Calibration Methods for Multiple Sentinel I-21/B-21/C-20 Instruments

APPLICATION BULLETIN #115A June 6, 2002

The Sentinel I-21/B-21/C-20 instrument is shipped with everything needed to perform an accurate automatic calibration. In certain multiple instrument applications, however, test accuracy can be further improved by altering the calibration procedure. This document will define some of the errors that become visible in these multiple instrument applications. It will also discuss various procedures that have been used in the past to minimize the resulting errors. The reader will have to determine which of the suggestions are most applicable to the particular application.

Discussion

There are many possible errors that can arise during a leak test calibration, but in most situations only two are significant and controllable. The first of these is the Orifice Value Error. The accuracy of a calibration orifice is ± 1% or 0.1 sccm, whichever is larger. If you have multiple instruments (and therefore multiple orifices), this error will occur. Consider a system with two instruments. The first instrument has an orifice certified at 0.53 sccm but an actual value of 0.47 sccm. That is, a part with a 0.47 sccm leak will be reported to have a leak rate of 0.53 sccm. The second instrument has an orifice certified to 0.51 sccm but an actual value of 0.58 sccm. On this instrument, the same part (with a 0.47 sccm leak) will be reported to leak 0.41 sccm.

Orifice Value Error can be eliminated by using only one orifice to calibrate all instruments. The best way to do this is to build an orifice into one of your production parts. This modified part now becomes a "master leak" part. Change the instrument's Auto Cal Method to "Manual,

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Orifice in Part" (please refer to Chapter 6 of your Sentinel B-21/I-21 manual). Use a good part for the first test of the calibration process and your new "master leak" part for the second test. Also, be sure to update the "Orifice" value in each instrument to match the orifice in the "master leak" part. To perform this procedure on the Sentinel C-20, the instrument setup for Auto Cal method should be set for MAN and a zero leak orifice installed in the internal orifice fitting (or the internal wiring to the calibration valve disconnected.)

Alternatively, you can place a small ball valve between your part and the orifice. When the ball valve is closed, air cannot pass through the orifice. This is your "master good" part. When the ball valve is opened, air can pass through the orifice. This is your "master leak" part. Be sure that you don't add a significant amount of volume (<5%) to your part if you choose this strategy. Again, be sure to update the "Orifice" value in each instrument to match the orifice in the "master leak" part.

A second source of calibration related test error is Part Repeatability Error. Calibration of any pressure decay instrument requires that you use an actual part so that the instrument can include the volume and expansion characteristics of your part into the calibration numbers. Unfortunately, if your parts are not very repeatable, the calibration numbers will be suspect. Additionally, since the calibration procedure runs two tests (a "no-leak" test followed by a "leak" test), the error will be twice as large as one might initially expect.

Part Repeatability Error can be nearly eliminated by using a calibration averaging procedure. For each instrument, conduct several calibrations. Between each calibration, record the "No-Leak Loss" and "Hi Lim (Reject) Loss" values generated by the instrument (these values can be found by pushing the PRESS button on the Sentinel I-21/B-21instrument or MENU button/Part on the Sentinel C-20 instrument a few times). These are the instrument's calibration values. If you've run five calibrations, you should have five "No-Leak Loss" values and five "Hi Lim (Reject) Loss" values. It is very possible that all five values will be different. Be sure to allow time between tests for your master parts to relax to their virgin condition.

Next, enter the <u>average</u> of the "No-Leak Loss" values into the "No-Leak Loss" location in the instrument. Do the same with the average of the "Hi Lim (Reject) Loss" values. Repeat this procedure for each of the instruments in your system. Also, be sure to secure the calibration procedure so that someone else can't accidentally re-calibrate the instrument.

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