

## Hecat H1000 Automotive A/C Component Flusher

Performance test data and summary analysis provided by the:  
Fluorine Products Research Laboratory in Buffalo, NY  
A Division of Honeywell Specialty Chemicals

The Hecat H1000 is a closed-loop flush cart designed for exclusive use with Genesolv® SF (HFC-245fa) solvent. Its excellent performance in flushing automobile air conditioning components during repair was described in an earlier industry article called "Serendipity Revisited" (Nov/Dec 2004 ACTION Magazine by MACS). Here we present a more detailed discussions of the performance of the H1000 system and address some of the questions that have been raised by potential users. In particular, we will discuss solvent consumption, the effectiveness of oil removal from components and the amount of flush solvent left in components after flushing. Most of the work described herein was done in Honeywell Specialty Chemical's Product Development Laboratory in Buffalo, New York.

One of the concerns of the potential users of the Hecat H1000 is the cost of operation. A major portion of the operating cost is the cost of the solvent, and that cost is directly related to the amount of solvent that is either lost in each cycle or is rendered unusable because it is contaminated. In order to determine the amount of solvent lost in each flush cycle, we did 36 consecutive flushes of a Ford fin plate evaporator. The entire Hecat H1000 flush cart was weighed before and after the flushes. The total solvent loss after 36 flushes was about one pound, for an average loss per flush of just under half an ounce (0.03 pounds). These results are summarized in Table 1. In the field, the loss per flush may vary but is expected to be extremely low.

**Table 1**  
**SOLVENT LOSS after flushing a Ford fin plate evaporator.**

NUMBER OF MACHINE FLUSH CYCLES	INITIAL WT. OF MACHINE AND SOLVENT	FINAL WT. OF MACHINE AND SOLVENT	AVERAGE LOSS PER FLUSH
<b>36</b>	<b>175.8 lb.</b>	<b>174.8 lb.</b>	<b>0.028 lb.</b>

The second element in the cost of using the solvent is the ability to keep using the same solvent for many jobs while retaining the effectiveness of clean, virgin solvent. It is well known that dirty solvent cannot clean, whether it is water in your dishwasher or solvent in your flushing machine. The unique design of the Hecat H1000 continually cleans the solvent as it is being used. In order to test the effectiveness of this feature, Honeywell personnel ran more than 20 flushing cycles in which PAG oil was put into a Ford fin plate evaporator. At the end of the 20 cycles, they measured the amount of oil residue in the solvent. The initial residue had been measured at 10 ppm. After the test, they found that it was 31 ppm (Table 2). At this level, the solvent is cleaner than many other virgin solvents. Thus once the solvent is loaded into the machine, it can be used over and over with no loss of effectiveness.

**Table 2**  
**OIL RESIDUE found in Solvent after repeated use.**

NUMBER OF MACHINE FLUSH CYCLES	AVERAGE PAG OIL LOAD PER FLUSH	INITIAL SOLVENT NVR (Non Volatile Residue)	FINAL SOLVENT NVR (Non Volatile Residue)
<b>+ 20</b>	<b>1 oz.</b>	<b>10 PPM</b>	<b>31 PPM</b>

In a discussion with mechanics and other experts in this area, we discovered that one of the concerns is that solvent would be left behind in the component that is being cleaned. Given the range of chemicals that are used as flushing solvents, this is a very valid concern. We therefore tested to see how much solvent would be left in a component after flushing. We again chose the Ford fin plate evaporator as the test component because its design allows solvents to “pool”, which makes it difficult to remove many of the solvents that are being used for A/C flushing. In this experiment, we flushed a clean evaporator and weighed it before and after. In ten such experiments, the average amount left behind was 0.20 ounces (Table 3). The Hecat H1000 uses a light vacuum in its recovery and with the boiling point of the solvent at just under 60°F; any trace solvent will be evaporated during the technician’s final hard vacuum process. Note: These tests were done in a 70°F climate controlled laboratory. Field-testing has determined that the external effects of higher ambient air temperature where this equipment is expected to be used has yielded improved recovery results over these laboratory numbers.

**Table 3**  
**SOLVENT REMAINING after flushing a Ford fin plate evaporator.**

NUMBER OF MACHINE FLUSH CYCLES	AVERAGE SOLVENT REMAINING IN EVAPORATOR
<b>10</b>	<b>0.20 oz. (0.0125 LB.)</b>

Having shown that the procedure leaves virtually no solvent behind, the final and most important question is how well the Hecat H1000 with the Genesolv® SF solvent removes the waste oil from a component being cleaned. Again we chose the Ford fin plate evaporator for the test we added a small amount of PAG oil (0.7 ounces) to the evaporator. The average left in the Ford fin plate evaporator after flushing was 0.16 oz. (Table 4). A quick (10 seconds) shot of nitrogen returned the evaporator nearly to its starting weight, indicating that this was residual solvent and not oil. This was indeed a difficult test. For condensers, the average remaining after such test is 0.06 oz (Table 5). Again, a quick shot of nitrogen returned to component to nearly its original weight. Actual waste oil removal efficiency exceeded 99.6%, confirming the cleaning effectiveness of the Hecat H1000 flusher combined with the Genesolv® SF solvent.

**Table 4**  
**AVERAGE SOLVENT/ OIL REMAINING after flushing a Ford fin plate evaporator.**

NUMBER OF MACHINE FLUSH CYCLES	AVERAGE PAG OIL LOAD INTO EVAPORATOR	AVERAGE SOLVENT/OIL REMAINING IN EVAPORATOR
<b>10</b>	<b>0.71 oz.</b>	<b>0.16 oz. (0.0131 LB.)</b>

**Table 5**  
**AVERAGE SOLVENT/ OIL REMAINING after flushing a GM truck evaporator.**

MACHINE FLUSH CYCLES (INDIVIDUAL)	AVERAGE PAG OIL LOAD INTO CONDENSER	AVERAGE SOLVENT/OIL REMAINING IN CONDENSER
<b>6</b>	<b>1 oz.</b>	<b>0.06 oz. (.00375 lb.)</b>

The Hecat H1000 has been field tested by some of the most skeptical technicians and shop owners, and the Honeywell Team believes it has passed with flying colors. This product will be of greatest interest to those who perform a large volume of A/C repairs or those who want to.