

Qwik System Flush® Impurity Absorption Capacity and Flushing Capability

Laboratory testing has been performed on Qwik System Flush® and other commercially available flushing products. Testing was performed by Dynalene Inc, Heat Transfer Fluids, located in Whitehall, PA, and Florida Institute of Technology, located in Melbourne, FL. A raw data sheet from both organizations is attached at the end of this document.

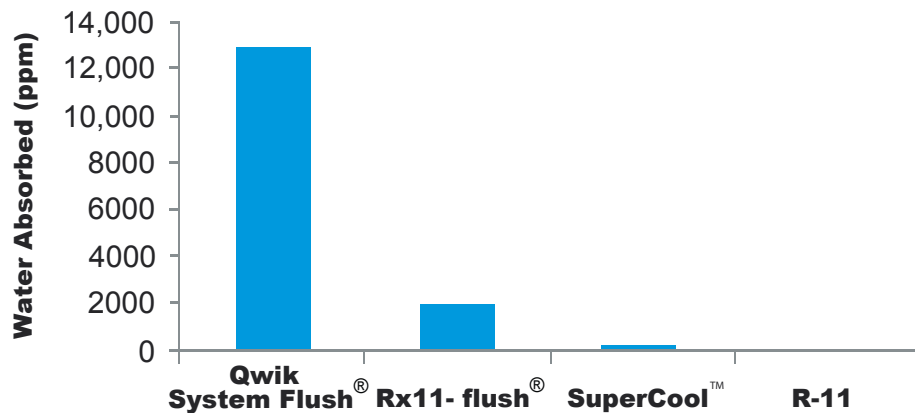
Qwik System Flush® was tested against competing products Rx-11 Flush®, SuperCool™ and was also tested against the original HVAC flushing solvent, CFC-11. These tests are described below and include impurity absorption capacity and the flushing capabilities of each of the flush products. It should also be noted that Rx-11® is a registered trademark of Nu-Calgon Corporation and SuperCool™ is a trademark of TSI Inc..

In an HVAC unit, moisture and/or contamination can lead to system failure. For this reason, it is important for the flushing product to absorb moisture and transport it out of the system. The results of a moisture absorption test are shown below. A Karl Fischer titration of Qwik System Flush®, Rx-11®, SuperCool™, and CFC-11 was performed before and after the addition of water to each flush. The difference between the initial moisture content and saturated moisture content is the total moisture absorbed by the flush.

Qwik System Flush® absorbed over 6x as much water compared to the other products tested.

Results courtesy of Dynalene, Inc.

Moisture Absorption



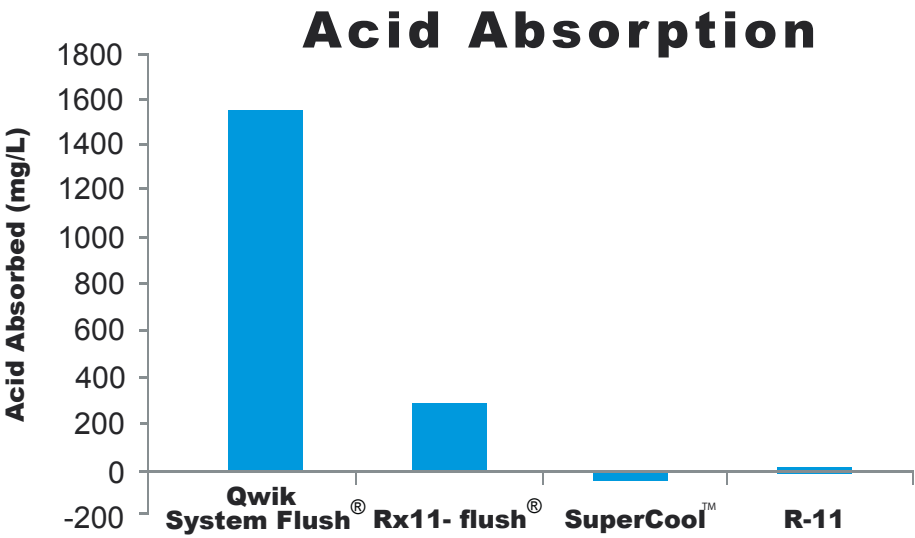
SuperCool is a trademark of TSI Inc., Lake Worth, FL
 Rx11-flush is a registered trademark of Nu-Calgon Corporation, St Louis, MO
 Qwik System Flush and Qwik-SF are registered trademarks of:
 Mainstream Engineering Corporation, Rockledge, FL

Similarly, acid absorption by a flush is of equal importance. Any amount of mineral or organic acid in the system can lead to failure. **All products absorbed organic acids equally well.** The results for the absorption of mineral acids are as follows. Hydrochloric acid is a possible contaminant in an HVAC unit after a compressor burns out.

In this experiment, a small amount of HCl was added to each flush. Each sample was titrated before and after the addition of the acid in order to be able to observe when each of the solutions became neutral. By taking the difference of the measured acid numbers, a conclusion on which product absorbed the most acid could be made. It was determined that **Qwik System Flush® absorbed over five times as much inorganic acid than any other flush.** SuperCool™ actually showed a decrease in acid number, which means that less acid was present after the acid was added. This means the acidic part of SuperCool™ phase separated from the flush and made the system more acidic in the end.

Qwik System Flush® absorbed over 5x as much acid compared to the other products tested.

Results courtesy of Dynalene, Inc.



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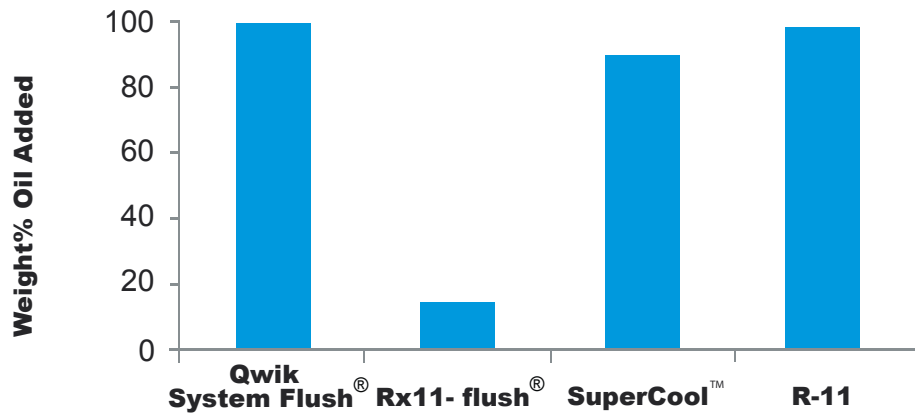
Oil absorption was the last impurity absorption test that was performed. Oil was added to samples of each product until there was a visible change in the properties of the solvent. In the case of Rx-11-flush® and SuperCool™, the flush became saturated with oil and two layers formed after the addition of 13, and 91 weight percent oil, respectively. No additional oil would be absorbed by this sample.

The Qwik System Flush® and CFC-11 did not become saturated with oil.

Qwik System Flush® absorbed over 10x as much oil compared to Rx-11-flush®.

Results courtesy of Dynalene, Inc.

Oil Absorption



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The final test that was performed was the flushing capability for each of the products. The lines of a small heat exchanger were filled with 30 g of oil. The same general procedure for flushing any unit in the field was strictly followed. An initial purge with nitrogen gas was performed on the system before flushing with the product to be tested. About 50 g of flush was then put into the system. Nitrogen gas was finally purged through the lines until no additional fluid exited the system. In each case, the heat exchanger was then cleaned with hexane. Hexane has the ability to absorb all contaminants left behind. Hexane was flushed through the system and the collected fluid was heated in an oven to evaporate off the hexane. The amount remaining after heating is the amount of residue left by the flush. The results are shown in the following Figure. **Rx-11-flush®, SuperCool™, and CFC-11 all left behind more residue of oil or flush in the lines of the system compared to Qwik System Flush®.**

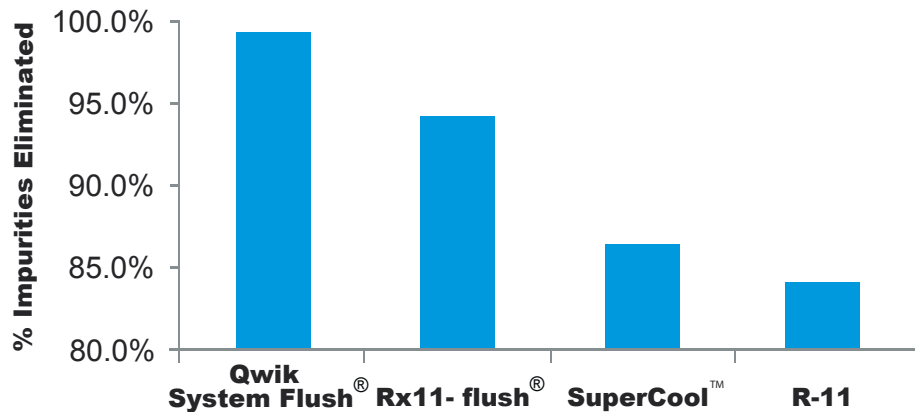
All test results were duplicated by the Florida Institute of Technology. See results on the last page.

It should be noted that Qwik System Flush® meets or exceeds the other products in flammability, toxicity, ozone depletion, global warming potential, and compatability with refrigerants and refrigeration system components. **In conclusion, Qwik System Flush® performed as well or better than the competition in all tests performed including: Moisture Absorption, Acid Absorption, Oil Absorption, and Flushing Capability.**

Qwik System Flush® performed as well or better than the competition in ALL tests performed.

Results courtesy of Dynalene, Inc.

Contamination Removed



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Dynalene Inc

Heat Transfer Fluids

LAB SERVICES # 1072

DATE: APRIL 9, 2008

5250 W. Coplay Rd, Whitehall, PA 18052
 Phone (610)262-9686 Fax (610)262-7437
 jeremym@dynalene.com

TO Dustin Zastro
 Mainstream Engineering Corp
 200 Yellow Place
 Rockledge, FL 32955-5327
 (321)631-3550

Technician:
 Jeremy Mock

COMPANY	JOB
Mainstream Engineering Corp	Comparative Testing

Experimental: All tests were performed following the Mainstream Engineering methods provided. Results are reported according to methods provided.

TEST METHOD	QWIK SF	RX-11 FLUSH	SUPERCOOL	CFC-11
Oil Partition Test	7.05g Fully Miscible	0.67g Phase Separation	4.57g Phase Separation	7.68g Fully Miscible
Cleanliness and Flushing	0.17g	1.69g	3.93g	4.71g
Water Absorption Pure Sample	454.17ppm	329.23ppm	171.73ppm	No Reading
Water Absorption Spiked Sample	1.3564%	0.2249%	279.25ppm	No Reading
Mineral Acid Number Pure Sample	18.79	33.00	344.14	4.72
Mineral Acid Number Spiked Sample	1557.15	338.47	288.10	33.86

Report Verified by : Jeremy Mock Lab Manager _____

THANK YOU FOR YOUR BUSINESS!



May 12, 2008

Dustin Zastrow
Mainstream Engineering Corporation
200 Yellow Place
Rockledge, FL 32955

Mr. Zastrow:

I have compiled the results of our testing in the table below.

Test Method	Qwik-SF	RX-11	Supercool	CFC-11
Oil Partition Test (%)	∞	0.17 wt. % oil	∞	∞
Flushing Test (g)	0.3038	0.6641	3.3847	0.8535
Water Absorption (%)	0.396	0.180	0.016	0.007
Acid Absorption (mg/L)	385.00	38.64	89.62	98.04

All procedures were followed as per your most recent requested testing procedures. Please feel free to contact me if you have any additional questions.

Sincerely,

Joel A. Olson
Assistant Professor
Department of Chemistry
Florida Institute of Technology
150 West University Blvd.
Melbourne, FL 32901