



Advanced Development Test Capabilities

Vernay Laboratories' functional test capabilities cover a broad range of performance parameters on finished products. In addition to a wide variety of test machines located throughout the production facilities, Vernay operates a complete functional test lab at its headquarters located in Yellow Springs, Ohio. While most production testers are used to ensure quality off the line by checking one or two critical performance parameters, the functional test lab characterizes the entire performance envelope of the finished product where possible. This complete description of the part's function is useful in support of advanced development activities by verifying new product designs, reducing prototype iterations, and developing baseline performance curves used in sales literature.

Since elastomeric check valves comprise most of Vernay's diverse product line, characterizing their function has been the focus of the advanced development test lab. While our valves are used in a myriad of fluid types in the end product, as a standard, we produce functional performance curves in air and water. Given the performance in these basic fluids, customers can then extrapolate performance for the particular fluid used in their application.

Vernay runs three fully automatic, computer controlled air test machines in plants located in North America, Italy, and Holland almost non-stop in an effort to understand performance and improve quality on umbrella and duckbill check valves. These machines can test every valve Vernay makes, from the smallest duckbill valve (less than 0.003 SLPM air flow at 10 mbar) to the largest umbrella valve (greater than 200 SLPM air flow at 10 mbar), with no operator input, adjustments, or special setups required.

Vernay's air test machines (fig. 1.) use a pc based data acquisition system to produce the complete differential pressure verses mass flow performance curve on any check valve in an average time of 20 minutes. The results are displayed on the screen real time (fig. 2) and stored on a network at completion of test. Capable of controlling differential pressures from 0.3 to 4,500 mbar, they measure pressure with an accuracy of 2% of reading over nearly the entire range, and measure flow from 0.01 cc/min to 150 L/min with 2% of reading accuracy above 1 cc/min.

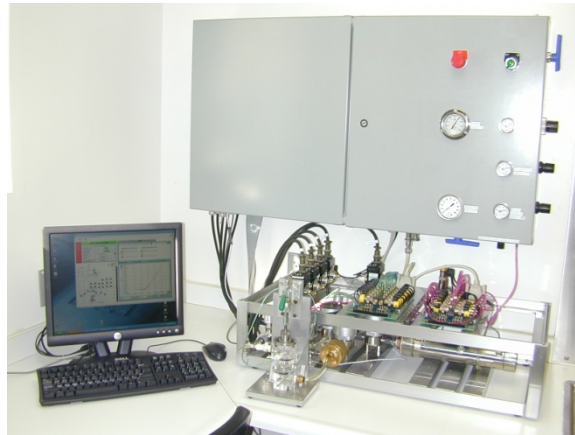


Figure 1 - Automatic Air Tester

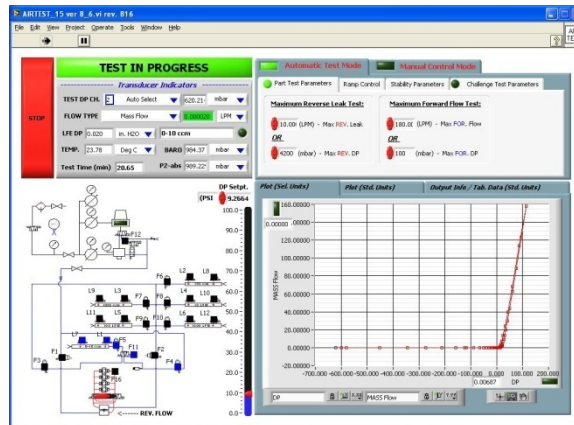


Figure 2

The end result of the test is a complete functional performance curve made from an increasing forward pressure ramp, a decreasing forward pressure ramp, and an increasing reverse pressure ramp. Each pressure ramp provides several key performance indicators which help define the check valve's function. From the increasing forward ramp, we find opening pressure, any leakage occurring prior to opening, as well as the flow curve in it's initial, relaxed state. From

the decreasing forward pressure ramp, we find the flow curve after initial creep, as well as reseal pressure. The reverse increasing pressure ramp shows any leakage at pressures from zero to maximum test pressure, as well as failure pressure if applicable. All pressure losses due to the test system are removed from the measured curve, resulting in a pressure/flow curve of the test part only. Removing the system loss gives a more precise representation of the part function to the customer, as the loss due to the test system is not applicable to their particular application.

Utilizing the same concepts as the air tester, Vernay's water test machine (Fig. 3) produces the same differential pressure verses flow curves on elastomeric check valves, as well as flow control products, using water as test media.



Figure 3 – Automatic Water Tester

A wide assortment of additional test machines helps quantify part function in other Vernay product lines. These include an endurance tester for automatic transmission balls, water hammer simulator endurance test machine for mixing-valve diaphragms, hot/cold level-switch diaphragm cycling, and poppet bond strength tester among others.