

## HOW DO YOU CALIBRATE?



Any refinery control lab, R&D lab, or gas sensor development lab requires accurate calibration gas standards for calibrating GC, GC-MS, or other analytical or detection devices. Gas Cylinders are typically thought of for calibrating instrumentation in lab and process applications. While gas cylinders are certified NIST traceable standards, they have inherent characteristics that create unknown calibration issues. Complications arise when the calibration requires extremely low concentrations, complex gas mixtures, or a large variety of compounds are required.

Static mixtures in gas cylinders can be unreliable and inaccurate at the trace concentration levels (ppm to ppb) that analytical technology now demands. In gas cylinders containing low level mixtures, the trace components often adsorb to, or react with, the cylinder walls causing the standard to be inaccurate and unreliable. Also, it may be impossible to get a matrix gas that is completely free of the trace component, thus making it difficult to get a true reference point with a cylinder mixture. Cylinder storage, temperature and pressure changes, and chemical reactivity all contribute to inaccuracies when using static gas cylinder mixtures.

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*“Labs requiring an accurate and dependable calibration solution look to other technologies.”*

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# Permeation Tubes... accurate, dependable gas calibration.

Highly reactive gas standards are more reliable if dynamically created using a gas standard generator and permeation tubes. The small amount of known pure gas emission from a permeation tube is diluted by a precisely measured flow rate to dynamically create an accurate fresh gas standard with each use. Broad ranges of permeation tubes and the flexibility of a modular gas standard generating system provide a highly accurate NIST traceable alternative to using a gas cylinder.

Permeation tube technology was started over 55 years ago to provide a method for creating a very low emitting gas source for analytical device calibration. KIN-TEK revolutionized permeation tube technology in the 1970's and introduced Trace Source™ Disposable and Refillable Permeation Tubes as commercially available products for gas detector and gas analyzer calibration.



Trace Source™ Permeation Tubes provide a highly accurate alternative to using gas cylinder.

- One Permeation tube can replace several large gas cylinders.
- Permeation Tubes provide trace concentrations difficult to achieve with gas cylinders.
- Permeation Tubes create a fresh dynamic standard with each use.
- Pure standard without addition of impurities or loss due to absorption.
- Multiple gases and a multipoint calibration curve generated easily using a Trace Source™ Permeation Tube in a KIN-TEK Gas Standard Generator.
- Over 550 NIST-traceable chemical compounds available, including toxic air pollutants, VOCs, acid gases, amines, sulfurs and hydrides

KIN-TEK Analytical, Inc. offers a full array of chemical gas standards and equipment and to fit your lab with the most reliable sources for trace gas calibration.

The Trace Source™ Permeation Tube technology is available in over 550 chemical gas standards and is used in KIN-TEK's Gas Standard Generators to provide accurate, on-demand calibration standards.

# How Trace Source™ Permeation Tubes Work!

KIN-TEK Trace Source™ permeation tubes use a permeable membrane to dispense a small flow of chemical vapor. The most common type is a small tubular device that has liquid analyte sealed inside the tube. KIN-TEK manufactures two types of permeation tubes; disposable and refillable. The basic principle behind the operation of these two categories of tubes remains the same.

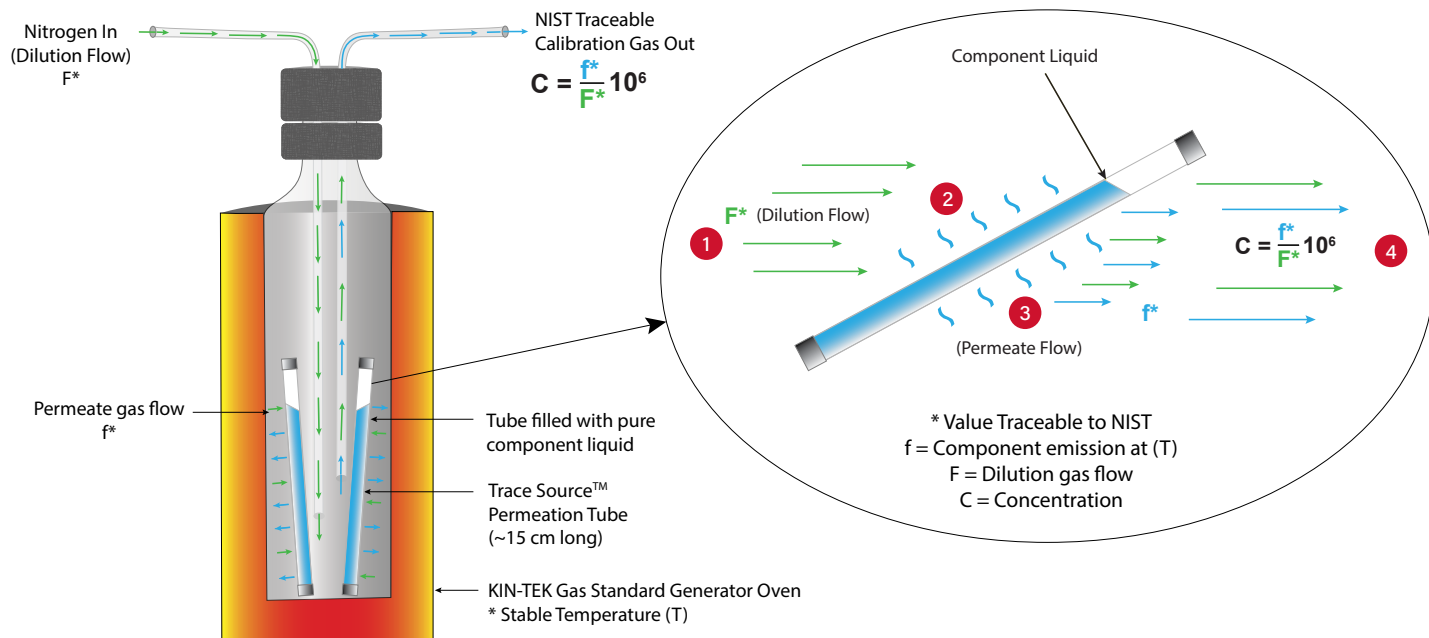


Figure 1 Trace Source™ Permeation Tube - How it Works

- 1 Nitrogen In (Dilution Flow)  $F^*$  – Dilution flow ( $F^*$ ) in a permeation system mixes with an emitting permeate gas from a Trace Source™ permeation tube to create an output concentration in ppmv.
- 2 Permeation tube characteristics – The emission rate is determined by the geometry of the tube, permeability of the compound, Teflon® characteristics, and the partial pressure difference of component vapor across the membrane (this is usually the vapor pressure and is set by the temperature).
- 3 Permeation tube component and permeability – In a Trace Source™ Permeation Tube, component compound contacts one side of a Teflon® membrane and emits through the permeation tube wall. This vapor 'leak' is the emission rate ( $f^*$ ) of the permeation tube and is far too low flow to be controlled by conventional means. The emission rate ( $f^*$ ) is established by gravimetric weight loss over time and provided in units of ng/min.
- 4 NIST Traceable Calibration Gas Out – The permeation tube emits a constant amount, so changing the dilution flow changes the final concentration, making the concentration needed for calibration adjustable. One tube, or one set of tubes can produce a whole range of concentrations.

Trace Source™ tubes are currently available for over 550 compounds and concentrations from sub-ppb to over 50 ppm (depending on the analyte) can be created using disposable tubes. Permeation tubes are available certified and non-certified depending on the application requirements. Certified permeation tubes are assigned a unique serial number and the certification data is kept on file for a minimum of two years for reference.

# Three Calibration Challenges Solved with Permeation Tube Technology:

KIN-TEK Analytical, Inc. specializes in providing a wide range of chemical gas standards to calibrate highly sensitive gas analyzers, sensors, or detectors used for ambient air monitoring, environmental health and safety, research and development, chemical processes, and portable and field monitoring applications. The following applications are only 3 of the many calibration challenges that can be solved using KIN-TEK Analytical, Inc. Trace Source™ permeation tube technology.



## Challenge 1: Calibrating Sensors for Trace Concentrations & Complex Mixtures

Reliable calibration for extremely low concentrations and for complex multi-gas mixtures can be difficult to achieve due to the limitations of traditional calibration gas cylinders. In gas cylinders containing low level mixtures, the trace components often adsorb to, or react with, the cylinder walls causing the standard to be inaccurate and unreliable. This complication can also be found in applications requiring reliable standards for trace sulfur compounds in an olefin matrix for quality assurance.

### Solution:

Using permeation tubes to dynamically blend the required mixtures offers a simple, safe, and accurate solution. KIN-TEK's FlexStream™ Base module connected with a Secondary Dilution (SD) module allows for the dynamic generation of precise concentrations down to ppb and ppt levels. The FlexStream™ SD Module (FlexSD) extends the concentration range attained from permeation tubes by providing an additional stage of dilution of the primary gas stream. Very low concentrations – ppb or ppt – can be generated depending on the emission rate of the tubes and the flow rate range of the primary and secondary dilution mass flow controllers. KIN-TEK recommended options of heat tracing and special output coating applied to the equipment also alleviate loss of analyte to ensure accurate output delivery of the the calibration gas.



## Challenge 2: Delivering Accurate Trace Moisture Calibration

Trace water contamination affects product quality in a variety of industries. Semiconductor manufacturing, specialty gas production, and industrial gas operations must quantify the level of moisture present (or verify the absence of moisture) in the product, sometimes at various stages of industrial gas purification. Calibrating analyzers to detect water at sub-ppm, ppb, and ppt concentrations is extremely challenging. Background moisture as well as changes in pressure and temperature can affect the accuracy of the calibration standard.

### Solution:

Trace moisture calibration is achieved easily with Trace Source™ water permeation tubes used within a KIN-TEK Span Pac™ 61 H2O Moisture Generator by delivering a very precise level of moisture to the analyzer for calibration using the "standard addition" technique. Concentrations within 0.01 to 10,000 ppm H2O ranges are available.



## Challenge 3: Dependable On-line Calibration for Process GC's

Process analyzers used in industrial shelters may require low concentration gas mixture calibration. Different mixtures of gas standards such as trace sulfurs, NOx, BTEX, and many others used for Continuous Emission Monitoring Systems are required but difficult to achieve in a hazardous environment.

### Solution:

KIN-TEK Gas Standard Generators provide the temperature controlled environment for equilibration of the permeation tubes and carrier gas control for generating the desired concentrations.

KIN-TEK Analytical, Inc. Process Gas Standard Generators provide the temperature controlled environment for equilibration of the permeation tubes and carrier gas control for generating the desired concentrations.

Built for use in harsh environments, the KIN-TEK Analytical Span Pac™ 61-I can be equipped with a Z-Purge and is designed to mount on the wall next to your on-line process gas analyzer. Trace Source™ Disposable & Refillable Permeation Tubes are used in the Span Pac™ 61-I to deliver dependable and accurate calibration gas to process gas chromatographs (GCs) and Continuous Emission Monitoring Systems (CEMS). Trace Source™ Permeation Tubes provide a clean, accurate, fresh standard for calibrating with no extra verification needed.



## Solve Your Calibration Challenges with KIN-TEK Analytical Inc. Products

The Trace Source™ Permeation Tube technology is employed in KIN-TEK's Gas Standard Generators to provide accurate, NIST traceable calibration standards. KIN-TEK's products include a range of gas standard generators and permeation devices to fit almost any application that relies on the delivery of an accurate trace gas concentration. Individual gas generator modules can operate as stand-alone calibrators or be combined into a Gas Standard Generator System configured to solve the most complex applications. The System utilizes the FlexLink™ software that can log and export data for analysis and reference.

Contact a customer service representative now and discuss your specific application.

**KIN-TEK**   
*The Calibration Specialists*

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