SPECTROLINE®
HVAC/R

LOW TEMP EVALUATION OF AR-GLO 4/E FLUORESCENT LEAK DETECTION DYE

TECHNICAL BULLETIN #196

Fluorescent leak detection has proven itself to be a powerful tool for the maintenance of a refrigeration or air conditioning system. It allows for any system leakage to be quickly and easily found, helping service personnel to maintain equipment and keep everything operating effectively and efficiently. Testing and millions of field applications show that a properly formulated leak detection dye can be used safely and effectively in all commonly seen refrigeration circuits. However, there are many specialty designs that operate outside the norm of typical systems, and these applications must be addressed on a case-by-case basis in order to assure that a fluorescent leak detection dye can be used without affecting any of their operating characteristics. Low temperature systems represent one of these cases.

Refrigeration systems working at very low temperatures have specific requirements that must be met to assure that they can run properly. Lubricant management is an important part of assuring that low temperature systems can operate with long service lives while maintaining their performance. The system lubricant must be chosen carefully, and even minor changes in lubricants will quickly cause changes in operating temperatures and pressures. Fluorescent leak detection dyes are oil-based materials, and they are designed to be fully miscible throughout any refrigerant circuit and, other than changing the oil color and allowing it to fluoresce, they should not have any effect on any system's operations. Low temperatures could cause a poorly designed dye product to reduce oil flow, change system temperatures, and at worst, fall out of solution in an evaporator causing flow restrictions or complete blockages.

EQUIPMENT

TEST UNIT

An Xtreme Freeze™, a self-contained pipe freezer composed of a refrigeration circuit designed to operate at -75 to -85°F (-60 to -65°C), was used as a test platform. R-507 refrigerant and PVE lubricant was utilized in the test unit. Sight glasses were added into the suction lines for each of the two evaporators just before they join together into the compressor return port. This location was chosen to present the longest flow path for the dye and to allow monitoring of the state of the oil returning from the evaporators.

DATA LOGGER

An Omega RD8812 data logger was used to monitor 10 channels of data. The test unit was instrumented to monitor high and low side pressures, amperage, and temperatures in the compressor discharge, the liquid line just past the filter, both evaporators, both vapor returns from the evaporators and the ambient temperature. High pressure was measured in PSIG, and low pressure was measured in PSIA. All temperatures were measured in Degrees F and the amperage data was collected in Amps. Data was collected at 10 minute intervals throughout the test.

DYE

AR-GLO 4/E POE-based leak detection dye was used, 539.7 ppm moisture. Spectronics recommends a fluorescent dye dosage of 500:1 ratio of lubricant to dye. As added insurance, testing was conducted using a significant overcharging of dye, with a ratio of 500:6.

PROCEDURE

The test fixture was operated for 7 days prior to the addition of dye to allow for baseline data. After the 7 days' operation, 0.12ml AR-GLO 4/E was added into the suction line just upstream of the compressor. This was chosen as it is the location which would most restrict the dye from circulating and traveling throughout the system. This process was repeated two more times for a total operation time of 4 weeks, and a cumulative dye load of 0.48ml.

RESULTS

VISUAL

Dye circulation was confirmed after approx. 1 hour of operation. The dye penetrated effectively throughout the system over time. The low temperatures and the low mass flow did not limit the ability of the AR-GLO/E to circulate and work as a leak detection tool.

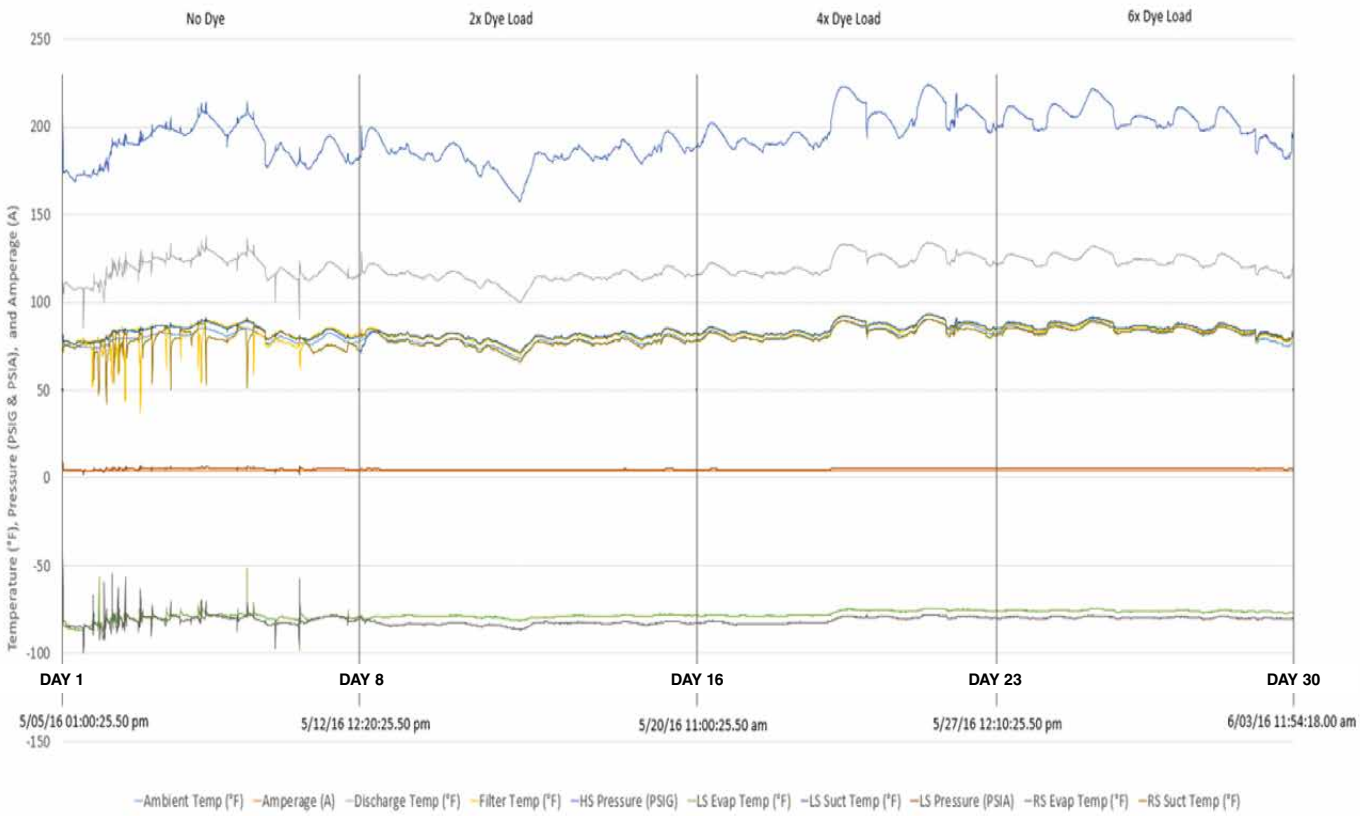
DATA

At the conclusion of the test, the data was collected and charted to determine if the addition of the AR-GLO/E had any effect on the operating characteristic of the test fixture. Any changes in oil or refrigerant flow would quickly show up as changes in operating pressures, temperatures or system power consumption. There were no unexpected changes to the operations of the test unit. Even at vastly excessive dye dosages, there were no discernable effects on the test system.

CONCLUSION

AR-GLO/E can be used within a low temperature refrigeration device operating at temperatures as low as -85°F (-65°C). It will effectively travel throughout the system, as it proved to be suction-returned from the coldest areas in a low temperature evaporator, without affecting the refrigerant or lubricant flows. The dye will remain effective as a leak detection tool and will not affect the operating characteristics of these systems.

Figure 3.0



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12/17 A17354
PRINTED IN USA