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Fordys Chilling Filter Test for AFC Energy Solutions, Inc.

Conducted at the
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EXECUTIVE SUMMARY

Test results from operating the Fordys chilling filter showed a significant improvement in the energy efficiency of the heat pump in cooling mode. The discharge temperature into the room from the indoor unit also showed a significant reduction in air temperature—6 degrees on average from the discharge temperature without the Fordys chilling filter attached to the outdoor unit. Since the test was conducted as a steady state test, the efficiency gained by idling the outdoor unit in cooling mode due to satisfying the indoor required temperature was not realized or measured. It can be inferred though that this savings exists in cooling mode due to the reduction in run time needed by the outdoor unit to satisfy the indoor thermostat temperature.

The engineering principle employed by the Fordys chilling filter is evaporative cooling. By introducing chilled water to the filter surrounding the coils on the outdoor unit during cooling mode, the outdoor unit operates as if the outdoor temperature is lower than the actual outdoor temperature. As the chilled water evaporates on the Fordys chilling filter, this cools the air as it passes from the outdoor unit into the air handler. The discharge temperature into the conditioned space coming through the registers is then therefore cooler than the normal discharge temperature. The improvement in energy efficiency in cooling mode was 22% with the Fordys chilling filter installed on the heat pump versus normal operation without the filter installed using the Coefficient of Performance (COP). The test was conducted as a steady state test, details of test conditions in next section.

Regarding the results from the heating mode steady state testing, the Fordys chilling filter showed no significant impact on the energy efficiency or COP. Due to the steady state testing, though, and the fact that the outside temperature designed was 40 degrees Fahrenheit, the influence of the filter during outside temperatures below 40 was not tested. In theory, during heating mode the water passing through the filter is 130 – 140 degrees Fahrenheit and the outdoor unit operates as if the outdoor temperature is higher than the actual outdoor temperature. Instead of the electric heat strips activating (using significant electricity) to increase the air temperature entering the conditioned space during very cold outdoor weather, the Fordys filter preheats the incoming air and thus reduces the time the heat strips are activated. Based on the steady state testing done, the Fordys chilling filter definitely has no negative effect during heating mode. COP with the filter was 3.07 and without the filter the COP was 3.06. This was again steady state testing as described in subsequent pages.

TEST CONDITIONS

Test unit was a 2.5 Ton Amana Heat Pump that was manufactured in 2003. As strictly a test unit this unit had less than 100 operational hours. The highly controlled environmental chamber was set for 95 degrees Fahrenheit outdoor temperature and 80 degrees Fahrenheit indoor temperature for cooling mode. The heating mode was set for 42 degrees outside temperature and 70 degrees indoor temperature. The indoor chamber contained an air handler with an output register to measure the effective temperature for indoor outlet air. This temperature is what would be seen at an indoor register when operating this system. Strict guidelines for beginning the testing were observed by Dr. Gao making sure that the chamber temperatures were stable before beginning any testing. The two tests without the chilling filter installed were conducted first and then on a subsequent day two more tests were conducted with the Fordys chilling filter installed. Installation of the filter took approximately two hours.

The four tests conducted were as follows:

Test 1 Cooling mode with outdoor temperature of 95 degrees F. and indoor 80 degrees F.
Normal test with NO chilling filter installed

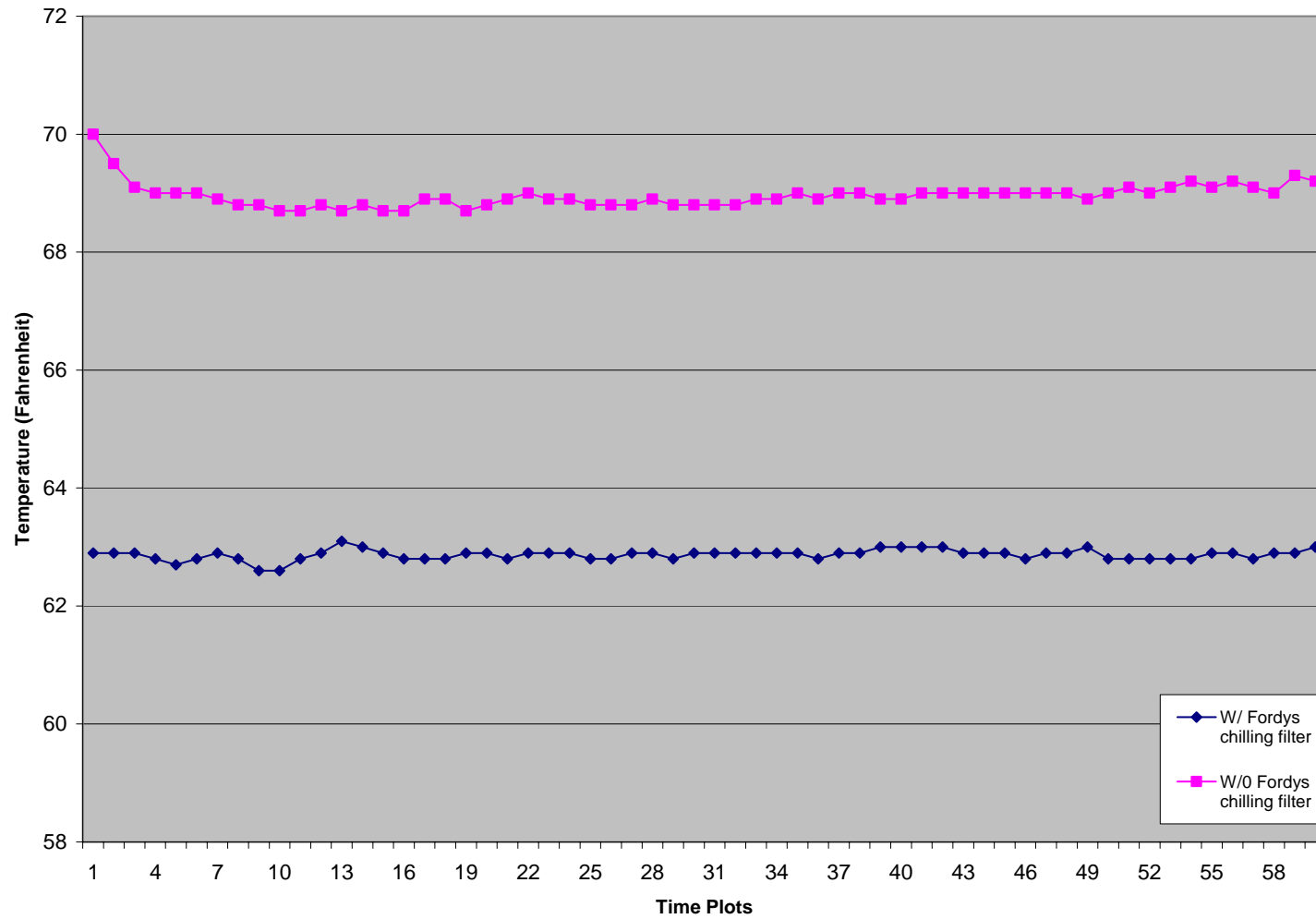
Test 2 Heating mode with outdoor temperature of 42 degrees F. and indoor of 70 degrees F.
Normal testing with No chilling filter installed

Test 3 Cooling mode with outdoor temperature of 95 degrees F. and indoor 80 degrees F.
Fordys chilling Filter installed and operating on unit

Test 4 Heating mode with outdoor temperature of 42 degrees F. and indoor of 70 degrees F.
Fordys chilling filter installed and operating on unit

GRAPHS/CHARTS

Indoor Outlet Temperature



Outdoor Inlet Temperature

