Temp
113	0	0.09	High D Temp
114	0	0.11	High D Temp
115	0	0.08	High D Temp
116	0	0.06	High D Temp
117	2	0.03	High D Temp
118	1	0.03	High D Temp
119	0	0.09	High D Temp
120	0	0.05	High D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/3GS (g)

Moisture and TAN Analysis of Lubricant Samples Drawn at Ambient Conditions with Filter Driers Removed after Compressors Were Static for 20 days after 120 hours at Test Conditions with R-134a and RL32S

Table D.4

Stand	Water (ppm)	TAN*	Miscellaneous
121	33	0.03	Low D Temp
122	22	0.02	Low D Temp
123	13	0.03	Low D Temp
124	20	0.02	Low D Temp
125	14	0.11	Low D Temp
126	16	0.01	Low D Temp
127	15	0.10	Low D Temp
128	5	0.09	Low D Temp
129	9	0.03	Low D Temp
130	15	0.10	Low D Temp
131	44	0.03	Low D Temp
132	52	0.10	Low D Temp
133	62	0.04	Low D Temp
134	60	0.01	Low D Temp
135	53	0.06	Low D Temp
136	59	0.12	Low D Temp
137	43	0.06	Low D Temp
138	53	0.10	Low D Temp
139	15	0.03	High D Temp
140	14	0.02	High D Temp
141	15	0.02	High D Temp
142	17	0.02	High D Temp
143	13	0.07	High D Temp
144	12	0.02	High D Temp
145	7	0.09	High D Temp
146	26	0.09	High D Temp
147	10	0.02	High D Temp
148	55	0.08	High D Temp
149	49	0.03	High D Temp
150	15	0.05	High D Temp
151	60	0.03	High D Temp
152	48	0.05	High D Temp
153	80	0.08	High D Temp
154	59	0.08	High D Temp
155	52	0.02	High D Temp
156	69	0.08	High D Temp

Shading indicates that contaminant water or acid was added to the unit.
* KOH (mg)/RL32S (g)

Appendix E
First Dynamic Moisture, TAN, and Gas Analysis of Test Systems after Complete Addition of Water, Organic Acid, Air, and Contaminant Refrigerant

First Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-507A and RL32S

Table E.1

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-502 (%)	Miscellaneous
5	CLY	92	0.03	543	0.30	0.10	High D Temp
6	C	29	0.09	575	0.13	0.09	High D Temp
7	CLY	75	0.10	581	0.23	0.11	High D Temp
8	CLY	62	0.14	582	0.20	3.8	High D Temp
9	CY	74	0.16	594	0.20	0.09	High D Temp
10	CDY	51	0.09	582	1.3	0.09	High D Temp
11	CLY	39	0.16	2382	0.36	3.5***	High D Temp
12	CY	51	0.09	1821	0.59	4.7*	High D Temp
13	CDY	67	0.07	593	3.1	3.7	High D Temp
14	CDY	55	0.07	576	1.5	0.09	High D Temp
15	CLY	67	0.14	593	0.43	4.0	High D Temp
16	C	86	0.15	562	0.23	0.09	High D Temp
17	CY	47	0.39	565	0.24	0.10	High D Temp
18	CG	68	0.21	593	0.23	0.09	High D Temp
19	CY	70	0.16	598	0.23	4.2	High D Temp
20	CY	27	0.29	2524	2.6	3.9***	High D Temp
21	CY	63	0.12	783	2.6	4.1***	High D Temp
22	CDY	80	0.11	589	3.2	0.09	High D Temp
23	C	81	0.10	617	0.43	0.10	Low D Temp
24	C	62	0.05	617	0.40	0.10	Low D Temp
25	C	58	0.06	618	0.40	0.10	Low D Temp
26	C	67	0.05	609	0.30	3.8	Low D Temp
27	C	152	0.11	619	0.40	0.07	Low D Temp
28	C	80	0.06	604	2.8	0.03	Low D Temp
29	C	73	0.13	617	0.40	3.8	Low D Temp
30	C	68	0.10	620	3.7	3.7	Low D Temp
31	C	74	0.09	2477	2.8	3.9***	Low D Temp
32	C	57	0.10	601	3.0	0.03	Low D Temp
33	C	71	0.05	590	1.2	4.0	Low D Temp
34	C	198	0.71	621	0.56	0.05	Low D Temp
35	C	105	0.06	620	3.2	0.09	Low D Temp
36	insufficient	sample	0.10	621	2.5	0.08	Low D Temp
37	C	152	0.12	2532	4.1	4.3***	Low D Temp
38	C	26	0.14	2529	2.8	4.7***	Low D Temp
39	C	95	0.06	2484	3.1	3.8***	Low D Temp
40	C	80	0.09	630	3.7	0.09	Low D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminant added to the unit.
[1] C = clear, CLY = clear light yellow, CY = clear yellow, CDY = clear dark yellow, CG = clear gray
[2] Samples drawn at 2030-2050 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)
* Additional contaminant refrigerant added.
*** Additional test refrigerant added.

First Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-407C and RL32S

Table E.2

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,7]	Hours[3]	Air[4] (%)	R-22 (%)	Miscellaneous
41	C	64	0.13	855	0.43	0.04	Low D Temp
42	C	25	0.08	803	0.49	0.00	Low D Temp
43	C	61	0.01	856	0.37	0.04	Low D Temp
44	C	58	0.03	2560	1.4	3.5***	Low D Temp
45	C	89	0.12	837	0.40	0.06	Low D Temp
46	C	80	0.06	805	1.6	0.14	Low D Temp
47	C	155	0.14	1842	0.72	3.6*	Low D Temp
48[5]	C	212	0.12	2541	2.8**	4.7***	Low D Temp
49	C	510	0.05	1815	2.9	4.1*	Low D Temp
50	C	389	0.11	1818	1.4**	0.28	Low D Temp
51	C	87	0.06	1867	0.52	4.2	Low D Temp
52	C	194	0.13	858	0.52	0.00	Low D Temp
53	CLY	71	0.05	1596	3.1	0.06	Low D Temp
54	C	99	0.08	1595	0.84	0.07	Low D Temp
55	C	208	0.14	1580	0.46	4.6	Low D Temp
56	C	161	0.12	1820	1.2	3.9*	Low D Temp
57	C	174	0.02	1868	1.9	4.5*	Low D Temp
58	C	150	0.08	1598	2.1	0.05	Low D Temp
59	C	60	0.05	1602	0.37	0.05	High D Temp
60	C	28	0.05	1600	0.92	0.05	High D Temp
61	C	86	0.04	1600	1.5	0.05	High D Temp
62	CLY	74	0.06	2173	0.17	3.8***	High D Temp
63	C	54	0.13	1598	0.26	0.05	High D Temp
64	CY	99	0.13	1559	3.6	0.26	High D Temp
65	C	72	0.15	2575	0.78	3.7***	High D Temp
66	CLY	77	0.09	2497	2.3**	4.0***	High D Temp
67	CLY	175	0.07	2559	1.3	3.7***	High D Temp
68	CY	80	0.10	1563	2.9	0.05	High D Temp
69	C	97	0.06	1616	1.0	3.7	High D Temp
70	C	128	0.08	1604	1.4	0.04	High D Temp
71	C	125	0.04	1605	2.8	0.06	High D Temp
72	C	171	0.06	1620	0.78	0.03	High D Temp
73	C	54	0.12	1618	0.72	3.6	High D Temp
74[6]	C	163	0.09	2364	1.3	4.8	High D Temp
75	C	256	0.12	1619	2.4	3.6	High D Temp
76	C	104	0.13	1615	1.9	0.06	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminant added to the unit.
[1] C = clear, CLY = clear light yellow, CY = clear yellow
[2] Samples drawn at 2030-2050 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] Repaired, pumped down, filled with R-407C, and re-inoculated with contaminants.
[6] Low lubricant, pumped down, filled with R-407C, and re-inoculated with contaminants.
[7] KOH (mg)/RL32S (g)
* Additional contaminant refrigerant added.
** Additional contaminant air added.
*** Additional test refrigerant added.

First Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-22 and 3GS

Table E.3

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	Miscellaneous
85	CLY	10	0.02	761	3.8	Low D Temp
86	CY	0.00	0.03	741	0.75	Low D Temp
87	CLY	9.7	0.03	752	0.20	Low D Temp
88	CY	33	0.07	762	2.9	Low D Temp
89	CLY	19	0.04	762	2.4	Low D Temp
90	CLY	5.4	0.01	761	0.20	Low D Temp
91	CY	14	0.06	780	2.8	Low D Temp
92	CLY	3.5	0.09	780	3.6	Low D Temp
93	CY	17	0.02	781	5.2	Low D Temp
94	CY	7.4	0.02	781	13	Low D Temp
95	CLY	7.4	0.10	781	5.3	Low D Temp
96	CLY	2.4	0.09	781	3.8	Low D Temp
97	CY	7.7	0.09	782	0.40	Low D Temp
98	CLY	13	0.08	782	2.9	Low D Temp
99	CY	10	0.01	762	2.9	Low D Temp
100	CY	16	0.03	783	2.2	Low D Temp
101	CY	12	0.07	784	1.4	Low D Temp
102	CLY	1.8	0.05	784	1.9	Low D Temp
103	CLY	11	0.01	778	1.6	High D Temp
104	CLY	0.00	0.02	765	0.23	High D Temp
105	CDY	20	0.06	760	1.9	High D Temp
106	insufficient	sample	0.02	781	0.78	High D Temp
107	CY	9.4	0.04	799	0.46	High D Temp
108	CY	29	0.03	776	0.78	High D Temp
109	CLY	16	0.06	785	0.63	High D Temp
110	CY	17	0.04	779	0.40	High D Temp
111	CDY	23	0.03	755	2.4	High D Temp
112	CDY	13	0.04	804	1.4	High D Temp
113	CDY	21	0.08	805	1.3	High D Temp
114	CDY	12	0.05	805	1.1	High D Temp
115	CY	14	0.05	790	2.7	High D Temp
116	CDY	13	0.07	794	1.1	High D Temp
117	CDY	25	0.04	801	1.6	High D Temp
118	CDY	18	0.05	770	1.3	High D Temp
119	CDY	1.3	0.07	786	1.5	High D Temp
120	CDY	20	0.08	800	1.2	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminant added to the unit.
[1] CLY = clear light yellow, CY = clear yellow, CDY = clear dark yellow
[2] Samples drawn at 2030-2050 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/3GS (g)

First Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-134a and RL32S

Table E.4

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-12 (%)	Miscellaneous
121	C	63	0.04	659	1.2	0.00	Low D Temp
122	C	91	0.05	633	0.54	0.01	Low D Temp
123	insufficient sample		0.02	661	0.37	0.00	Low D Temp
124	insufficient sample		0.09	661	1.7	3.8	Low D Temp
125	C	89	0.12	663	1.0	0.00	Low D Temp
126	C	83	0.04	655	1.5	0.04	Low D Temp
127	C	66	0.11	663	0.27	4.8	Low D Temp
128	C	71	0.10	663	0.72	3.8	Low D Temp
129	C	67	0.03	251	1.2	3.7	Low D Temp
130	C	69	0.07	665	0.68	0.01	Low D Temp
131	C	99	0.10	2585	0.41	3.3***	Low D Temp
132	C	93	0.09	665	0.85	0.00	Low D Temp
133	C	102	0.04	660	2.2	0.01	Low D Temp
134	insufficient	sample	0.06	667	0.65	0.00	Low D Temp
135	C	113	0.12	2567	0.24	3.3***	Low D Temp
136	C	152	0.10	667	0.78	4.0	Low D Temp
137	C	113	0.07	1864	0.61	3.9***	Low D Temp
138	C	106	0.08	645	0.61	0.03	Low D Temp
139	C	179	0.06	679	0.55	0.00	High D Temp
140	C	29	0.06	679	0.17	0.02	High D Temp
141	C	71	0.04	681	0.24	0.01	High D Temp
142	C	100	0.09	2472	0.75	3.7***	High D Temp
143	CY	89	0.08	656	1.3	0.00	High D Temp
144	CLY	93	0.06	676	0.82	0.02	High D Temp
145	C	75	0.11	2563	0.10	4.0***	High D Temp
146	C	98	0.08	678	0.68	4.1	High D Temp
147	C	87	0.09	655	0.99	4.2	High D Temp
148	CLY	92	0.10	638	0.61	0.01	High D Temp
149	C	68	0.10	672	0.20	3.9	High D Temp
150	C	93	0.08	680	0.10	0.00	High D Temp
151	C	0.00	0.05	665	0.68	0.04	High D Temp
152	C	85	0.08	649	0.17	0.00	High D Temp
153	C	111	0.11	689	0.20	4.4	High D Temp
154	C	34	0.08	2560	0.20	4.1***	High D Temp
155	C	114	0.06	689	0.72	4.6	High D Temp
156	CLY	104	0.11	1871	0.75	0.02	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminant added to the unit.
[1] C = clear, CLY = clear light yellow, CY = clear yellow
[2] Samples drawn at 2030-2050 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)
*** Additional test refrigerant added.

Appendix F
Second Dynamic Moisture, TAN, and Gas Analysis of Test Systems after Complete Addition of Water, Organic Acid, Air, and Contaminant Refrigerant

Second Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-507A and RL32S

Table F.1

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-502 (%)	Miscellaneous
5	DY	61	0.29	10524	0.19	0.02	High D Temp
6	G	89	0.10	9300	1.4	0.11	High D Temp
7	LY	79	0.48	8823	0.14	0.09	High D Temp
8	LY	40	0.36	9283	0.08	4.0	High D Temp
9	failed			5368	0.68	0.10	High D Temp
10	DY	43	0.19	9295	0.53	0.10	High D Temp
11	G	47	0.22	8999	0.16	3.9	High D Temp
12	Y	52	0.44	9141	0.27	4.3	High D Temp
13	DY	92	0.29	9250	0.83	3.7	High D Temp
14	DY	46	0.49	9231	0.85	0.08	High D Temp
15	Y	33	0.66	8886	0.16	4.0	High D Temp
16	LY	50	0.77	9319	0.25	0.08	High D Temp
17	G	47	0.45	9337	0.12	0.12	High D Temp
18	LY	47	0.68	9423	0.32	0.08	High D Temp
19	LY	58	1.1	9249	0.23	4.4	High D Temp
20	DY	46	0.44	9299	0.44	4.1	High D Temp
21	DY	40	0.82	3487	0.75	4.9	High D Temp
22	DY	81	0.66	9205	1.1	0.08	High D Temp
23	Y	110	0.04	8995	1.3	0.07	Low D Temp
24	C	53	0.01	9216	0.19	0.07	Low D Temp
25	C	98	0.04	9176	1.2	0.08	Low D Temp
26	C	73	0.01	8779	0.24	3.9	Low D Temp
27	C	65	0.05	9101	0.31	0.05	Low D Temp
28	LY	71	0.04	8671	1.1	0.02	Low D Temp
29	C	52	0.13	8768	0.27	3.7	Low D Temp
30	DY	57	0.11	7822	0.94	3.7	Low D Temp
31	LY	79	0.03	8544	0.80	3.8	Low D Temp
32	Y	57	0.12	8234	0.64	0.04	Low D Temp
33	C	56	0.01	8418	0.38		Low D Temp
34	C	insufficient sample		9295	0.05	0.09	Low D Temp
35			failed				Low D Temp
36	C	89	0.08	9186	0.82		Low D Temp
37	C	390	0.14	8953	0.77	4.2	Low D Temp
38	DY	59	0.15	9010	0.83	3.6	Low D Temp
39	LY	64	0.04	9177	0.65	4.0	Low D Temp
40	Y	52	0.20	9094	0.94	0.12	Low D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at ≤9600 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)

Second Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-407C and RL32S

Table F.2

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-22 (%)	Miscellaneous
41	C	52	0.01	8397	0.27	0.04	Low D Temp
42	C	53	0.01	9246	0.67	0.13	Low D Temp
43	C	insufficient sample		9489	0.23	0.05	Low D Temp
44	C	41	0.05	9430	1.2	2.7	Low D Temp
45	C	140	0.10	9290	0.18	0.05	Low D Temp
46	C	110	0.03	9487	0.75	0.10	Low D Temp
47	C	130	0.08	8651	0.76	0.04	Low D Temp
48	C	64	0.09	8700	1.4	5.9	Low D Temp
49	C	47	0.03	9428	1.1	4.6	Low D Temp
50	Y	97	0.09	8277	0.46	0.07	Low D Temp
51	C	98	0.05	8969	0.50	3.9	Low D Temp
52	C	190	0.12	9368	0.18	0.04	Low D Temp
53	C	130	0.18	9234	0.94	0.04	Low D Temp
54	C	140	0.03	9502	0.27	0.05	Low D Temp
55		failed					Low D Temp
56	C	160	0.01	9521	0.61	3.3	Low D Temp
57	C	180	0.05	8946	0.87	5.0	Low D Temp
58	C	74	0.12	8724	0.23	0.04	Low D Temp
59	LY	82	0.10	5583	0.12	0.05	High D Temp
60	LY	74	0.05	9240	0.65	0.05	High D Temp
61	LY	insufficient sample		9244	0.48	0.05	High D Temp
62	Y	260	0.12	8545	0.41	4.0	High D Temp
63	LY	insufficient sample	0.06	8873	0.22	0.07	High D Temp
64	DY	170	0.18	9178	1.5	0.04	High D Temp
65	DY	100	0.25	8668	0.39	3.6	High D Temp
66	DY	85	0.18	9115	0.93	5.1	High D Temp
67	LY	insufficient sample		9075	0.41	.36	High D Temp
68	DY	82	0.20	9019	1.3	0.05	High D Temp
69		failed					High D Temp
70	Y	110	0.18	9196	0.40	0.05	High D Temp
71		failed					High D Temp
72	C	390	0.08	8835	0.55	0.03	High D Temp
73	C	73	0.17	9110	0.21	3.8	High D Temp
74	Y	90	0.20	8751	1.7	3.6	High D Temp
75	Y	71	0.09	9134	0.68	3.7	High D Temp
76	DY	110	0.20	9328	2.2	0.05	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at ≤9600 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)

Second Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-22 and 3GS

Table F.3

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	Miscellaneous
85	LY	15	0.01	9068	0.10	Low D Temp
86	DY	23	0.06	8936	0.28	Low D Temp
87	LY	14	0.01	9350	0.18	Low D Temp
88	DY	38	0.03	9378	1.3	Low D Temp
89	Y	15	0.04	9408	0.19	Low D Temp
90	LY	15	0.04	9367	0.33	Low D Temp
91	DY	25	0.06	8632	0.49	Low D Temp
92	LY	17	0.02	8998	0.13	Low D Temp
93	Y	17	0.05	9392	0.22	Low D Temp
94	DY	130	0.05	9249	0.51	Low D Temp
95	DY	37	0.09	8424	0.58	Low D Temp
96	DY	88	0.07	9258	0.47	Low D Temp
97	LY	64	0.05	9461	0.32	Low D Temp
98	LY	38	0.08	9464	0.27	Low D Temp
99	Y	51	0.03	9381	0.47	Low D Temp
100	Y	25	0.03	9465	0.49	Low D Temp
101	Y	43	0.06	9458	0.14	Low D Temp
102	Y	33	0.05	9420	1.1	Low D Temp
103	LY	16	0.11	8832	0.39	High D Temp
104	LY	50	0.05	9016	0.14	High D Temp
105	DY	28	0.06	8896	0.69	High D Temp
106	LY	23	0.01	8851	1.3	High D Temp
107	LY	insufficient	sample	8839	0.23	High D Temp
108	Y	24	0.01	8759	0.49	High D Temp
109	Y	26	0.03	8791	0.34	High D Temp
110	LY	19	0.06	9036	0.32	High D Temp
111	DY	21	0.04	3317	0.57	High D Temp
112	DY	11	0.03	9075	0.54	High D Temp
113	DY	13	0.05	8819	0.89	High D Temp
114	DY	9.6	0.01	9400	0.38	High D Temp
115	Y	7.7	0.09	9212	0.22	High D Temp
116	DY	9.1	0.05	8923	0.67	High D Temp
117	DY	6.1	0.02	9227	0.54	High D Temp
118	DY	8.8	0.04	9109	0.45	High D Temp
119	DY	6.8	0.05	8651	0.84	High D Temp
120	DY	18	0.06	9005	0.29	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at ≤9600 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/3GS (g)

Second Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-134a and RL32S

Table F.4

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-12 (%)	Miscellaneous
121	C	73	0.03	9497	0.51	0.03	Low D Temp
122	C	52	0.04	9364	0.26	0.00	Low D Temp
123	C	54	0.01	9328	0.22	0.00	Low D Temp
124	LY	130	0.06	9035	1.1	3.4	Low D Temp
125	LY	76	0.11	9467	0.37	0.00	Low D Temp
126	C	76	0.05	9174	0.55	0.00	Low D Temp
127	C	95	0.08	9379	0.40	5.0	Low D Temp
128	C	81	0.15	9246	0.36	3.4	Low D Temp
129	C	58	0.05	9112	0.55	3.4	Low D Temp
130	LY	42	0.10	9040	0.47	0.03	Low D Temp
131	C	79	0.05	9504	0.23	2.6	Low D Temp
132	LY	250	0.13	9388	0.53	0.00	Low D Temp
133	LY	88	0.05	8838	7.4	0.00	Low D Temp
134	C	72	0.03	9340	0.32	0.00	Low D Temp
135	C	110	0.16	8832	0.15	3.3	Low D Temp
136	C	120	0.12	9501	0.36	3.1	Low D Temp
137	C	100	0.04	9325	0.39	3.4	Low D Temp
138	Y	100	0.14	9417	0.27	0.01	Low D Temp
139	DY	110	0.13	8754	0.29	0.08	High D Temp
140	Y	66	0.07	9307	0.16	0.01	High D Temp
141	C	99	0.47	9012	0.15	0.00	High D Temp
142	C	41	0.50	9398	0.20	3.0	High D Temp
143	DY	90	0.21	9083	0.31	0.00	High D Temp
144	DY	61	0.12	3560	0.38	0.01	High D Temp
145	LY	86	0.12	9402	0.14	3.6	High D Temp
146	DY	100	0.20	9400	0.53	3.8	High D Temp
147	Y	67	0.07	9606	0.28	3.3	High D Temp
148	DY	70	0.60	9105	1.1	0.04	High D Temp
149			failed				High D Temp
150	Y	74	0.55	8795	0.18	0.04	High D Temp
151	LY	99	0.03	2731	0.19	0.00	High D Temp
152	C	59	0.22	9441	0.24	0.01	High D Temp
153	C	72	0.15	9432	0.18	4.2	High D Temp
154	C	140	0.29	9479	0.30	3.9	High D Temp
155	LY	130	0.11	9325	0.25	1.5	High D Temp
156	DY	140	0.48	9451	0.41	0.01	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at ≤9600 hours.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)

Appendix G
Final Dynamic Moisture, TAN, and Gas Analysis of Test Systems after Completion of the 12,000 hour Test Period

Final Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-507A and RL32S

Table G.1

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-502 (%)	Miscellaneous
5	DY	100	0.50	10524	0.19	0.02	High D Temp
6	G	187	0.23	9300	1.4	0.11	High D Temp
7	LY	202	0.43	8823	0.14	0.09	High D Temp
8	LY	69	0.34	9283	0.08	4.0	High D Temp
9	CY	100	0.40	5368	0.68	0.10	High D Temp
10	DY	50	0.61	9295	0.53	0.10	High D Temp
11	G	581	0.45	8999	0.16	3.9	High D Temp
12	Y	247	0.62	9141	0.27	4.3	High D Temp
13	DY	89	0.98	9250	0.83	3.7	High D Temp
14	DY	157	0.64	9231	0.85	0.08	High D Temp
15	Y	35	0.96	8886	0.16	4.0	High D Temp
16	LY	54	1.0	9319	0.25	0.08	High D Temp
17	G	54	0.51	9337	0.12	0.12	High D Temp
18	LY	44	0.87	9423	0.32	0.08	High D Temp
19	LY	72	1.2	9249	0.23	4.4	High D Temp
20	DY	120	1.1	9299	0.44	4.1	High D Temp
21	DY	81	1.1	3487	0.75	4.9	High D Temp
22	DY	58	1.8	9205	1.1	0.08	High D Temp
23	Y	174	0.05	8995	1.3	0.07	Low D Temp
24	C	172	0.03	9216	0.19	0.07	Low D Temp
25	C	184	0.05	9176	1.2	0.08	Low D Temp
26	C	50	0.03	8779	0.24	3.9	Low D Temp
27	C	261	0.08	9101	0.31	0.05	Low D Temp
28	LY	96	0.04	8671	1.1	0.02	Low D Temp
29	C	262	0.15	8768	0.27	3.7	Low D Temp
30	DY	47	0.14	7822	0.94	3.7	Low D Temp
31	LY	54	0.07	8544	0.80	3.8	Low D Temp
32	Y	41	0.15	8234	0.64	0.04	Low D Temp
33	C	65	0.07	8418	0.38		Low D Temp
34	C	125	0.14	9295	0.05	0.09	Low D Temp
35	C	100	0.20	620	3.2	0.09	Low D Temp
36	C	59	0.11	9186	0.82		Low D Temp
37	C	139	0.29	8953	0.77	4.2	Low D Temp
38	DY	58	0.23	9010	0.83	3.6	Low D Temp
39	LY	97	0.08	9177	0.65	4.0	Low D Temp
40	Y	68	0.18	9094	0.94	0.12	Low D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at <12400 hrs.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)

Final Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-407C and RL32S

Table G.2

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-22 (%)	Miscellaneous
41	C	174	0.03	8397	0.27	0.04	Low D Temp
42	C	112	0.06	9246	0.67	0.13	Low D Temp
43	C	211	0.05	9489	0.23	0.05	Low D Temp
44	C	85	0.06	9430	1.2	2.7	Low D Temp
45	C	65	0.10	9290	0.18	0.05	Low D Temp
46	C	34	0.06	9487	0.75	0.10	Low D Temp
47	C	63	0.09	8651	0.76	0.04	Low D Temp
48	C	92	0.12	8700	1.4	5.9	Low D Temp
49	C	60	0.07	9428	1.1	4.6	Low D Temp
50	Y	95	0.17	8277	0.46	0.07	Low D Temp
51	C	862	0.03	8969	0.50	3.9	Low D Temp
52	C	369	0.10	9368	0.18	0.04	Low D Temp
53	C	74	0.05	9234	0.94	0.04	Low D Temp
54	C	120	0.02	9502	0.27	0.05	Low D Temp
55	C	180	0.16	1580	0.46	4.6	Low D Temp
56	C	206	0.15	9521	0.61	3.3	Low D Temp
57	C	187	0.08	8946	0.87	5.0	Low D Temp
58	C	68	0.11	8724	0.23	0.04	Low D Temp
59	LY	187	0.16	5583	0.12	0.05	High D Temp
60	LY	179	0.08	9240	0.65	0.05	High D Temp
61	LY	167	0.11	9244	0.48	0.05	High D Temp
62	Y	153	0.13	8545	0.41	4.0	High D Temp
63	LY	39	0.17	8873	0.22	0.07	High D Temp
64	DY	140	0.22	9178	1.5	0.04	High D Temp
65	DY	122	0.23	8668	0.39	3.6	High D Temp
66	DY	246	0.22	9115	0.93	5.1	High D Temp
67	LY	506	0.14	9075	0.41	0.36	High D Temp
68	DY	82	0.27	9019	1.3	0.05	High D Temp
69	C	110	0.09	1616	1.0	3.7	High D Temp
70	Y	225	0.31	9196	0.40	0.05	High D Temp
71	C	200	0.09	1605	2.8	0.06	High D Temp
72	C	321	0.09	8835	0.55	0.03	High D Temp
73	C	70	0.13	9110	0.21	3.8	High D Temp
74	Y	76	0.17	8751	1.7	3.6	High D Temp
75	Y	71	0.25	9134	0.68	3.7	High D Temp
76	DY	57	0.18	9328	2.2	0.05	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at <12400 hrs.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)

Final Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-22 and 3GS

Table G.3

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	Miscellaneous
85	LY	39	0.51	9068	0.10	Low D Temp
86	DY	32	0.31	8936	0.28	Low D Temp
87	LY	26	0.05	9350	0.18	Low D Temp
88	DY	34	0.14	9378	1.3	Low D Temp
89	Y	18	0.08	9408	0.19	Low D Temp
90	LY	2	0.07	9367	0.33	Low D Temp
91	DY	1	0.15	8632	0.49	Low D Temp
92	LY	25	0.14	8998	0.13	Low D Temp
93	Y	37	0.13	9392	0.22	Low D Temp
94	DY	37	0.18	9249	0.51	Low D Temp
95	DY	56	0.26	8424	0.58	Low D Temp
96	DY	57	0.11	9258	0.47	Low D Temp
97	LY	32	0.07	9461	0.32	Low D Temp
98	LY	21	0.23	9464	0.27	Low D Temp
99	Y	49	0.08	9381	0.47	Low D Temp
100	Y	20	0.13	9465	0.49	Low D Temp
101	Y	26	0.10	9458	0.14	Low D Temp
102	Y	26	0.11	9420	1.1	Low D Temp
103	LY	19	0.04	8832	0.39	High D Temp
104	LY	15	0.04	9016	0.14	High D Temp
105	DY	14	0.15	8896	0.69	High D Temp
106	LY	14	0.07	8851	1.3	High D Temp
107	LY	36	0.05	8839	0.23	High D Temp
108	Y	21	0.09	8759	0.49	High D Temp
109	Y	16	0.08	8791	0.34	High D Temp
110	LY	62	0.07	9036	0.32	High D Temp
111	DY	33	0.24	3317	0.57	High D Temp
112	DY	21	0.11	9075	0.54	High D Temp
113	DY	13	0.15	8819	0.89	High D Temp
114	DY	62	0.11	9400	0.38	High D Temp
115	Y	15	0.06	9212	0.22	High D Temp
116	DY	22	0.13	8923	0.67	High D Temp
117	DY	124	0.10	9227	0.54	High D Temp
118	DY	49	0.13	9109	0.45	High D Temp
119	DY	30	0.16	8651	0.84	High D Temp
120	DY	69	0.17	9005	0.29	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at <12400 hrs.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/3GS (g)

Final Moisture and TAN Analysis of Lubricant Samples Drawn with Filter Driers Removed and Air and Refrigerant Contamination Analysis of Circulating Gas[+]: R-134a and RL32S

Table G.4

Stand	Lubricant Appearance[1]	Water[2] (ppm)	TAN[2,5]	Hours[3]	Air[4] (%)	R-12 (%)	Miscellaneous
121	C	220	0.06	9497	0.51	0.03	Low D Temp
122	C	209	0.07	9364	0.26	0.00	Low D Temp
123	C	188	0.04	9328	0.22	0.00	Low D Temp
124	LY	48	0.09	9035	1.1	3.4	Low D Temp
125	LY	43	0.11	9467	0.37	0.00	Low D Temp
126	C	27	0.09	9174	0.55	0.00	Low D Temp
127	C	41	0.14	9379	0.40	5.0	Low D Temp
128	C	50	0.11	9246	0.36	3.4	Low D Temp
129	C	40	0.05	9112	0.55	3.4	Low D Temp
130	LY	41	0.09	9040	0.47	0.03	Low D Temp
131	C	57	0.10	9504	0.23	2.6	Low D Temp
132	LY	126	0.17	9388	0.53	0.00	Low D Temp
133	LY	136	0.07	8838	7.4	0.00	Low D Temp
134	C	57	0.06	9340	0.32	0.00	Low D Temp
135	C	42	0.16	8832	0.15	3.3	Low D Temp
136	C	81	0.16	9501	0.36	3.1	Low D Temp
137	C	67	0.06	9325	0.39	3.4	Low D Temp
138	Y	65	0.17	9417	0.27	0.01	Low D Temp
139	DY	212	0.19	8754	0.29	0.08	High D Temp
140	Y	172	0.07	9307	0.16	0.01	High D Temp
141	C	307	0.08	9012	0.15	0.00	High D Temp
142	C	40	0.07	9398	0.20	3.0	High D Temp
143	DY	44	0.21	9083	0.31	0.00	High D Temp
144	DY	60	0.18	3560	0.38	0.01	High D Temp
145	LY	41	0.09	9402	0.14	3.6	High D Temp
146	DY	78	0.17	9400	0.53	3.8	High D Temp
147	Y	39	0.09	9606	0.28	3.3	High D Temp
148	DY	41	0.16	9105	1.1	0.04	High D Temp
149	C	70	0.08	672	0.20	3.9	High D Temp
150	Y	58	0.67	8795	0.18	0.04	High D Temp
151	LY	60	0.12	2731	0.19	0.00	High D Temp
152	C	38	0.32	9441	0.24	0.01	High D Temp
153	C	69	0.80	9432	0.18	4.2	High D Temp
154	C	32	0.52	9479	0.30	3.9	High D Temp
155	LY	88	0.16	9325	0.25	1.5	High D Temp
156	DY	138	0.38	9451	0.41	0.01	High D Temp

[+] Samples taken while compressors were running (dynamic) at test conditions.
Shading indicates contaminants added to the unit.
[1] C = clear, LY = light yellow, Y = yellow, DY = dark yellow, G = gray
[2] Samples drawn at <12400 hrs.
[3] Hour gas sample drawn.
[4] % volume of refrigerant
[5] KOH (mg)/RL32S (g)

Appendix H
Summary of Final Lubricant Analysis:
TAN, Moisture, Total Metals, Trash in Expansion Valve Screen,
Debris in Compressor Bottom, Fluoride, and Chloride

Summary of Final Lubricant Analysis:
R-507A and RL32S
Table H.1

Stand #	Final TAN*	Final H_2O (ppm)	Total Metals (ppm)	Trash in screen (g)	Debris in bottom (g)	F (ppm)	Cl (ppm)
5	0.50	100	101	0.019	1.579	1.5	12
6	0.23	187	180	0.108	0.590	1.1	11
7	0.43	202	19	0.050	0.564	1.1	10
8	0.35	69	38	0.182	0.516	0.90	8.8
9	0.40	100	56	0.045	1.636	1.5	10
10	0.61	50	14	0.018	0.572	1.8	9.9
11	0.45	581	56	0.059	0.878	2.5	17
12	0.62	247	26	0.154	0.874	1.3	10
13	0.98	89	69	0.062	0.714	1.5	11
14	0.64	157	163	0.045	1.901	2.0	9.4
15	0.96	35	51	0.075	0.785	1.7	11
16	1.0	54	50	0.071	0.633	1.4	11
17	0.51	54	44	0.172	1.123	2.0	10
18	0.87	44	66	0.075	1.307	1.4	10
19	1.2	72	45	0.133	0.893	0.9	11
20	1.1	120	251	0.138	0.902	2.0	13
21	1.1	81	55	0.101	1.082	2.0	17
22	1.8	58	39	0.176	1.220	1.5	11
23	0.05	174	5	0.036	0.935	1.8	8.8
24	0.03	172	2	0.058	1.192	1.5	8.3
25	0.05	184	3	0.060	0.644	1.4	7.2
26	0.03	50	3	0.145	0.664	1.5	10
27	0.08	261	2	0.043	0.726	2.3	12
28	0.04	96	5	0.017	0.683	1.7	9.2
29	0.15	262	2	0.075	0.313	1.4	7.5
30	0.14	47	5	0.115	1.302	1.4	7.7
31	0.07	54	6	0.146	1.314	1.3	11
32	0.15	41	15	0.051	1.357	1.3	8.0
33	0.07	65	5	0.259	1.507	1.4	8.9
34	0.14	125	11	0.126	0.649	2.4	9.6
35	0.20	100	5	0.064	0.946	2.0	10
36	0.11	59	2	0.069	0.944	1.4	8.7
37	0.29	139	6	0.024	1.318	2.2	9.0
38	0.23	58	35	0.039	1.038	1.7	8.6
39	0.08	97	4	0.108	0.644	1.4	8.3
40	0.18	68	7	0.145	1.110	1.2	8.8

* KOH (mg)/RL32S (g)

Summary of Final Lubricant Analysis:
R-407C and RL32S
Table H.2

Stand #	Final TAN*	Final H_2O (ppm)	Total Metals (ppm)	Trash in screen (g)	Debris in bottom (g)	F (ppm)	Cl (ppm)
41	0.03	174	2	0.034	0.270	1.3	8.8
42	0.06	112	6	0.000	0.500	0.99	8.3
43	0.05	211	1	0.041	0.227	1.2	9.1
44	0.06	85	4	0.022	0.511	1.1	9.2
45	0.10	65	4	0.057	0.554	2.1	19
46	0.06	34	7	0.000	0.437	1.1	12
47	0.09	63	8	0.005	1.102	0.83	12
48	0.12	92	11	0.065	1.310	0.66	12
49	0.07	60	2	0.071	0.982	0.78	11
50	0.17	95	2	0.014	0.412	1.1	12
51	0.03	862	4	0.000	0.717	0.86	13
52	0.10	369	4	0.041	0.280	1.1	11
53	0.05	74	3	0.000	0.405	0.72	11
54	0.02	120	5	0.019	0.873	1.7	9.7
55	0.16	180	51	0.021	0.823	1.8	10
56	0.15	206	34	0.002	0.685	1.1	13
57	0.08	187	6	0.006	0.899	0.75	11
58	0.11	68	6	0.002	0.429	0.85	13
59	0.16	187	3	0.014	0.917	0.82	12
60	0.08	179	2	0.000	0.894	1.8	9.7
61	0.11	167	9	0.000	0.314	1.6	9.9
62	0.13	153	9	0.074	0.586	1.3	10
63	0.17	39	14	0.095	0.854	1.3	9.2
64	0.22	140	5	0.083	0.681	1.1	9.7
65	0.23	122	10	0.085	0.453	1.5	9.8
66	0.22	246	9	0.027	0.375	1.3	9.3
67	0.14	506	13	0.025	0.185	1.1	9.1
68	0.27	82	6	0.000	1.066	1.3	11
69	0.09	110	4	0.016	0.967	0.90	9.6
70	0.31	225	6	0.011	1.004	1.1	9.3
71	0.09	200	8	0.001	1.017	0.90	9.2
72	0.09	321	6	0.050	0.810	1.5	11
73	0.13	70	3	0.013	0.747	1.6	9.3
74	0.17	76	16	0.065	0.658	1.3	10
75	0.25	71	2	0.046	0.906	1.3	13
76	0.18	57	12	0.102	1.062	1.7	9.2

* KOH (mg)/RL32S (g)

Summary of Final Lubricant Analysis:
R-22 and 3GS
Table H.3

Stand #	Final TAN*	Final H_2O (ppm)	Total Metals (ppm)	Trash in screen (g)	Debris in bottom (g)	F (ppm)	Cl (ppm)
85	0.51	39	3	0.050	0.111	1.2	9.3
86	0.31	32	15	0.119	0.537	1.5	15
87	0.05	26	6	0.066	0.504	1.4	11
88	0.14	34	30	0.061	0.358	1.3	9.2
89	0.08	18	3	0.059	0.487	1.5	10
90	0.07	2	4	0.114	0.379	1.1	11
91	0.15	1	15	0.031	0.586	1.1	11
92	0.14	25	39	0.003	0.122	0.93	11
93	0.13	37	16	0.071	0.042	0.98	11
94	0.18	37	13	0.026	0.256	0.93	10
95	0.26	56	16	0.084	0.930	0.99	11
96	0.11	57	83	0.038	0.754	1.1	10
97	0.07	32	31	0.002	0.499	1.0	9.7
98	0.23	21	32	0.076	0.477	1.1	11
99	0.08	49	7	0.016	0.381	1.2	11
100	0.13	20	4	0.034	0.814	0.92	16
101	0.10	26	31	0.047	0.738	0.91	15
102	0.11	26	22	0.023	0.431	0.88	15
103	0.04	19	2	0.022	0.499	0.92	14
104	0.04	15	1	0.028	0.584	0.78	14
105	0.15	14	2	0.059	0.304	0.85	13
106	0.07	14	2	0.004	0.293	0.87	14
107	0.05	36	4	0.031	0.354	0.85	14
108	0.09	21	1	0.000	0.599	0.88	14
109	0.08	16	8	0.000	0.255	0.84	14
110	0.07	62	7	0.025	0.003	0.75	14
111	0.24	33	4	0.013	0.682	0.75	14
112	0.11	21	7	0.029	1.115	0.70	13
113	0.15	13	0	0.064	1.071	0.72	15
114	0.11	62	17	0.000	0.720	0.64	17
115	0.06	15	3	0.043	0.546	0.70	15
116	0.13	22	17	0.029	0.346	0.67	14
117	0.10	124	5	0.045	0.344	0.64	15
118	0.13	49	5	0.014	0.338	0.67	14
119	0.16	30	7	0.068	0.583	0.59	13
120	0.17	69	14	0.033	0.954	0.68	11

* KOH (mg)/3GS (g)

Summary of Final Lubricant Analysis:
R-134a and RL32S
Table H.4

Stand #	Final TAN*	Final H_2O (ppm)	Total Metals (ppm)	Trash in screen (g)	Debris in bottom (g)	F (ppm)	Cl (ppm)
121	0.06	220	3	0.001	0.380	1.3	14
122	0.07	209	5	0.024	0.314	1.1	16
123	0.04	188	3	0.001	0.510	1.2	15
124	0.09	48	6	0.011	0.717	1.3	17
125	0.11	43	9	0.032	1.168	1.1	16
126	0.09	27	2	0.100	0.974	0.92	16
127	0.14	41	3	0.073	0.752	0.95	17
128	0.11	50	7	0.036	0.694	0.99	17
129	0.05	40	3	0.022	0.546	0.91	16
130	0.09	41	10	0.019	0.282	0.82	9.0
131	0.10	57	2	0.000	0.380	0.95	15
132	0.17	126	5	0.009	0.709	0.87	14
133	0.07	136	4	0.049	0.802	0.88	16
134	0.06	57	3	0.000	0.997	0.88	14
135	0.16	42	11	0.006	0.609	0.95	13
136	0.16	81	5	0.092	0.362	0.86	13
137	0.06	67	3	0.000	0.662	0.88	13
138	0.17	65	9	0.000	0.865	0.91	13
139	0.19	212	14	0.041	0.513	0.88	13
140	0.07	172	7	0.081	0.678	0.94	14
141	0.08	307	7	0.073	0.212	0.91	13
142	0.07	40	26	0.061	0.533	0.95	14
143	0.21	44	13	0.000	0.554	0.81	16
144	0.18	60	4	0.070	0.613	0.81	22
145	0.09	41	8	0.031	0.673	0.77	21
146	0.17	78	21	0.011	0.650	0.78	24
147	0.09	39	4	0.041	0.886	0.78	17
148	0.16	41	24	0.038	0.575	0.81	13
149	0.08	70	60	0.153	0.550	0.85	14
150	0.67	58	62	0.159	1.025	0.78	12
151	0.12	60	7	0.085	0.690	0.88	14
152	0.32	38	6	0.025	0.675	0.82	13
153	0.80	69	14	0.000	1.369	0.91	14
154	0.52	32	22	0.019	0.382	0.81	14
155	0.16	88	2	0.053	0.817	1.1	13
156	0.38	138	19	0.034	0.987	1.1	13

* KOH (mg)/RL32S (g)

Appendix I
Glass Sealed Tube Evaluation and Photographic History of R-507A after 224 days Aging at 135°C and 28 days Aging at 165°C with Contaminants Added

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.1

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	-	-	-	3	NR	NR	NR	clear							
				7	NR	NR	NR	clear							
				14	NR	NR	NR	clear							
				28	NR	NR	NR	clear							
				56	NR	NR	NR	clear							
				112	NR	NR	NR	clear							
				224	NR	NR	blue-gray	clear	-	-	-	-	100	-	0.10
200	-	-	-	3	NR	gray-orange/orange	NR	clear							
				7	NR	gray-orange/orange	light tan	clear							
				14	NR	yellow/gray-orange	tan	clear							
				28	NR	yellow-orange	brown	light yellow							
				56	NR	yellow-orange	brown	light yellow							
				112	NR	yellow-orange	brown	light yellow							
				224	NR	orange	brown & dark gray/brown	light yellow	-	-	-	-	100	-	2.0
<20	0.1	-	-	3	NR	dark orange/NR	light tan/NR	clear							
				7	NR	dark orange/ NR	light tan/ blue-green	clear							
				14	NR	tan/NR	tan/blue-green	clear							
				28	NR	yellow-tan/NR	tan/blue-green	clear							
				56	NR	brown/NR	tan/blue-gray	clear							
				112	NR	tan/NR	tan/blue-gray	clear							
				224	NR	dark orange/NR	tan/blue-gray	clear	-	-	-	-	100	-	0.78

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.2

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	0.4	-	-	3	NR	dark orange/orange	NR/blue-green	clear							
				7	NR	dark orange/orange	NR/blue-green	clear							
				14	NR	dark orange/orange	NR/blue-green	clear							
				28	NR	dark orange/orange	NR/blue-green	clear							
				56	NR	dark orange/NR	light tan/NR	clear							
				112	NR	tan/ NR	light tan/ blue-gray	clear							
				224	NR	orange/ NR	light tan/ blue-gray	clear							
<20	-	-	4	3	NR	orange	NR	clear							
				7	NR	orange/NR	NR	clear							
				14	NR	dark orange/NR	NR	clear							
				28	NR	dark orange/NR	NR	clear							
				56	NR	orange/NR	NR	clear							
				112	NR	NR	NR	clear							
				224	NR	NR	blue-gray	clear	-	-	-	-	96.5	3.5	0.15
<20	-	4	-	3	NR	dark orange	NR	clear							
				7	NR	dark orange/NR	NR	light yellow							
				14	NR	dark orange/NR	NR	yellow							
				28	NR	dark orange/NR	NR	yellow ✪							
				56	NR	orange/NR	NR	yellow ✪							
				112	NR	NR	NR	yellow ✪							
				224	NR	NR	blue-gray	yellow ✪ (1)	2.3	-	0.10	0.20	97.4	-	9.9

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.3

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	0.1	-	-	3	NR	dark orange/NR	light tan/NR	clear							
				7	NR	dark orange/NR	light tan/blue-green	clear							
				14	NR	light tan/NR	light tan/blue-green	clear							
				28	NR	tan/NR	gray, blue-green	clear							
				56	NR	tan/NR	blue-gray	clear							
				112	NR	tan/NR	light tan/blue-gray	clear							
				224	NR	dark orange/NR	light tan/blue-gray	clear	-	-	-	-	99.8	0.20	2.1
200	0.4	-	-	3	NR	dark orange	blue-green	clear							
				7	NR	dark orange/NR	light tan/blue-green	clear							
				14	NR	dark orange/NR	light tan/blue-green	clear							
				28	NR	dark orange/NR	light tan/blue-green	clear							
				56	NR	dark orange/NR	light tan/blue-green	clear							
				112	NR	orange/NR	gray, tan/blue-gray	clear							
				224	NR	NR	black & tan	cloudy with ppt (1)							
200	-	-	4	3	NR	yellow/dark orange	NR	clear							
				7	NR	yellow/dark orange	light tan	clear							
				14	NR	yellow-tan/ light orange	tan	clear							
				28	NR	yellow-tan/ light orange	tan/ blue-green	light yellow							
				56	NR	NR/ yellow-orange	tan/ blue-green	light yellow							
				112	NR	yellow-tan/ NR	tan/ blue-green	light yellow							
				224	NR	yellow-tan/ NR	tan	light yellow	-	-	-	-	95.8	4.2	2.0

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.4

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	-	4	-	3	NR	dark orange	NR	clear							
				7	NR	dark orange/NR	blue-green	light yellow							
				14	NR	dark orange/NR	blue-green	yellow							
				28	NR	dark orange/NR	blue-green	yellow ✪							
				56	NR	orange/NR	blue-green	yellow ✪							
				112	NR	NR	light tan/blue-green	yellow ✪							
				224	NR	NR	tan/blue-gray	yellow ✪	3.4	0.15	0.10	0.20	96.2	-	11
<20	0.1	-	4	3	NR	dark orange/NR	light tan/NR	clear							
				7	NR	dark orange/NR	tan/blue-green	clear							
				14	NR	light tan/NR	tan/blue-green	clear							
				28	NR	light tan/NR	tan/blue-green	clear							
				56	NR	tan/NR	tan/blue-gray	clear							
				112	NR	tan/NR	tan/blue-gray	clear							
				224	NR	dark orange	tan/blue-gray	clear	-	-	-	-	95.7	4.3	0.76
<20	0.4	-	4	3	NR	dark orange/NR	gray/blue-green	clear							
				7	NR	dark orange/NR	light tan	clear							
				14	NR	dark orange/NR	light tan/blue-green	clear							
				28	NR	tan/NR	light tan/blue-green	clear							
				56	NR	tan/NR	light tan/blue-green	clear							
				112	NR	tan/NR	light tan/blue-green	clear							
				224	NR	tan/NR	light tan/blue-green	clear							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.5

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	0.1	4	-	3	NR	dark orange/NR	blue-green	clear							
				7	NR	dark orange/NR	gray, blue-green	light yellow							
				14	NR	light tan/NR	gray, blue-green	yellow							
				28	NR	light tan/NR	gray, blue-green	yellow							
				56	NR	light tan/NR	blue-gray	yellow							
				112	NR	dark orange/NR	light tan/blue-gray	yellow							
				224	NR	orange/NR	tan & dark gray	yellow	3.2	0.10	0.10	0.30	96.3	-	12
<20	0.4	4	-	3	NR	dark orange	blue-green	clear							
				7	NR	dark orange/NR	light tan	light yellow							
				14	NR	dark orange/NR	light tan	yellow							
				28	NR	light tan/ NR	light tan/ blue-green	yellow ✪							
				56	NR	light tan/ NR	light tan	yellow-red ppt ✪							
				112	NR	orange/ NR	light tan/ blue-gray	yellow-red ppt ✪							
				224	NR	NR	black & brown	yellow-red ppt ✪ (3)							
<20	-	4	4	3	NR	dark orange	blue-green	clear							
				7	NR	dark orange/NR	blue-green	light yellow							
				14	NR	dark orange/NR	blue-green	yellow							
				28	NR	dark orange/NR	blue-green	yellow							
				56	NR	corrosion spots/ NR	blue-green/ light tan	yellow							
				112	NR	tan spots/NR	light tan	yellow							
				224	NR	tan spots/ NR	black spots & tan	cloudy yellow with ppt (3)	3.1	0.15	0.10	0.20	93.0	3.5	15

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(3) significant amounts of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.6

Contaminants										GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	0.1	-	4	3	NR	dark orange/NR	light tan/NR	clear							
				7	NR	dark orange/NR	tan/blue-green	clear							
				14	NR	light tan/dark orange	tan/blue-green	clear							
				28	NR	light tan/dark orange	tan/blue-green	clear							
				56	NR	brown/NR	tan	clear							
				112	NR	brown/NR	tan	clear							
				224	NR	tan/NR	tan	light yellow	-	-	-	-	96.4	3.6	2.1
200	0.4	-	4	3	NR	dark orange	blue-green	clear							
				7	NR	dark orange/ NR	light tan/ blue-green	clear							
				14	NR	dark orange/NR	tan/blue-green	clear							
				28	NR	light tan/NR	tan/blue-green	clear							
				56	NR	tan/NR	tan/blue-green	clear							
				112	NR	tan/NR	tan/blue-gray	clear							
				224	NR	orange/NR	tan/blue-gray	clear							
200	0.1	4	-	3	NR	dark orange/NR	tan/blue-green	clear							
				7	NR	light tan/ NR	gray, blue-green	light yellow							
				14	NR	tan/orange	gray, light tan	yellow							
				28	NR	tan/orange	gray, light tan	yellow							
				56	NR	orange/NR	blue-gray	yellow							
				112	NR	orange/ NR	light tan	yellow- dark ppt							
				224	NR	orange/ NR	tan & gray	yellow- red ppt ✪ (2)	3.0	-	0.15	0.25	96.6	-	12

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(2) precipitate readily noticeable (1-10mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.7

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	0.4	4	-	3	NR	dark orange	NR	clear							
				7	NR	dark orange	NR	light yellow							
				14	NR	dark orange/NR	NR	yellow							
				28	NR	dark orange/NR	blue-green	yellow							
				56	NR	orange/NR	blue-green	yellow							
				112	NR	orange/ NR	light tan/ light tan with gray spots	yellow-brown ppt							
				224	NR	NR	black & dark gray	yellow-brown ppt (2)							
200	-	4	4	3	NR	light tan/ dark orange	blue-green	clear							
				7	NR	dark orange/NR	blue-green	light yellow							
				14	NR	tan/ NR	light tan/ blue-green	yellow							
				28	NR	tan/ NR	light tan/ blue-green	yellow							
				56	NR	dark orange/ NR	light tan/ blue-green	yellow ✪							
				112	NR	orange/ NR	light tan/ blue-gray	yellow ✪							
				224	NR	NR	black & tan	yellow with ppt (2)	2.6	-	0.19	0.22	93.5	3.4	15

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(2) precipitate readily noticeable (1-10mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.8

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	0.1	4	4	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	dark orange/NR	gray, blue-green	yellow							
				14	NR	dark orange/NR	gray, blue-green	yellow							
				28	NR	light tan/NR	gray, blue-green	yellow							
				56	NR	light tan/NR	light tan, gray	yellow							
				112	NR	dark orange/NR	light tan/black	yellow							
				224	NR	orange/ NR	black & dark gray	hazy yellow-brown ppt (3)	2.9	-	0.20	0.28	93.2	3.3	14
<20	0.4	4	4	3	NR	light tan/ dark orange	blue-green	clear							
				7	NR	brown/NR	blue-green	light yellow							
				14	NR	tan/NR	blue-green	yellow							
				28	NR	tan/NR	blue-green	yellow ✪							
				56	NR	dark orange/ NR	blue-gray, tan	yellow-dark ppt ✪							
				112	NR	orange/ NR	light tan/ gray & black	yellow-dark ppt ✪							
				224	NR	NR	black & gray	cloudy yellow-dark ppt ✪ (3)							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on the inside tube wall

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 135°C

Table I.9

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	0.1	4	4	3	NR	light tan/ dark orange	blue-green	light yellow							
				7	NR	light tan/NR	gray, blue-green	yellow							
				14	NR	tan/NR	gray, blue-green	yellow							
				28	NR	tan/NR	gray, blue-green	yellow							
				56	NR	tan/NR	light tan, gray	yellow							
				112	NR	light tan/ NR	light tan, gray	yellow- dark ppt							
				224	NR	orange/ NR	black & dark gray	yellow- brown ppt (1)	2.4	-	0.18	0.25	93.9	3.2	15
200	0.4	4	4	3	NR	light tan/ dark orange	blue-green	clear							
				7	NR	brown/NR	light tan/blue-green	light yellow							
				14	NR	tan/NR	light tan/blue-green	yellow							
				28	NR	tan/NR	light tan/blue-green	yellow ✪							
				56	NR	dark orange/ NR	blue-gray, tan	yellow- dark ppt ✪							
				112	NR	dark orange/ NR	light tan/ gray & black	yellow- dark ppt ✪							
				224	NR	orange/ NR	black & gray	cloudy yellow- ppt ✪ (3)							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 165°C

Table I.10

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	-	-	-	3	NR	NR	NR	clear							
				7	NR	NR	NR	clear							
				14	NR	NR	blue-green	clear							
				28	NR	NR	blue-green	clear	-	-	-	-	99.9	0.10	0.53
200	-	-	-	3	NR	yellow/NR	tan/NR	clear							
				7	NR	light green/NR	tan/NR	clear							
				14	NR	tan/NR	tan/blue-green	clear							
				28	NR	tan/NR	tan/blue-green	clear	-	-	-	-	99.8	0.20	2.1
<20	0.1	-	-	3	NR	tan/NR	brown/blue-green	clear							
				7	NR	tan/NR	brown/blue-green	clear							
				14	NR	brown/NR	brown/blue-green	clear							
				28	NR	brown/NR	brown/blue-green	clear	-	-	-	-	99.9	0.10	0.77
<20	0.4	-	-	3	NR	dark orange/NR	tan/blue-green	clear							
				7	NR	dark orange/NR	tan/blue-green	light yellow							
				14	NR	dark orange/NR	tan/blue-green	light yellow							
				28	NR	tan/NR	tan/blue-green	light yellow							
<20	-	-	4	3	NR	dark orange/NR	blue-green	clear							
				7	NR	orange/NR	light tan/blue-green	clear							
				14	NR	dark orange/NR	light tan/blue-green	clear							
				28	NR	tan/NR	light tan/blue-green	clear	-	-	-	-	98.7	1.3	0.12
<20	-	4	-	3	NR	light tan/NR	blue-green	light yellow							
				7	NR	orange/NR	light tan/blue-green	light yellow							
				14	NR	NR	light tan/blue-green	yellow							
				28	NR	NR	light tan/blue-green	yellow	3.7	0.12	0.27	0.88	94.8	0.07	12
200	0.1	-	-	3	NR	light tan/NR	brown/blue-green	clear							
				7	NR	light tan/NR	brown/blue-green	clear							
				14	NR	tan/NR	brown/blue-green	clear							
				28	NR	tan/NR	brown/blue-green	clear	-	-	-	-	99.8	0.20	NA

* water content of lubricant and refrigerant
** KOH (mg) / RL32S (g)
NR = no reaction/no visible color change
NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 165°C

Table I.11

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	0.4	-	-	3	NR	light tan/NR	tan/blue-green	clear							
				7	NR	brown/NR	tan/blue-green	light yellow							
				14	NR	tan/NR	brown/blue-green	light yellow							
				28	NR	tan/NR	brown/gray	light yellow-hazy ppt (2)							
200	-	-	4	3	NR	gold tan/NR	tan/blue-green	clear							
				7	NR	gold tan/NR	tan/blue-green	clear							
				14	NR	gold tan/NR	brown/blue-green	clear							
				28	NR	gold tan/NR	brown/blue-green	clear	-	-	-	-	95.7	4.3	NA
200	-	4	-	3	NR	light tan/NR	tan/blue-green	light yellow							
				7	NR	light tan/NR	tan/blue-green	light yellow							
				14	NR	NR	tan/blue-green	yellow ✪							
				28	NR	brown spots/ NR	tan/ blue-green	yellow-brown ppt ✪ (1)	3.3	0.14	0.25	1.0	94.1	0.05	14
<20	0.1	-	4	3	NR	tan/NR	brown/blue-green	clear							
				7	NR	tan/NR	brown/blue-green	clear							
				14	NR	tan/NR	brown/blue-green	clear							
				28	NR	tan/NR	brown/blue-green	clear	-	-	-	-	96.1	3.9	0.61
<20	0.4	-	4	3	NR	dark orange/NR	tan/blue-green	clear							
				7	NR	tan/NR	tan/blue-green	clear							
				14	NR	dark orange/NR	tan/blue-green	clear							
				28	NR	dark orange/NR	tan/blue-green	clear							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

(2) precipitate readily noticeable (1-10mg)

NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 165°C

Table I.12

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	0.1	4	-	3	NR	dark orange/NR	tan/blue-green	yellow-dark ppt							
				7	NR	dark orange/NR	tan/blue-green	yellow-dark ppt							
				14	NR	dark orange/NR	tan/blue-green	yellow-dark ppt✪							
				28	NR	brown spots/ NR	tan/ blue-green	yellow- dark ppt (1)	3.5	0.14	0.27	0.77	95.3	0.05	11
<20	0.4	4	-	3	NR	tan/ NR	blue-green	dark gold- brown ppt							
				7	NR	tan/ NR	light tan/ blue-green	dark gold- brown ppt							
				14	NR	tan/ NR	light tan/ blue-green	dark yellow- brown ppt							
				28	NR	brown spots/ NR	light tan/ blue-green	dark yellow- brown ppt (2)							
<20	-	4	4	3	NR	tan/ NR	light tan/ blue-green	light yellow							
				7	NR	tan/ NR	light tan/ blue-green	light yellow							
				14	NR	dark orange/ NR	light tan/ blue-green	dark yellow							
				28	NR	brown spots/ NR	light tan/ blue-green	dark yellow- brown ppt (1)	2.3	-	0.17	0.25	94.3	3.0	16
200	0.1	-	4	3	NR	dark orange/ NR	brown/ blue-green	clear							
				7	NR	light tan/ NR	brown/ blue-green	clear							
				14	NR	tan/ NR	brown/ blue-green	clear							
				28	NR	yellow orange/ NR	brown/ blue-green	clear	-	-	-	-	96.0	4.0	2.2

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

(2) precipitate readily noticeable (1-10mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 165°C

Table I.13

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
200	0.4	-	4	3	NR	dark orange/NR	tan/blue-green	clear							
				7	NR	brown/NR	tan/blue-green	clear							
				14	NR	tan/NR	brown/blue-green	light yellow							
				28	NR	tan/NR	brown/blue-green	light yellow							
200	0.1	4	-	3	NR	dark orange/NR	tan/blue-green	yellow							
				7	NR	dark orange/NR	tan/blue-green	yellow							
				14	NR	dark orange/ NR	light tan/ blue-green	yellow- dark ppt ✪							
				28	NR	brown spots/ NR	tan/ gray spots, blue-green	yellow- dark ppt (1)	2.0	-	0.09	0.19	97.7	-	13
200	0.4	4	-	3	NR	dark orange/NR	tan/blue-green	yellow							
				7	NR	orange/NR	tan/blue-green	yellow							
				14	NR	dark orange/ NR	tan/ blue-green	dark yellow- brown ppt							
				28	NR	brown spots/ NR	tan/ gray	dark yellow- brown ppt ✪ (1)							
200	-	4	4	3	NR	tan/ NR	tan/ blue-green	light yellow- tan ppt							
				7	NR	tan/ NR	tan/ blue-green	light yellow- tan ppt							
				14	NR	tan/NR	tan/blue-green	yellow- tan ppt							
				28	NR	tan, brown spots/ NR	dark gray spots	yellow- brown ppt (2)	3.0	-	0.07	1.6	92.0	3.3	20

* water content of lubricant and refrigerant
** KOH (mg) / RL32S (g)
NR = no reaction/no visible color change
✪ red, orange, or tan precipitate rings on inside tube wall
(1) precipitate barely noticeable (0-1mg)
(2) precipitate readily noticeable (1-10mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-507A (1:1) at 165°C

Table I.14

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-502 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-507A (%)	R-502 (%)	TAN**
<20	0.1	4	4	3	NR	dark orange/NR	blue-green	yellow							
				7	NR	dark orange/NR	blue-green	yellow							
				14	NR	brown spots/ NR	tan/ blue-green	yellow- dark ppt ✪							
				28	NR	brown spots/ NR	tan, gray spots/ gray, blue-green	yellow- dark ppt (2)	3.2	0.15	0.10	0.50	92.6	3.5	18
<20	0.4	4	4	3	NR	tan/NR	blue-green	yellow-tan ppt							
				7	NR	light tan/NR	blue-green	yellow-tan ppt							
				14	NR	tan/ NR	light tan/ blue-green	dark yellow- red-brown ppt							
				28	NR	tan, brown spots/ NR	light tan/ gray	dark yellow- red-brown ppt (2)							
200	0.1	4	4	3	NR	dark orange/NR	tan/blue-green	yellow							
				7	NR	dark orange/NR	tan/blue-green	yellow							
				14	NR	brown spots/ NR	tan/ blue-green	yellow- dark ppt ✪							
				28	NR	brown spots/ NR	tan/ blue-green	yellow- dark ppt (2)	3.5	0.10	0.51	0.75	91.8	3.3	16
200	0.4	4	4	3	NR	tan/NR	tan/blue-green	yellow							
				7	NR	tan/NR	tan/blue-green	yellow							
				14	NR	tan/ NR	tan/blue-green	dark yellow- red-brown ppt							
				28	NR	tan/ NR	dark gray spots	dark yellow- red-brown ppt (3)							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

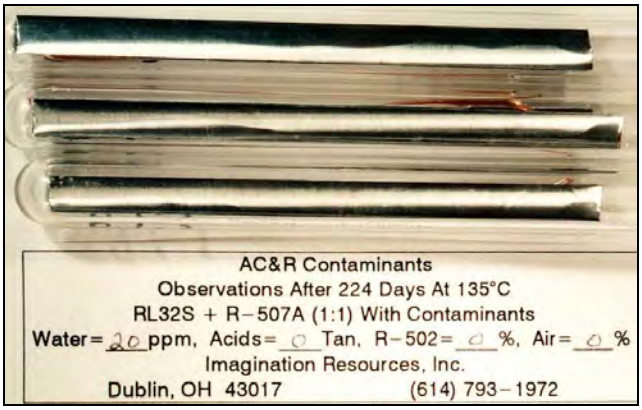
✪ red, orange, or tan precipitate rings on inside tube wall

(2) precipitate readily noticeable (1-10mg)

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

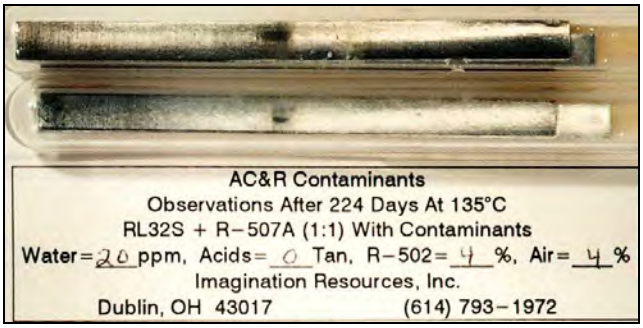
Photos of Sealed Tubes Containing R-507A and Contaminants at 135°C (275°F) for 224 days

Figure I.1



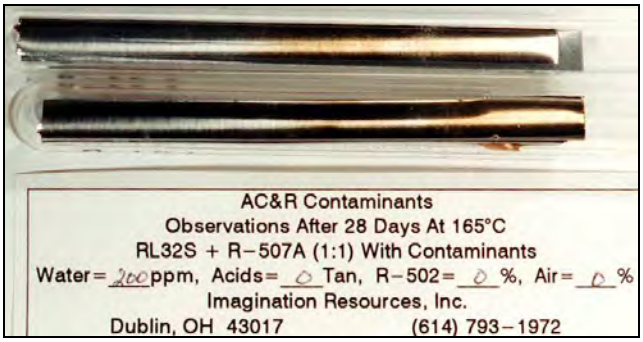
Photos of Sealed Tubes Containing R-507A and Contaminants at 135°C (275°F) for 224 days

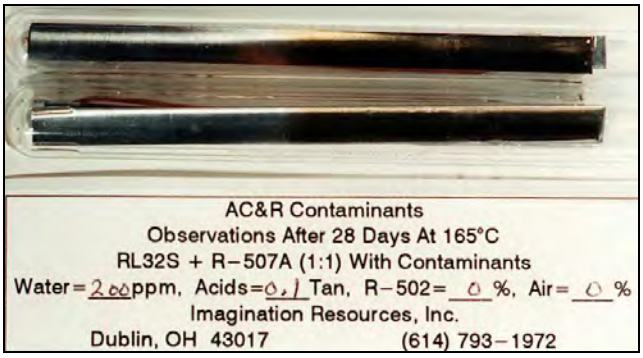
Figure I.2



Photos of Sealed Tubes Containing R-507A and Contaminants at 165°C (329°F) for 28 days

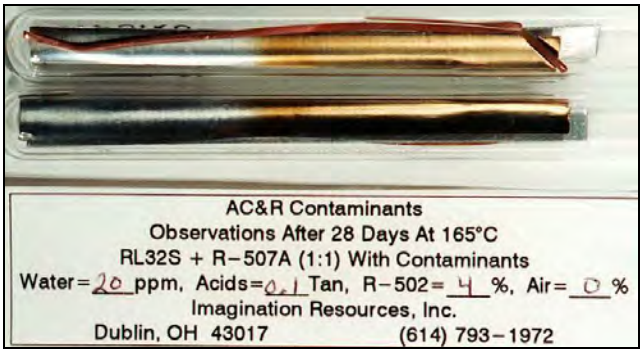
Figure I.3

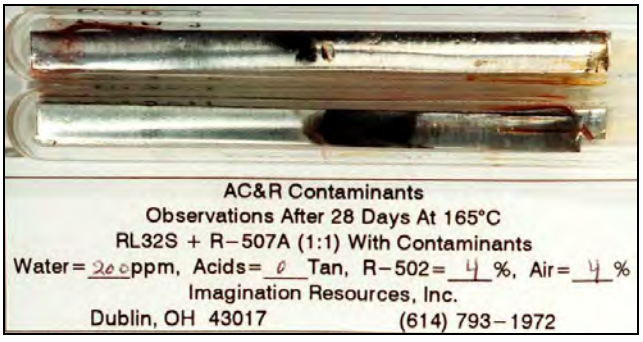




Photos of Sealed Tubes Containing R-507A and Contaminants at 165°C (329°F) for 28 days

Figure I.4





Appendix J
Glass Sealed Tube Evaluation and Photographic History of R-407C after 224 days Aging at 135°C and 28 days Aging at 165°C with Contaminants Added

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 135°C

Table J.1

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	-	-	-	3	NR	NR	NR	clear							
				7	NR	NR	NR	clear							
				14	NR	NR	blue-green	clear							
				28	NR	NR	blue-green	clear							
				56	NR	NR	blue-green	clear							
				112	NR	NR	NR	clear							
				224	NR	NR	NR	clear	-	-	-	-	100	-	0.17
200	-	-	-	3	NR	yellow-tan/ dark orange	tan	clear							
				7	NR	yellow-tan/ dark orange	tan	clear							
				14	NR	yellow-tan	tan	light yellow							
				28	NR	yellow-tan/NR	tan	light yellow							
				56	NR	tan/NR	tan	light yellow							
				112	NR	tan/NR	tan	light yellow							
				224	NR	dark orange/NR	tan	light yellow	-	-	-	-	100	-	NA
<20	0.1	-	-	3	NR	light tan/ dark orange	tan/ blue-green	clear							
				7	NR	yellow-tan/ dark orange	tan/ blue-green	clear							
				14	NR	yellow-tan/ dark orange	tan/ blue-green	clear							
				28	NR	tan/dark orange	tan/blue-gray	clear							
				56	NR	tan/NR	tan/blue-gray	clear							
				112	NR	tan/NR	tan/blue-gray	clear							
				224	NR	dark orange/NR	tan/blue-gray	clear	-	-	-	-	100	-	0.78

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 135°C

Table J.2

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	-	-	4	3	NR	yellow-tan/dark orange	tan	clear							
				7	NR	yellow-tan/dark orange	tan	clear							
				14	NR	yellow-tan/dark orange	tan	clear							
				28	NR	yellow-tan/dark orange	tan	clear							
				56	NR	yellow-tan/NR	brown	clear							
				112	NR	yellow-tan/NR	brown	clear							
				224	NR	gold/NR	brown	clear	-	-	-	-	97.5	2.5	NA
<20	-	4	-	3	NR	light tan/NR	NR	light yellow							
				7	NR	orange-tan/NR	NR	yellow							
				14	NR	tan/NR	blue-green	yellow							
				28	NR	tan/NR	blue-green	yellow							
				56	NR	dark orange/NR	blue-gray	yellow							
				112	NR	orange/ NR	blue-gray	yellow-gray ppt							
				224	NR	NR	tan & dark gray	yellow-gray ppt (1)	3.5	0.70	0.10	0.50	95.2	-	12
200	0.1	-	-	3	NR	yellow-tan/NR	tan	clear							
				7	NR	yellow-tan/dark orange	tan	clear							
				14	NR	yellow-tan/dark orange	tan	clear							
				28	NR	yellow-tan/dark orange	tan	clear							
				56	NR	yellow-tan/NR	tan	light yellow							
				112	NR	tan/NR	brown	light yellow							
				224	NR	tan/NR	brown	light yellow	-	-	-	0.48	99.5	-	2.0

* water content of lubricant and refrigerant
** KOH (mg) / RL32S (g)
NR = no reaction/no visible color change
(1) precipitate barely noticeable (0-1mg)
NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 135°C

Table J.3

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
200	-	-	4	3	NR	yellow-tan/ dark orange	light tan	clear							
				7	NR	yellow-tan	tan	clear							
				14	NR	yellow-tan	tan	clear							
				28	NR	yellow-tan	brown	light yellow							
				56	NR	tan	brown	light yellow							
				112	NR	tan	brown	light yellow							
				224	NR	tan/NR	brown	light yellow	-	-	-	-	97.2	2.8	1.9
200	-	4	-	3	NR	light tan/NR	gray, blue-green	clear							
				7	NR	orange-tan/NR	gray, blue-green	light yellow							
				14	NR	orange-tan/NR	gray, blue-green	yellow							
				28	NR	NR	gray, blue-green	yellow							
				56	NR	NR	blue, tan/ blue-gray	yellow-gray ppt							
				112	NR	NR	blue, tan/ blue-gray	yellow-gray ppt							
				224	NR	NR	gray & tan/ black	yellow-gray ppt (2)	3.4	0.39	0.30	0.86	95.0	0.11	15
<20	0.1	-	4	3	NR	yellow-tan/ dark orange	light tan	clear							
				7	NR	yellow-tan/ dark orange	tan	clear							
				14	NR	tan/dark orange	brown	clear							
				28	NR	brown/ yellow-orange	brown	clear							
				56	NR	brown/ yellow-orange	brown	clear							
				112	NR	brown/ yellow-orange	brown	light yellow							
				224	NR	brown/NR	brown	light yellow	-	-	-	0.41	96.4	3.2	NA

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(2) precipitate readily noticeable (1-10mg)

NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 135°C

Table J.4

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	0.1	4	-	3	NR	orange-tan/NR	gray, blue-green	light yellow							
				7	NR	tan/NR	gray, blue-green	yellow							
				14	NR	tan/NR	gray, blue-green	yellow							
				28	NR	dark orange/NR	gray, blue-green	yellow ✪							
				56	NR	orange/ NR	blue-gray	yellow- red ppt ✪							
				112	NR	NR	blue-gray/ gray-black	yellow- red ppt ✪							
				224	NR	NR	gray & tan/ black	yellow- red ppt ✪ (2)	3.9	0.48	0.29	0.78	94.6	-	14
<20	-	4	4	3	NR	tan/NR	gray, blue-green	light yellow							
				7	NR	tan/NR	gray, blue-green	yellow							
				14	NR	tan/NR	gray, blue-green	yellow							
				28	NR	tan/NR	gray, blue-green	yellow							
				56	NR	dark orange/ NR	blue-gray	yellow- red ppt							
				112	NR	orange/ NR	blue-gray/ gray-black	yellow- red ppt							
				224	NR	NR	gray & black	yellow- red ppt (2)	3.6	0.43	0.31	0.54	92.4	2.7	13
200	0.1	-	4	3	NR	yellow-tan/ yellow	tan	clear							
				7	NR	yellow-tan	tan	clear							
				14	NR	tan	brown	light yellow							
				28	NR	brown	brown	light yellow							
				56	NR	brown	brown	light yellow							
				112	NR	brown/ dark orange	brown	light yellow							
				224	NR	brown/NR	brown	light yellow	-	-	-	-	97.1	2.9	NA

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(2) precipitate readily noticeable (1-10mg)

NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 135°C

Table J.5

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
200	0.1	4	-	3	NR	light tan/ dark orange	gray, blue-green	light yellow							
				7	NR	orange-tan/NR	gray, blue-green	yellow							
				14	NR	orange-tan/NR	gray, blue-green	yellow							
				28	NR	dark orange/NR	gray, blue-green	yellow							
				56	NR	NR	blue-gray	yellow- dark ppt							
				112	NR	NR	blue-gray/ gray-black	yellow- dark ppt							
				224	NR	NR	gray & tan/ black	yellow- dark ppt (3)	3.9	0.46	0.12	0.96	94.6	0.09	16
200	-	4	4	3	NR	light tan/ yellow-orange	tan/ blue-green	light yellow							
				7	NR	orange-tan/yellow	tan/blue-green	yellow							
				14	NR	tan/NR	tan/blue-green	yellow							
				28	NR	tan/NR	tan/blue-green	yellow							
				56	NR	orange-tan/ NR	tan/ blue-green	yellow- orange ppt							
				112	NR	orange/ NR	tan/ gray-black	yellow- gray ppt							
				224	NR	NR	Black	yellow- gray ppt (3)	3.8	0.62	0.27	0.59	92.4	2.4	15

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 135°C

Table J.6

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	0.1	4	4	3	NR	tan/NR	gray, blue-green	light yellow							
				7	NR	tan/NR	gray, blue-green	yellow							
				14	NR	tan/NR	gray, blue-green	yellow							
				28	NR	tan/NR	gray, blue-green	yellow							
				56	NR	dark orange/ NR	blue-gray	yellow-gray, orange ppt							
				112	NR	orange/ NR	blue-gray/ gray-black	yellow-gray ppt							
				224	NR	NR	dark gray/ black	yellow-gray ppt (3)	3.7	0.57	0.28	0.81	92.2	2.4	14
200	0.1	4	4	3	NR	tan/NR	gray, blue-green	light yellow							
				7	NR	tan/NR	gray, blue-green	yellow							
				14	NR	tan/NR	gray, blue-green	yellow							
				28	NR	tan/NR	light tan/blue-gray	yellow							
				56	NR	dark orange/ NR	light tan/ blue-gray	yellow-tan ppt ✪							
				112	NR	orange/ NR	tan/ gray-black	yellow-tan ppt ✪							
				224	NR	NR	Black	yellow-tan ppt (3)	3.7	0.55	0.27	0.62	92.4	2.5	15

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 165°C

Table J.7

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	-	-	-	3	NR	NR	blue-green	clear							
				7	NR	NR	blue-green	clear							
				14	NR	NR	blue-green	clear							
				28	NR	NR	blue-green	clear	-	-	-	-	100	-	0.12
200	-	-	-	3	NR	yellow-orange/NR	brown/blue-green	clear							
				7	NR	yellow-tan/NR	brown/blue-green	clear							
				14	NR	tan/NR	brown/blue-green	clear							
				28	NR	tan/NR	brown/blue-green	clear	-	-	-	-	100	-	2.1
<20	0.1	-	-	3	NR	yellow-tan/NR	brown/blue-green	clear							
				7	NR	yellow-tan/NR	brown/blue-green	clear							
				14	NR	yellow-tan/NR	brown/blue-green	clear							
				28	NR	yellow-tan/NR	brown/blue-green	clear	-	-	-	-	100	-	0.70
<20	-	-	4	3	NR	yellow-orange/NR	brown/blue-green	clear							
				7	NR	yellow/NR	brown/blue-green	clear							
				14	NR	yellow-tan/NR	brown/blue-green	clear							
				28	NR	yellow-tan/NR	brown/blue-green	clear	-	-	-	0.32	96.7	2.9	0.28
<20	-	4	-	3	NR	dark orange/NR	blue-green	yellow ✪							
				7	NR	dark orange/ NR	blue-green	yellow-dark ppt ✪							
				14	NR	dark orange/ NR	gray, blue-green	yellow-dark ppt ✪							
				28	NR	dark orange/ NR	gray, tan/ maroon, blue	yellow-dark ppt ✪ (1)	3.4	0.41	0.32	1.2	94.5	0.16	14

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 165°C

Table J.8

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
200	0.1	-	-	3	NR	yellow-tan/NR	brown/blue-green	clear							
				7	NR	tan/NR	brown/blue-green	light yellow							
				14	NR	tan/NR	brown/blue-green	light yellow							
				28	NR	tan/NR	brown/blue-green	light yellow	-	-	-	-	100	-	2.0
200	-	-	4	3	NR	yellow-tan/NR	brown/blue-green	clear							
				7	NR	tan/dark orange	brown/blue-green	clear							
				14	NR	tan/NR	brown/blue-green	clear							
				28	NR	tan/NR	brown/blue-green	light yellow	-	-	-	-	96.7	3.3	NA
200	-	4	-	3	NR	dark orange/NR	blue-green	yellow							
				7	NR	dark orange/ NR	light tan/ blue-green	yellow							
				14	NR	dark orange/ NR	light tan/ blue-green	yellow-dark ppt							
				28	NR	dark orange, brown spots/NR	blue, tan/ blue-gray	yellow-dark ppt (1)	3.8	0.70	0.28	0.75	94.5	-	7.3
<20	0.1	-	4	3	NR	tan/NR	brown/blue-green	clear							
				7	NR	brown/orange	brown/blue-green	light yellow							
				14	NR	brown/orange	brown/blue-green	light yellow							
				28	NR	brown/orange	brown	light yellow	-	-	-	-	97.0	3.0	0.04
<20	0.1	4	-	3	NR	NR	light tan/ blue-green	yellow-dark ppt							
				7	NR	orange/ NR	light tan/ blue-green	yellow-dark ppt							
				14	NR	orange/ NR	light tan/ blue-green	yellow-dark ppt							
				28	NR	orange/ NR	blue, tan/ blue-gray	yellow-dark ppt (1)	3.4	1.1	-	1.3	94.1	0.11	15

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(1) precipitate barely noticeable (0-1mg)

NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 165°C

Table J.9

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	-	4	4	3	NR	orange-tan/ NR	light tan/ blue-green	yellow- dark ppt ✪							
				7	NR	brown spots/ NR	light tan/ blue-green	yellow- dark ppt ✪							
				14	NR	brown spots/ NR	light tan/ blue-green	yellow- dark ppt ✪							
				28	NR	brown spots/ NR	blue, tan/ blue-gray	yellow- dark ppt (1)	3.7	0.58	0.30	0.78	92.2	2.4	14
200	0.1	-	4	3	NR	yellow-tan/NR	brown/blue-green	clear							
				7	NR	tan/NR	brown/blue-green	light yellow							
				14	NR	tan/NR	brown/blue-green	light yellow							
				28	NR	brown/NR	brown	light yellow	-	-	-	-	96.7	3.3	NA
200	0.1	4	-	3	NR	brown spots/ NR	gray-tan/ blue-green	yellow- brown ppt							
				7	NR	brown spots/ NR	gray-tan/ blue-green	yellow- brown ppt							
				14	NR	brown spots/ NR	gray-tan/ blue-green	yellow- brown ppt							
				28	NR	brown spots/ NR	blue, tan/ blue-gray	yellow- brown ppt (1)	3.6	0.54	0.17	0.73	94.9	-	15
200	-	4	4	3	NR	dark orange/NR	gray-tan/blue-green	yellow							
				7	NR	dark orange/NR	gray-tan/blue-green	yellow							
				14	NR	dark orange/ NR	gray-tan/ blue-green	yellow- dark ppt							
				28	NR	brown spots/ NR	blue, tan/ blue-gray	yellow- dark ppt (1)	4.0	0.83	0.25	0.68	92.0	2.2	14

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

NA = not available/tube failure

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-407C (1:1) at 165°C

Table J.10

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-22 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-407C (%)	R-22 (%)	TAN**
<20	0.1	4	4	3	NR	tan, brown spots/ NR	tan/ blue-green	yellow-brown ppt							
				7	NR	tan, brown spots/ NR	tan/ blue-green	yellow-brown ppt ✪							
				14	NR	tan, brown spots/ NR	tan/ blue-green	yellow-brown ppt ✪							
				28	NR	brown spots/ NR	blue, tan/ blue-gray	yellow-dark ppt (1)	3.5	0.47	0.33	0.88	92.3	2.6	12
200	0.1	4	4	3	NR	brown spots/ NR	tan/ blue-green	yellow-brown ppt							
				7	NR	brown spots/ NR	tan/ blue-green	yellow-brown ppt ✪							
				14	NR	brown spots/ NR	tan/ blue-green	yellow-brown ppt ✪							
				28	NR	brown spots/ NR	blue, tan/ blue-gray	yellow-brown ppt (1)	3.8	0.75	0.28	0.74	91.9	2.5	12

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

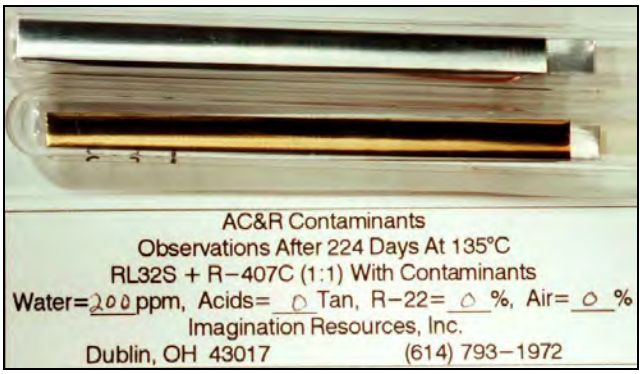
NR = no reaction/no visible color change

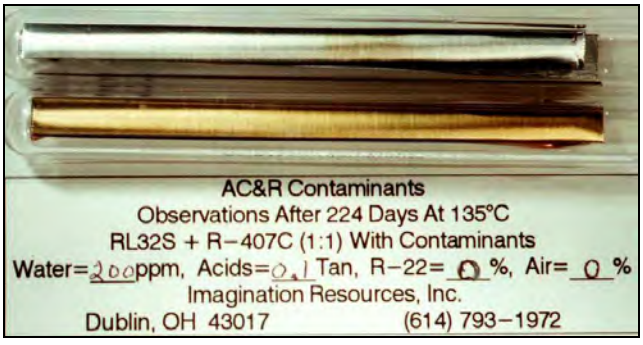
✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

Photos of Sealed Tubes Containing R-407C and Contaminants at 135°C (275°F) for 224 days

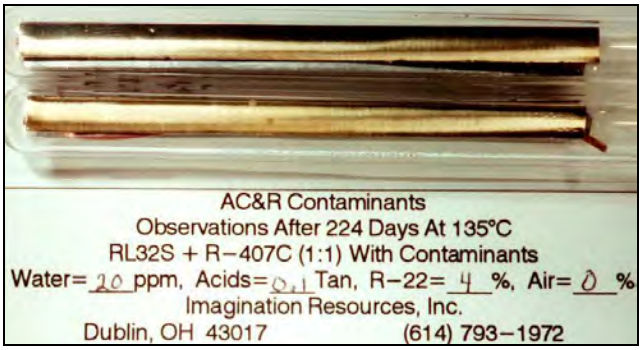
Figure J.1

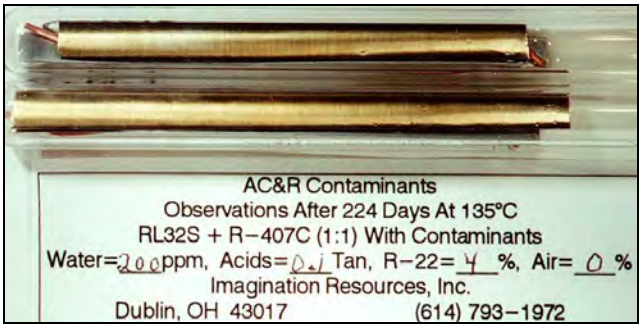




Photos of Sealed Tubes Containing R-407C and Contaminants at 135°C (275°F) for 224 days

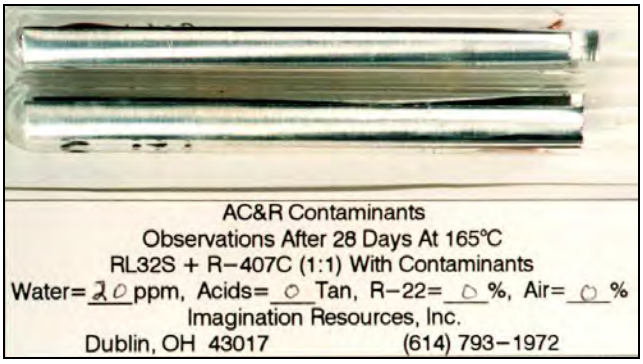
Figure J.2

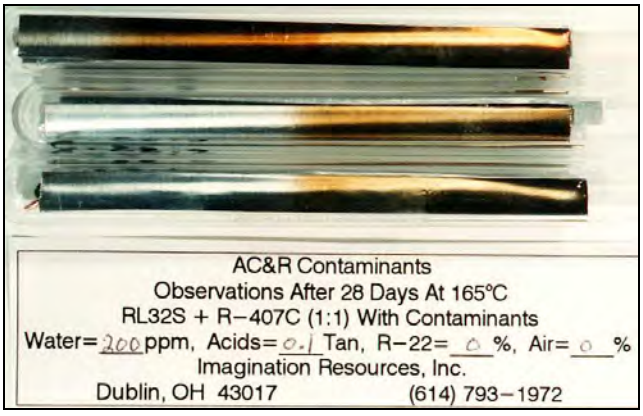


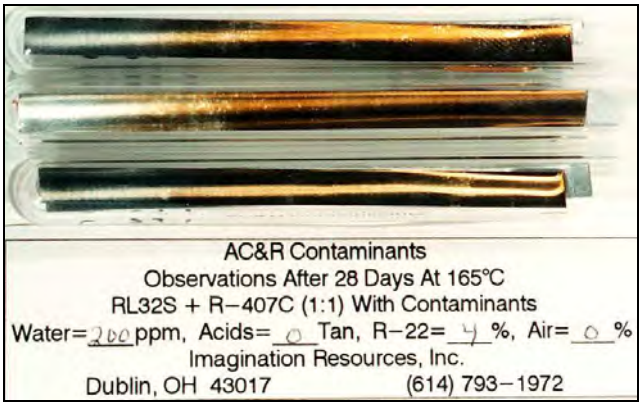


Photos of Sealed Tubes Containing R-407C and Contaminants at 165°C (329°F) for 28 days

Figure J.3

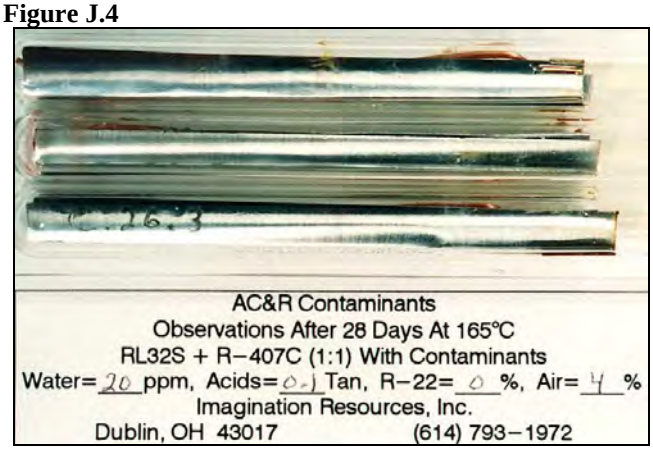


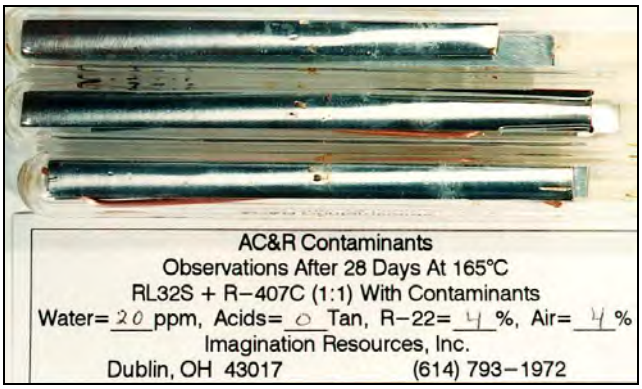




Photos of Sealed Tubes Containing R-407C and Contaminants at 165°C (329°F) for 28 days

Figure J.4





Appendix K
Glass Sealed Tube Evaluation and Photographic History of R-22 after 224 days Aging at 135°C and 28 days Aging at 165°C with Contaminants Added

Visual Observations and Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1) at 135°C

Table K.1

Contaminants								GC Vapor Composition					3GS
H_2O* (ppm)	Acids (TAN)	Air (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
<20	-	-	3	NR	NR	NR	yellow						
			7	NR	NR	NR	yellow						
			14	NR	NR	NR	yellow						
			28	NR	NR	NR	yellow						
			56	NR	NR	light tan	yellow						
			112	NR	NR	brown spots on light tan	yellow						
			224	NR	NR	dark gray on tan & blue-gray	yellow	-	-	-	-	100	0.04
200	-	-	3	NR	NR	NR	yellow						
			7	NR	NR	NR	yellow						
			14	NR	NR	NR	yellow						
			28	NR	NR	NR	yellow						
			56	NR	NR	light tan	yellow						
			112	NR	NR	brown spots on blue-gray	yellow						
			224	NR	NR	brown spots on blue-gray	yellow	-	-	-	-	100	0.01
<20	0.1	-	3	NR	orange/NR	brown spots	yellow						
			7	NR	orange/NR	brown spots	yellow						
			14	NR	orange/NR	brown spots/blue-gray	yellow						
			28	NR	orange/NR	brown spots/blue-gray	yellow						
			56	NR	NR	brown spots/gray	yellow						
			112	NR	NR	brown spots	yellow						
			224	NR	NR	brown spots	yellow	-	-	-	-	100	0.11

* water content of lubricant and refrigerant

** KOH (mg) / 3GS (g)

NR = no reaction/no visible color change

Visual Observations and Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1) at 135°C

Table K.2

Contaminants								GC Vapor Composition					3GS
H_2O* (ppm)	Acids (TAN)	Air (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
<20	-	4	3	dark gray	brown/brown spots	brown/blue-gray	orange-dark ppt ✪						
			7	dark gray	brown/brown spots	brown/blue-gray	dark orange-dark ppt ✪						
			14	dark gray	dark brown/ NR	brown-black/ blue-gray	brown-dark ppt ✪						
			28	dark gray	dark brown/ NR	brown-black/ blue-gray	brown-dark ppt ✪						
			56	dark gray	dark brown/ NR	brown-black/ blue-gray	brown-dark ppt ✪						
			112	blue-gray	dark brown/ NR	brown-black/ blue-gray	brown-dark ppt ✪						
			224	blue-gray	dark brown/NR	brown-black/brown	brown-dark ppt ✪ (1)	3.4	0.47	-	0.12	96.0	1.1
200	0.1	-	3	NR	NR	NR/blue-gray	yellow						
			7	NR	NR	blue-gray	yellow						
			14	NR	NR	blue-gray	yellow						
			28	NR	NR	blue-gray	yellow						
			56	NR	NR	light tan	yellow						
			112	NR	NR	brown spots on blue-gray	yellow						
			224	NR	NR	brown spots on blue-gray	yellow	-	-	-	-	100	0.10

* water content of lubricant and refrigerant

** KOH (mg) / 3GS (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1) at 135°C

Table K.3

Contaminants								GC Vapor Composition					3GS
H_2O* (ppm)	Acids (TAN)	Air (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
200	-	4	3	NR/ gray	brown spots, brown/ NR	brown/ blue-gray	orange-dark ppt ✪						
			7	dark gray	brown spots, brown/ NR	dark brown/ gray	dark orange-dark ppt ✪						
			14	gray/ blue-gray	dark brown/ NR	gray-black/ gray	brown, orange-dark ppt ✪						
			28	gray/ blue-gray	dark brown/ NR	gray-black/ gray	brown, orange-dark ppt ✪						
			56	gray/ blue-gray	dark brown/ NR	gray-black/ dark gray	brown-dark ppt ✪						
			112	blue-gray	dark brown/ NR	gray-black/ gray-brown	brown-dark ppt ✪						
			224	dark gray/ blue-gray	dark brown/ NR	gray-black/ brown	dark brown-dark ppt ✪ (1)	3.5	0.40	0.10	0.20	95.8	1.7
<20	0.1	4	3	dull gray	brown spots, brown/ NR	brown/ blue-gray	orange-dark ppt ✪						
			7	gray	brown spots, brown/ NR	dark brown/ gray	dark orange-dark ppt ✪						
			14	gray/ blue-gray	dark brown/ NR	gray-black/ gray	brown-dark ppt ✪						
			28	gray/ blue gray	dark brown/ NR	gray-black/ gray	brown-dark ppt ✪						
			56	gray/ blue-gray	dark brown/ tan	gray-black/ dark gray	brown-dark ppt ✪						
			112	dark gray	dark brown/ tan	brown-black/ gray-brown	brown-dark ppt ✪						
			224	dark gray/ blue-gray	dark brown spots	brown-black/ brown	dark brown-dark ppt ✪ (1)	3.6	0.13	0.12	0.23	95.9	1.5

* water content of lubricant and refrigerant
** KOH (mg) / 3GS (g)
NR = no reaction/no visible color change
✪ red, orange, or tan precipitate rings on inside tube wall
(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1) at 135°C

Table K.4

Contaminants								GC Vapor Composition					3GS
H_2O* (ppm)	Acids (TAN)	Air (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
200	0.1	4	3	gray/ maroon	brown spots, brown/ NR	brown/ blue-gray	orange-dark ppt ✪						
			7	gray/ maroon	brown spots, brown/ NR	dark brown/ dark gray	dark orange-dark ppt ✪						
			14	gray/ gray-pink	dark brown/ NR	gray-black/ gray	brown-dark ppt ✪						
			28	gray/ gray-pink	dark brown/ NR	gray-black/ gray	brown-dark ppt ✪						
			56	dark gray	dark brown/ NR	gray-black/ dark gray	brown-dark ppt ✪						
			112	dark gray	dark brown/ NR	brown-black/ gray-brown	brown-dark ppt ✪						
			224	dark gray/ blue-gray	dark brown/ NR	brown-black/ brown	dark brown-dark ppt ✪ (1)	3.4	0.12	0.18	0.21	96.1	1.5

* water content of lubricant and refrigerant

** KOH (mg) / 3GS (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1) at 165°C

Table K.5

Contaminants								GC Vapor Composition					3GS
H_2O* (ppm)	Acids (TAN)	Air (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
<20	-	-	3	NR	NR	NR/blue-gray	yellow						
			7	NR	NR	light tan/blue-gray	yellow						
			14	NR	NR	light tan/blue-gray	yellow						
			28	NR	NR	blue-gray	yellow	-	-	-	-	100	0.04
200	-	-	3	NR	NR	NR/blue-gray	yellow						
			7	NR	NR	light tan/blue-gray	yellow						
			14	NR	NR	light tan/blue-gray	yellow						
			28	NR	NR	blue-gray	yellow	-	-	-	-	100	0.03
<20	0.1	-	3	NR	NR	light tan/blue	yellow						
			7	NR	NR	light tan/blue	yellow						
			14	NR	NR	light tan/blue	yellow						
			28	NR	NR	light tan/ maroon-blue	yellow	-	-	-	-	100	0.13
<20	-	4	3	gray/ pink	brown, black spots/NR	brown/ blue-gray	orange-dark ppt ✪						
			7	gray/ pink	dark brown/ NR	gray-brown/ blue	dark orange-dark ppt ✪						
			14	gray/ blue-gray	black/ NR	tan/ blue	orange-brown- dark ppt						
			28	gray-tan/ pink	black/ NR	tan/ blue	brown-dark ppt (3)	0.68	<0.05	0.06	0.76	98.5	1.8
200	0.1	-	3	NR	NR	light tan/blue	yellow						
			7	NR	NR	light tan/blue	yellow						
			14	NR	NR	light tan/blue	yellow						
			28	NR	NR	light tan/green	yellow	-	-	-	0.28	99.7	0.13

* water content of lubricant and refrigerant

** KOH (mg) / 3GS (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(3) significant amount of precipitate on metal coupons, tube wall, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing 3GS:R-22 (1:1) at 165°C

Table K.6

Contaminants								GC Vapor Composition					3GS
H_2O* (ppm)	Acids (TAN)	Air (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-22 (%)	TAN**
200	-	4	3	gray/ pink	brown, black spots/NR	brown, black/ blue-gray	brown-dark ppt ✪						
			7	tan/ blue-gray	dark brown/ NR	brown, black/ blue	brown-dark ppt ✪						
			14	tan/ blue-gray	black/ NR	brown, black/ blue, maroon	brown-orange-dark ppt						
			28	gray-tan/ dark gray	black/ NR	brown, black/ blue, maroon	brown-dark ppt (3)	3.3	0.21	0.18	0.28	96.0	2.9
<20	0.1	4	3	gray/ pink	brown, black spots/NR	black/ gray, brown	brown-dark ppt ✪						
			7	gray/ blue-gray	dark brown/ NR	black/ gray, brown	brown-dark ppt ✪						
			14	gray/ blue-gray	dark brown/ NR	black/ gray-red	brown-dark ppt						
			28	tan/ blue-gray	black/ NR	black/ gray-red	brown-dark ppt (3)	3.2	0.10	0.10	0.40	96.2	2.1
200	0.1	4	3	gray/ pink	brown, black spots/NR	brown, black/ blue-gray	brown-dark ppt ✪						
			7	gray/ pink	dark brown/ NR	brown, black/ blue	brown-dark ppt ✪						
			14	gray/ gray-pink	dark brown/ NR	brown, black/ blue-gray	brown-dark ppt						
			28	tan/ blue-pink	black/ NR	brown, black/ blue-gray	brown-dark ppt (3)	3.0	<0.05	0.22	0.63	96.1	2.6

* water content of lubricant and refrigerant

** KOH (mg) / 3GS (g)

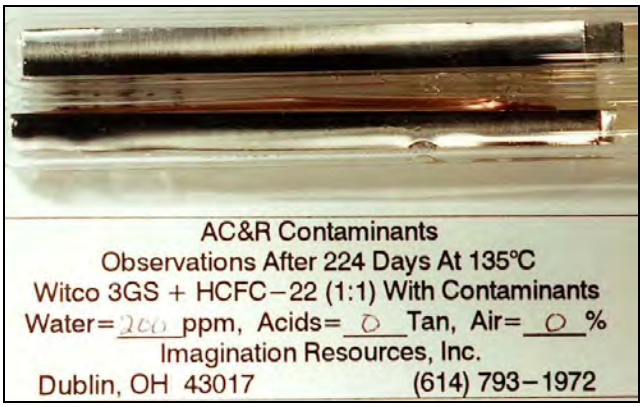
NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(3) significant amount of precipitate on metal coupons, tube wall, and tube bottom (10-100mg)

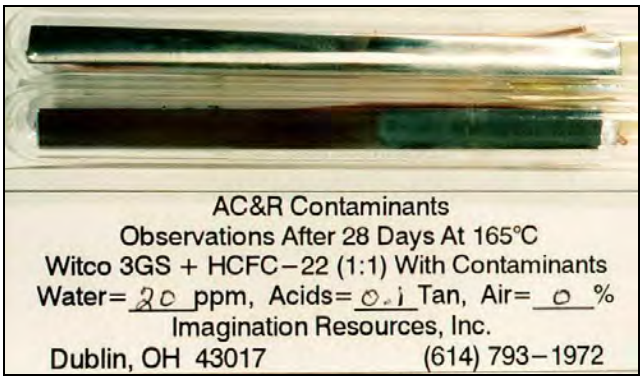
Photos of Sealed Tubes Containing R-22 and Contaminants at 135°C (275°F) for 224 days

Figure K.1



Photos of Sealed Tubes Containing R-22 and Contaminants at 165°C (329°F) for 28 days

Figure K.2



Appendix L
Glass Sealed Tube Evaluation and Photographic History of R-134a after 224 days Aging at 135°C and 28 days Aging at 165°C with Contaminants Added

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.1

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	-	-	-	3	NR	light tan/orange	light tan	clear							
				7	NR	yellow/orange	light tan	clear							
				14	NR	tan	tan	clear							
				28	NR	gold tan/gold	yellow tan	light yellow							
				56	NR	yellow-tan/ dark orange	brown	light yellow							
				112	NR	yellow/NR	brown	light yellow							
				224	NR	yellow/NR	brown	light yellow	-	-	-	-	100	-	0.18
200	-	-	-	3	NR	light tan/orange	light tan	clear							
				7	NR	light tan/orange	tan	clear							
				14	NR	tan	tan	clear							
				28	NR	brown/tan	golden tan	light yellow							
				56	NR	brown/orange	brown	light yellow							
				112	NR	brown/NR	brown	light yellow							
				224	NR	brown/NR	brown	light yellow	-	-	-	-	100	-	2.0
<20	0.1	-	-	3	NR	NR	NR/blue-green	clear							
				7	NR	NR	NR/blue-green	clear							
				14	NR	NR	NR/blue-green	clear							
				28	NR	orange/NR	NR/blue-green	clear							
				56	NR	orange/NR	blue-gray	clear							
				112	NR	orange/NR	blue-gray	clear							
				224	NR	NR	tan/blue-gray	clear	-	-	-	-	100	-	0.63

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.2

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	0.4	-	-	3	NR	light tan/orange	light tan	clear							
				7	NR	light tan/dark orange	tan	light yellow							
				14	NR	tan	tan	light yellow							
				28	NR	tan/orange	tan	light yellow							
				56	NR	brown/orange	brown	light yellow							
				112	NR	brown/NR	brown	light yellow							
				224	NR	brown/NR	brown	light yellow							
<20	-	-	4	3	NR	orange	blue-green	clear							
				7	NR	dark orange	blue-green	clear							
				14	NR	dark orange	blue-green	clear							
				28	NR	dark orange	tan/light tan	clear							
				56	NR	orange	blue-green/tan	clear							
				112	NR	NR	blue-green/ gray, tan	clear							
				224	NR	NR	dark gray/ maroon & blue-green	clear	-	-	-	-	97.6	2.4	0.18
<20	-	4	-	3	NR	light tan/orange	blue-green	clear							
				7	NR	light tan/dark orange	blue-green	light yellow							
				14	NR	light tan/dark orange	blue-green	light yellow							
				28	NR	light tan/dark orange	brown/tan	yellow							
				56	NR	orange	gray	yellow							
				112	NR	NR	gray	yellow							
				224	NR	NR	light tan/ blue-gray	yellow	3.5	0.90	<0.05	0.58	95.9	-	14

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.3

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
200	0.1	-	-	3	NR	NR	NR/blue-green	clear							
				7	NR	NR	NR/blue-green	clear							
				14	NR	NR	NR/blue-green	clear							
				28	NR	orange/NR	NR/blue-green	clear							
				56	NR	orange/NR	blue-gray	clear							
				112	NR	orange/NR	light tan/NR	clear							
				224	NR	orange/NR	tan/blue-gray	clear	-	-	-	-	100	-	1.9
200	0.4	-	-	3	NR	light tan/orange	light tan	clear							
				7	NR	light tan/dark orange	light tan	light yellow							
				14	NR	light tan/dark orange	tan	light yellow							
				28	NR	brown/light tan	tan	light yellow							
				56	NR	brown/dark orange	brown	light yellow							
				112	NR	brown/NR	brown	light yellow							
				224	NR	tan/NR	brown	light yellow							
200	-	-	4	3	NR	dark orange/light tan	light tan	clear							
				7	NR	yellow/light tan	light tan	clear							
				14	NR	yellow	tan	clear							
				28	NR	brown/light tan	brown/tan	clear							
				56	NR	yellow-tan/ dark orange	brown	light yellow							
				112	NR	yellow-tan/NR	brown	light yellow							
				224	NR	light tan/NR	blue-gray/ brown	yellow-white ppt (2)	-	-	-	-	97.6	2.4	2.1

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(2) precipitate readily noticeable (1-10mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.4

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
200	-	4	-	3	NR	dark orange/light tan	blue-green	clear							
				7	NR	dark orange	blue-green	light yellow							
				14	NR	dark orange	blue-green	light yellow							
				28	NR	brown/light tan	light tan	yellow							
				56	NR	orange	gray, blue-green	yellow							
				112	NR	NR	gray	yellow							
				224	NR	NR	blue-gray	yellow	3.8	-	0.28	-	95.9	-	15
<20	0.1	-	4	3	NR	dark orange	light tan	clear							
				7	NR	dark orange	tan/blue-green	clear							
				14	NR	light tan/orange	tan/blue-green	clear							
				28	NR	light tan/orange	tan/blue-green	clear							
				56	NR	light tan/orange	tan/blue-green	clear							
				112	NR	light tan/orange	tan/blue-green	light yellow							
				224	NR	NR/pink & orange	tan	yellow	-	-	-	-	97.7	2.3	0.69
<20	0.4	-	4	3	NR	orange	blue-green	clear							
				7	NR	light tan/ orange	light tan/ blue-green	clear							
				14	NR	light tan/orange	light tan	clear							
				28	NR	tan/light tan	light tan/tan	light yellow							
				56	NR	dark orange/orange	tan/blue-green	light yellow							
				112	NR	dark orange/NR	tan/gray	light yellow							
				224	NR	dark orange/NR	tan &blue-gray	light yellow							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.5

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	0.1	4	-	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	dark orange/NR	gray, blue-green	light yellow							
				14	NR	dark orange/NR	gray, blue-green	yellow ✪							
				28	NR	orange/NR	gray, blue-green	yellow ✪							
				56	NR	orange/NR	blue-gray	yellow ✪							
				112	NR	orange/ NR	light tan/ blue-gray	yellow- dark ppt ✪							
				224	NR	NR	gray & tan with black spots	yellow- red ppt ✪ (2)	3.5	-	0.10	0.50	95.9	-	12
<20	0.4	4	-	3	NR	dark orange	blue-green	clear							
				7	NR	light tan/orange	blue-green	light yellow							
				14	NR	tan/orange	blue-green	yellow							
				28	NR	brown/tan	brown/tan	yellow							
				56	NR	dark orange	gray	yellow							
				112	NR	dark orange/NR	light tan/gray	yellow							
				224	NR	orange/ NR	tan/ gray & black	yellow- dark ppt (3)							
<20	-	4	4	3	NR	dark orange	blue-green	clear							
				7	NR	light tan/orange	blue-green	light yellow							
				14	NR	light tan/orange	blue-green	yellow							
				28	NR	light tan/orange	blue-green	yellow							
				56	NR	dark orange/ orange	gray	yellow							
				112	NR	dark orange/ NR	blue-green/ gray, tan	yellow							
				224	NR	dark orange/ NR	gray & black/ maroon & blue	yellow- gray ppt (3)	3.5	-	0.10	0.50	93.4	2.5	10

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(2) precipitate readily noticeable (1-10mg)

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.6

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
200	0.1	-	4	3	NR	dark orange/NR	light tan	clear							
				7	NR	dark orange/ NR	light tan/ blue-green	clear							
				14	NR	dark orange/ NR	light tan/ blue-green	clear							
				28	NR	light tan/NR	light tan	clear							
				56	NR	light tan/NR	light tan	clear							
				112	NR	light tan/NR	gray & tan	light yellow							
				224	NR	NR/ pink & orange	gray & tan/ tan	yellow-white ppt (1)	-	-	-	-	96.1	3.9	0.72
200	0.4	-	4	3	NR	dark orange	light tan	clear							
				7	NR	light tan/orange	light tan	clear							
				14	NR	light tan/dark orange	light tan	clear							
				28	NR	dark orange/ light orange	light tan	light yellow							
				56	NR	dark orange/orange	light tan	light yellow							
				112	NR	NR	light tan	light yellow							
				224	NR	NR	black/ gray & tan	light yellow							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.7

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
200	0.1	4	-	3	NR	dark orange/NR	light tan spots	light yellow							
				7	NR	dark orange/NR	gray, blue-green	light yellow							
				14	NR	dark orange/NR	gray, blue-green	yellow							
				28	NR	dark orange/NR	gray, blue-green	yellow ✪							
				56	NR	orange/NR	blue-gray	yellow ✪							
				112	NR	orange/ NR	gray & light tan	yellow- red ppt ✪							
				224	NR	NR	gray & tan with black spots	yellow- red ppt (2)	3.9	-	0.37	0.66	95.1	-	2.7
200	0.4	4	-	3	NR	dark orange	blue-green	clear							
				7	NR	light tan/orange	blue-green	light yellow							
				14	NR	light tan/orange	blue-green	yellow							
				28	NR	tan/light orange	blue-green	yellow							
				56	NR	orange	blue-green	yellow							
				112	NR	NR	gray	yellow							
				224	NR	NR	black & gray	yellow							
200	-	4	4	3	NR	dark orange	blue-green	clear							
				7	NR	light tan/orange	blue-green	light yellow							
				14	NR	light tan/orange	blue-green	yellow							
				28	NR	tan/light orange	yellow	yellow							
				56	NR	orange	gray	yellow							
				112	NR	NR	gray with black spots	yellow- white ppt							
				224	NR	NR	black	yellow- dark ppt (3)	3.7	-	0.41	0.65	92.0	3.2	13

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

✪ red, orange, or tan precipitate rings on inside tube wall

(2) precipitate readily noticeable (1-10mg)

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.8

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	0.1	4	4	3	NR	light tan/ dark orange	blue-green	light yellow							
				7	NR	light tan/ dark orange	gray, blue-green	yellow							
				14	NR	tan/orange	gray, blue-green	yellow							
				28	NR	dark orange/NR	gray, blue-green	yellow ✪							
				56	NR	orange/NR	blue-gray	yellow ✪							
				112	NR	orange/ NR	gray/ black	yellow haze- dark ppt							
				224	NR	NR	dark gray & black	yellow haze- dark ppt (3)	3.6	-	0.53	0.79	91.8	3.2	12
<20	0.4	4	4	3	NR	light tan/orange	blue-green	clear							
				7	NR	light tan/orange	blue-green	light yellow							
				14	NR	light tan/orange	blue-green	yellow							
				28	NR	tan/orange	yellow	yellow							
				56	NR	orange	blue-green/ dark gray	yellow- brown ppt							
				112	NR	NR	gray, black	yellow- dark ppt							
				224	NR	NR	black	yellow- dark ppt (3)							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 135°C

Table L.9

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
200	0.1	4	4	3	NR	light tan/ dark orange	blue-green	light yellow							
				7	NR	light tan/ dark orange	gray, blue-green	yellow							
				14	NR	tan/orange	gray, blue-green	yellow							
				28	NR	tan/orange	gray, blue-green	yellow							
				56	NR	dark orange/NR	blue-gray	yellow							
				112	NR	dark orange/ NR	gray/ black	yellow- dark ppt							
				224	NR	NR	dark gray & black	yellow haze- dark ppt (3)	4.0	-	0.57	0.83	91.6	3.1	14
200	0.4	4	4	3	NR	light tan/orange	blue-green	clear							
				7	NR	light tan/orange	blue-green	light yellow							
				14	NR	light tan/ orange	light tan/ blue-green	yellow							
				28	NR	tan/ orange	light tan/ yellow-green	yellow							
				56	NR	orange	blue-green	yellow							
				112	NR	NR	gray, black spots	yellow- white ppt							
				224	NR	NR	black	yellow- dark ppt (3)							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 165°C

Table L.10

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	-	-	-	3	NR	dark orange/yellow	golden brown	clear							
				7	NR	dark orange/yellow	golden brown	light yellow							
				14	NR	dark orange/yellow	golden brown	light yellow							
				28	NR	tan/yellow-pink	brown/tan	light yellow	-	-	-	-	100	-	0.14
200	-	-	-	3	NR	dark orange/yellow	golden brown	clear							
				7	NR	light tan/yellow	golden brown	clear							
				14	NR	light tan/yellow	golden brown	light yellow							
				28	NR	brown/yellow-pink	brown/tan	light yellow	-	-	-	-	100	-	2.4
<20	0.1	-	-	3	NR	NR	gray/blue-green	clear							
				7	NR	NR	light tan/ blue-green	clear							
				14	NR	orange/ NR	light tan/ blue-green	clear							
				28	NR	orange/ NR	light tan/ blue-green	clear	-	-	-	-	100	-	0.59
<20	0.4	-	-	3	NR	dark orange/ orange	golden brown/ blue-green	light yellow							
				7	NR	light tan/ orange	golden brown/ blue-green	light yellow							
				14	NR	light tan/ orange	brown/ blue-green	light yellow							
				28	NR	brown/orange	tan/light tan	light yellow							
<20	-	-	4	3	NR	orange	light tan/ blue-green	clear							
				7	NR	orange	light tan/ blue-green	clear							
				14	NR	orange	light tan/ blue-green	clear							
				28	NR	NR	brown/tan	light yellow	-	-	-	-	97.6	2.4	0.27

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 165°C

Table L.11

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	-	4	-	3	NR	dark orange/ orange	blue-green	light yellow							
				7	NR	dark orange/ orange	blue-green	light yellow							
				14	NR	dark orange/ orange	blue-green	yellow							
				28	NR	orange/ yellow	light tan	yellow-orange ppt (1)	3.3	-	0.15	0.50	96.0	-	12
200	0.1	-	-	3	NR	NR	gray/blue-green	clear							
				7	NR	orange/NR	light tan/blue-green	clear							
				14	NR	orange/NR	light tan/blue-green	clear							
				28	NR	orange/NR	light tan/blue-green	clear	-	-	-	-	100	-	2.3
200	0.4	-	-	3	NR	dark orange	golden brown	light yellow							
				7	NR	tan/dark orange	golden brown	light yellow							
				14	NR	tan/dark orange	golden brown	light yellow							
				28	NR	brown/orange	brown/tan	yellow							
200	-	-	4	3	NR	dark orange	brown/blue-green	clear							
				7	NR	tan/orange	brown/blue-green	clear							
				14	NR	tan/orange	brown/blue-green	clear							
				28	NR	orange	tan/pink	light yellow	-	-	-	-	97.6	2.4	2.0
200	-	4	-	3	NR	dark orange/ orange	blue-green	light yellow							
				7	NR	dark orange/ orange	blue-green	yellow							
				14	NR	dark orange/ orange	tan/ blue-green	yellow							
				28	NR	orange	tan/ light tan	yellow-orange ppt (1)	2.7	-	0.13	0.53	96.7	-	15

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 165°C

Table L.12

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	0.1	-	4	3	NR	dark orange/NR	brown/blue-green	clear							
				7	NR	light tan/NR	brown/blue-green	clear							
				14	NR	light tan/NR	brown/blue-green	clear							
				28	NR	light tan/NR	brown/blue-green	light yellow	-	-	-	-	97.2	2.8	0.74
<20	0.4	-	4	3	NR	dark orange	brown/blue-green	clear							
				7	NR	tan/orange	brown/blue-green	light yellow							
				14	NR	tan/orange	brown/blue-green	light yellow							
				28	NR	yellow/orange	tan/light tan	light yellow							
<20	0.1	4	-	3	NR	NR	blue-green	yellow							
				7	NR	NR	blue-green	yellow							
				14	NR	orange/ NR	gray, blue-green	yellow- dark ppt							
				28	NR	brown spots/ NR	gray, blue-green	yellow- dark ppt (1)	3.5	-	0.15	0.40	96.0	-	12
<20	0.4	4	-	3	NR	orange	blue-green	light yellow							
				7	NR	orange	blue-green	yellow							
				14	NR	orange	tan/blue-green	yellow							
				28	NR	tan/ light gold	light tan/ NR	yellow- orange ppt (1)							
<20	-	4	4	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	dark orange/NR	blue-green	yellow							
				14	NR	dark orange/ orange	tan/ blue-green	yellow							
				28	NR	tan/ orange	tan/ light green	yellow- orange ppt (1)	3.6	-	0.28	0.56	92.6	3.0	13

* water content of lubricant and refrigerant
** KOH (mg) / RL32S (g)
NR = no reaction/no visible color change
(1) precipitate barely noticeable (0-1mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 165°C

Table L.13

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
200	0.1	-	4	3	NR	dark orange/NR	brown/blue-green	clear							
				7	NR	dark orange/NR	brown/blue-green	clear							
				14	NR	dark orange/NR	brown/blue-green	clear							
				28	NR	dark orange/NR	brown/blue-green	light yellow	-	-	-	-	97.8	2.8	1.9
200	0.4	-	4	3	NR	dark orange/ NR	golden brown/ blue-green	clear							
				7	NR	light tan/ NR	golden brown/ blue-green	clear							
				14	NR	light tan/orange	brown/blue-green	clear							
				28	NR	orange	light tan/ red-green	light yellow							
200	0.1	4	-	3	NR	dark orange/NR	blue-green	yellow							
				7	NR	dark orange/ NR	blue-green/ red-gray	yellow- dark ppt							
				14	NR	dark orange/ NR	gray/ maroon-gray	yellow- dark ppt							
				28	NR	light tan/ NR	tan/ maroon-gray	yellow- dark ppt (1)	4.0	-	0.28	0.71	95.0	-	10
200	0.4	4	-	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	tan/ NR	blue-green	yellow- brown ppt							
				14	NR	tan/ orange	brown/ blue-green	yellow- brown ppt							
				28	NR	tan/ orange	tan/ light green	yellow- brown ppt (2)							
200	-	4	4	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	dark orange/NR	blue-green	yellow							
				14	NR	dark orange/ orange	tan/ blue-green	yellow							
				28	NR	orange/gold	tan/light tan	yellow	3.2	-	0.24	0.53	93.0	3.0	16

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

NR = no reaction/no visible color change

(1) precipitate barely noticeable (0-1mg)

(2) precipitate readily noticeable (1-10mg)

Visual Observations and Chemical Analysis of Sealed Tubes Containing RL32S:R-134a (1:1) at 165°C

Table L.14

Contaminants									GC Vapor Composition						RL32S
H_2O* (ppm)	Acids (TAN)	Air (%)	R-12 (%)	Day	Al	Copper	Valve Steel	Liquid	N_2 (%)	O_2 (%)	CO (%)	CO_2 (%)	R-134a (%)	R-12 (%)	TAN**
<20	0.1	4	4	3	NR	NR	blue-green	yellow							
				7	NR	NR	blue-green	yellow							
				14	NR	orange/NR	gray, blue-green	yellow							
				28	NR	orange/NR	tan/dark gray	dark yellow	4.2	-	0.31	0.72	91.7	3.1	16
<20	0.4	4	4	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	dark orange/NR	blue-green	yellow							
				14	NR	dark orange/ orange	brown/ blue-green	yellow-brown ppt							
				28	NR	tan/ light gold	light tan/ NR	yellow-brown ppt (2)							
200	0.1	4	4	3	NR	dark orange/ NR	tan/ blue-green	yellow-dark ppt							
				7	NR	tan spots/ NR	tan/ blue-green	yellow-dark ppt							
				14	NR	brown spots/ NR	light tan/ blue-green	yellow-dark ppt							
				28	NR	brown spots/ NR	tan/ dark gray	dark yellow/ gray-brown ppt (3)	3.5	-	0.26	0.59	92.7	3.0	16
200	0.4	4	4	3	NR	dark orange/NR	blue-green	light yellow							
				7	NR	dark orange/NR	blue-green	yellow							
				14	NR	dark orange/ orange	brown/ blue-green	yellow-brown ppt							
				28	NR	tan/ light gold	light tan/ black	yellow-brown ppt (3)							

* water content of lubricant and refrigerant

** KOH (mg) / RL32S (g)

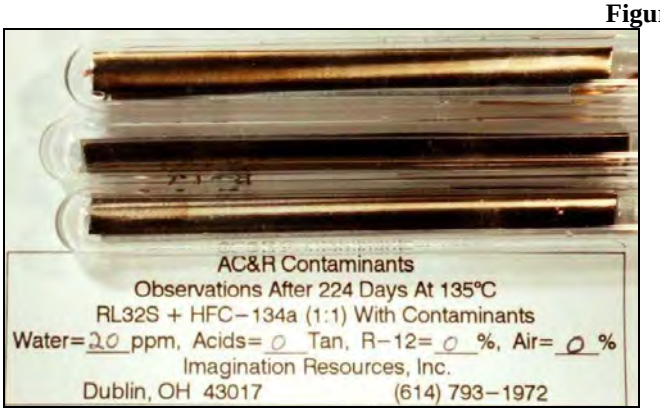
NR = no reaction/no visible color change

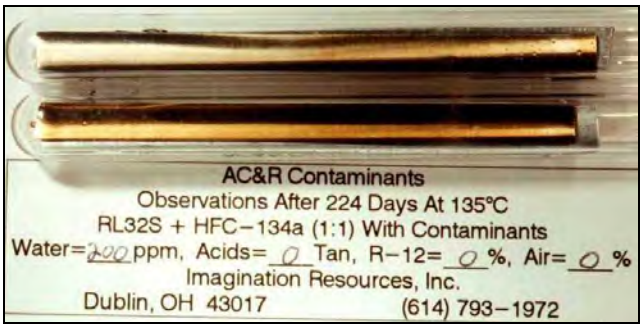
(2) precipitate readily noticeable (1-10mg)

(3) significant amount of precipitate on metal coupons, tube walls, and tube bottom (10-100mg)

Photos of Sealed Tubes Containing R-134a and Contaminants at 135°C (275°F) for 224 days

Figure L.1

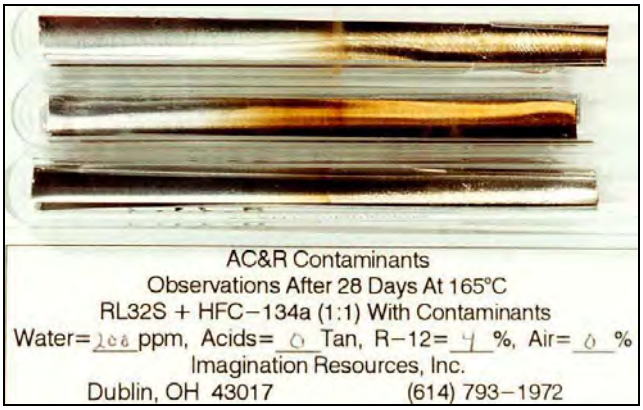




Photos of Sealed Tubes Containing R-134a and Contaminants at 135°C (275°F) for 224 days

Figure L.2

Photos of Sealed Tubes Containing R-134a and Contaminants at 165°C (329°F) for 28 days
Figure L.3



Photos of Sealed Tubes Containing R-134a and Contaminants at 165°C (329°F) for 28 days

Figure L.4