

Interlaboratory Comparison of Low Gas Flow in the Range 10^{-13} to 10^{-11} mol/s (10^{-9} to 10^{-7} cm³/s) Using Helium Permeation Leak Artifacts

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Abstract

Leak detection is important in every process that involves a sealed container. Many industrial applications set upper limits on the tolerable leak rates of such vessels. Examples include nuclear waste containment, food packaging, and medical devices that are inserted into the human body. Therefore, calibration of leak detecting apparatus is important. Many leak detectors use a mass spectrometer that is tuned to respond to helium. These detectors are calibrated with helium flow standards, commonly called “helium leak artifacts” that are based on the permeation of helium through a glass medium. The purpose for this interlaboratory comparison is to appraise and compare laboratory performance in measuring flows from helium permeation leak artifacts in the range of 10^{-13} to 10^{-11} mol/s (10^{-9} to 10^{-7} std cm³/s). The National Institute of Standards and Technology (NIST) served as the pilot laboratory, and a total of ten calibration laboratories participated in this comparison, including the pilot lab. Among the participants were laboratories from industry, vacuum equipment manufacturers, and secondary calibration laboratories, all located within the United States.

Three glass permeation leak artifacts were used for this comparison; two artifacts have a history of approximately ten years in the NIST Leak Calibration Service, while the third leak is new. Each participant was asked to measure the leak rate of each test artifact at 23 OC. The comparison takes into account depletion rates that have occurred during the course of the comparison (Dec. 2003 - Feb. 2006). The results of each participant’s measurements are presented anonymously along with their estimated expanded uncertainties.