Configuring Sentinel I-21/B-21/C-20 Instruments for High Flow Applications

APPLICATION BULLETIN #114A **June 6, 2002**

The Sentinel I-21/B-21/C-20 pressure decay instruments can be used to test parts that have a very high flow requirement if some simple additions are made to the test circuit. This bulletin describes the problem encountered in high flow applications using pressure decay test instruments and offers one possible solution.

Discussion

In some applications where the test part volume is small and the desired leak/flow rate is rather high, the air pressure in the test circuit (combination of the instrument manifold, test line, and part) will fall significantly during a very brief Stabilize and Test time. In this situation, the test is being completed at a much lower pressure than desired. As a result, the accuracy of the test is affected.

To reduce this effect, additional volume must be added to the test circuit. Whitey (Phone 216-473-1050) makes a number of such volumes (a 1000 cc tank is their part number 304L-HDF4-1000-W4). Size these volume tanks such that the new test circuit volume is large enough to limit the pressure drop during the stabilization and test cycle to a defined percentage of the original test pressure. The following formula calculates how much additional volume is required to limit the pressure drop during the stabilization and test cycle to a percentage of the original test pressure.

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Formula to calculate extra volume requirement

$$\text{Extra Volume} = \frac{(\text{Leak Rate}) \times (\text{Stab \& Test times}) \times 14.7 \text{ psi}}{(\text{Percent drop}) \times (\text{Test Pressure}) \times 60 \text{ sec}} - (\text{System \& Part Volume})$$

- Extra Volume and System & Part Volume are in cubic centimeters
- Leak rate is in sccm.
- Stabilization & Test time is in seconds (Stabilization time must be at least 0.3 seconds and test time must be at least 0.2 seconds)
- Percent drop is stated as a decimal value (ie. 1% is stated as 0.01)
- Test pressure is in psi.

For example, how much additional volume would be required for a 5 psi pressure decay test on a 20 cc part looking for a 200 sccm leak/flow rate without more than a 0.1 psi drop (2%) during the stabilization and test cycle .

$$\text{Extra Volume} = \frac{(200 \text{ sccm}) \times (0.5 \text{ seconds}) \times 14.7 \text{ psi}}{(0.02) \times (5 \text{ psi}) \times 60 \text{ sec}} - (20 \text{ cc})$$

Extra Volume = 245 cc – 20 cc = 225 cc

As the pressure goes down, more volume is required to slow the pressure decay curve.

Adding an extra volume effectively desensitizes the test. A problem can occur on dual test instruments (Sentinel I-21-D or I-21-T) where one test needs to be desensitized and the other test must be highly sensitive. This often occurs on check valve testers. The first test, conducted at a low pressure, checks for leakage around the spring loaded ball seat. A typical reject rate is 3 sccm. The second test, conducted at a higher pressure, checks for sufficient flow past the unseated ball. The part must flow at least 800 sccm to pass.

In this case, we want to desensitize only the second test. To accomplish this, add a normally closed two-way valve between the tank and test circuit. Wire the two-way valve to the IN SECOND TEST and TB4 outputs on the Sentinel I-21/B-21 instrument. Now the tank is a part of the test circuit only during the second test. The first test will maintain its high sensitivity.

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