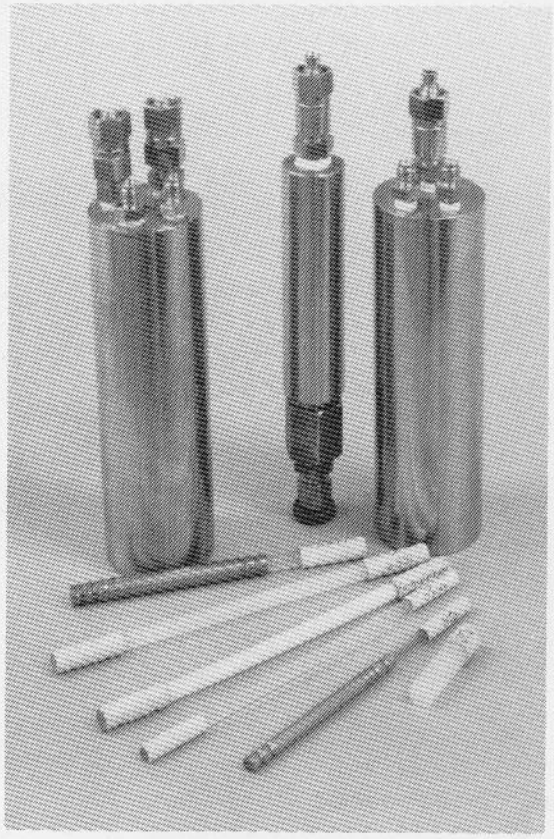
KIN-TEK

The Calibration Specialists



TRACE SOURCE™ PERMEATION TUBES

TRACE SOURCE™

DESCRIPTION

Trace Source™ Permeation Tubes are used to dispense a very small, extremely stable, flow of pure component gas, for making low concentration gas mixtures.

In a **Trace Source™ Permeation Tube** the component compound contacts one side of rugged Teflon® membrane. The vapor of the compound slowly passes through the membrane by molecular permeation. The flow rate of the component vapor through the membrane is determined by

(1) the physical characteristics of the Teflon® membrane (the surface area, thickness and density of the material),

(2) the permeability of the component compound,

(3) the temperature of the permeation tube, and

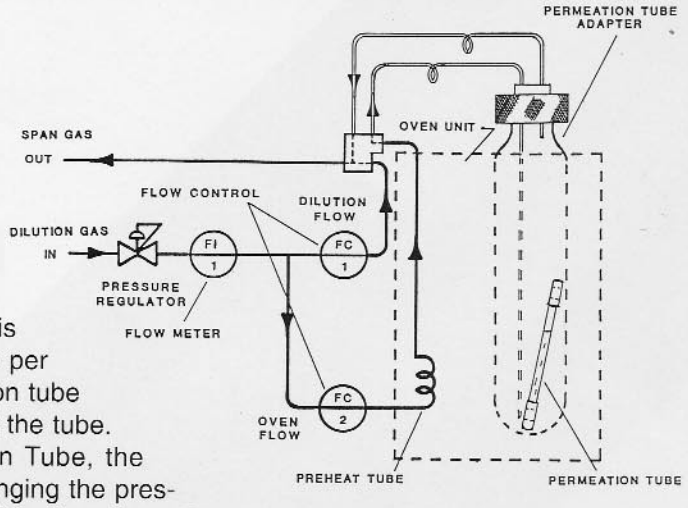
(4) the partial pressure difference across the membrane.

The **Trace Source™ Permeation Tubes** are currently available for over 250 compounds. For most compounds, concentrations from the sub-ppb range to over 1000 ppm can be generated.

KIN-TEK manufactures four basic types of **Trace Source™ Permeation Tubes**:

- Disposable Tubes
- Extended Life Disposable Tubes
- Refillable Gas Filled Tubes
- Refillable Liquid Filled Tubes

Flow Diagram
Permeation Tube Apparatus
(shown with disposable tube)



OPERATION

When the **Trace Source™ Permeation Tube** is held at a constant temperature it emits a very small constant flow of pure component gas. This flow is measured in nanograms or nanoliters per minute. The emission rate of the permeation tube is varied by changing the temperature of the tube.

In a Refillable Gas-Filled Permeation Tube, the emission rate is also varied by changing the pressure of the component gas inside the tube. To form low concentration gas mixtures, the emission of component gas from the permeation tube is mixed with a known flow of clean dilution gas. The mixture concentration can be adjusted by varying the dilution flow or the emission rate of the permeation tube.

PERMEATION TUBES

CERTIFICATION

Each tube is numbered and laboratory certified at the temperatures specified by the customer. A certificate listing a description of the tube, its serial number and its emission rate is supplied with each certified tube. Emission rate data for each tube is kept on file at the factory for future reference.

ACCURACY

The accuracy of certification depends on the type of tube, the component compound and the emission rate level. For most compounds, the accuracy of disposable tubes is as follows:

Emission Rate	Accuracy
>500 ng/min	± 2%
100-500 ng/min	± 2% or 5 ng/min
20-100 ng/min	± 5% or 2 ng/min

APPLICATIONS

Generate Low Concentration (ppm-ppt) Gas Mixtures Of:

- **Polar and Unstable Compounds**
- **Halogenated Hydrocarbons**
- **Nitrogen Compounds**
- **Atmospheric Gases**
- **Hydrocarbons**
- **Halogens**
- **Moisture**
- **Hydrides**
- **Sulfurs**

BENEFITS

- **Deal with Very Small Quantities of the Component Gas**
- **Long Term, Drift-free Standards**
- **Adjustable Concentrations**
- **Verifiable Accuracy**
- **Safe to Handle**
- **Easy to Use**
- **Saves Space**
- **Low Cost**

PERMEATION TUBES

Trace Source™ Disposable Tubes are short lengths of Teflon® tubing with the liquid phase of the compound sealed inside. All Disposable Permeation Tubes are available in membrane lengths of 1 to 10 cm, except the type LRT which is available in 1 to 2 cm lengths.

HRT Tube

Used for generating moderate concentrations of low vapor pressure compounds such as C_2H_5SH, CCl_4, acrylonitrile, benzene, styrene, and water; also, for generating high concentration mixtures of SO_2, CH_3SH and other moderate vapor pressure compounds. Typical emission rate is 1 to 20 ppm, depending on the compound and the operating temperature.

HRT

SRT Tube

Used for generating moderate concentrations of high vapor pressure compounds such as SO_2, H_2S, NH_3, and Cl_2; also, for generating very low concentrations of low vapor pressure compounds such as CS_2, methylene chloride, and HNO_3. Typical emission rate is 1 to 10 ppm, depending on the compound and the operating temperature.

SRT

SRT-2 Tube

Used for generating low to moderate concentrations of high vapor pressure compounds such as Cl_2, NO_2, and NH_3. Typical emission rate is sub-ppm to 5 ppm, depending on the compound and the operating temperature. Because of its sturdy construction, this type of tube is also used for field service where higher operating temperatures may be required.

SRT-2

LRT-2

Used for sub-ppm concentrations of SO_2 and NO_2.

LRT tubes are available in 2 cm membrane length.

LRT-2

Trace Source™ Extended Life Permeation Tubes are adaptations of disposable permeation tubes, designed for longer operating life. An EL tube is a disposable permeation tube with a 3 inch stainless steel reservoir for storing extra compound. This impermeable reservoir more than doubles the operating life of the tube. Type EL permeation tubes are available in 0.5 to 5 cm membrane lengths.

ELHRT Tube

Used for generating moderate concentrations of low vapor pressure compounds such as C_2H_5SH, benzene, and water; and for generating high concentration mixtures of SO_2, CH_3SH and other moderate vapor pressure compounds. Typical emission rate is1 to 10 ppm, depending on the compound and the operating temperature.

ELHRT

ELSRT Tube

Used for generating moderate concentrations of high vapor pressure compounds such as SO_2, H_2S, NH_3, and Cl_2; and for generating very low concentrations of low vapor pressure compounds such as benzene, acrolein, and water. Typical emission rate is 1 to 5 ppm, depending on the compound and the operating temperature.

ELSRT

ELSRT-2 Tube

Used for generating low to moderate concentrations of high vapor pressure compounds such as Cl_2, NO_2, and NH_3. Typical emission rate is sub-ppm to 2.5 ppm, depending on the compound and the operating temperature. This type of tube is also used for field service where higher operating temperatures may be required.

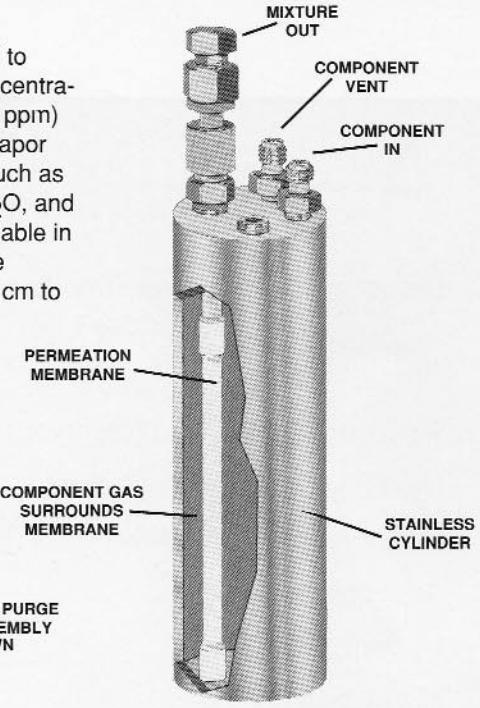
ELSRT-2

MODEL	Total Length	Tube Length	Diameter	Wall
HRT	2.8" to 5.9"	2 cm to 10 cm	1/4"	0.030" T.F.E.
SRT	2.8" to 5.9"	2 cm to 10 cm	3/16"	0.030" F.E.P.
SRT-2	2.4" to 5.9"	1 cm to 10 cm	1/4"	0.062" F.E.P.
LRT-2	1.6" only	2 cm only	3/8"	0.094" F.E.P.
ELHRT	4.2" to 6.0"	.5 cm to 5 cm	1/4"	0.030" T.F.E.
ELSRT	4.2" to 6.0"	.5 cm to 5 cm	3/16"	0.030" F.E.P.
ELSRT-2	4.2" to 6.0"	.5 cm to 5 cm	1/4"	0.062" F.E.P.

Trace Source™ Refillable Tubes

Trace Source™ Refillable Tubes are small stainless steel cylinders with a tubular Teflon® membrane sealed inside. In Refillable Permeation Tubes, the component compound surrounds the tubular membrane and permeates to the inside, where it mixes with the dilution gas. Refillable Permeation Tubes are designed to be refilled without disturbing the permeation membrane.

57S Tube is used to generate low concentration (sub ppb - 10 ppm) mixtures of high vapor pressure gases such as CO, CO_2, NO, N_2O, and CH_4. 57S is available in tubular membrane lengths from 0.01 cm to 10 cm.

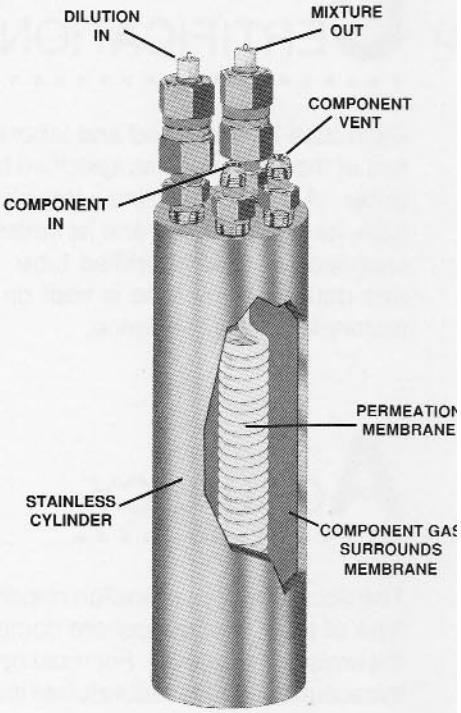


57S

(Gas Filled)

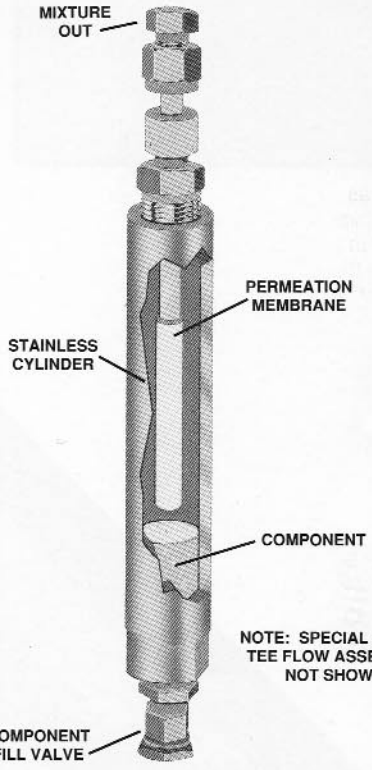
NOTE: SPECIAL PURGE TEE FLOW ASSEMBLY NOT SHOWN

57H Tube is for generating high concentration (10 ppm to over 1000 ppm) mixtures of high vapor pressure gases such as CO, CO_2, and NO. 57H tubes are available in membrane lengths from 15 cm to 2,000 cm.



57H

(Gas Filled)



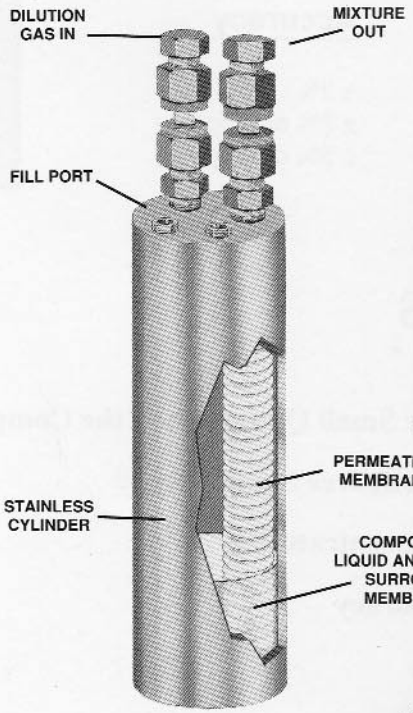
ULED Tube is for generating extremely low concentration mixtures of Cl_2, NO_2, $COCl_2$, H_2S, and SO_2. Other compounds available upon request. ULED Tubes are available in 0.01 cm to 4 cm membrane lengths.

Note: Type ULED tubes are factory refillable.

NOTE: SPECIAL PURGE TEE FLOW ASSEMBLY NOT SHOWN

ULED

(Liquid Filled)



LFH Tube is for moderate to high concentration mixtures of low vapor pressure liquids such as acrylonitrile, benzene, methanol, and water. LFH tubes are available in tubular membrane lengths from 10 cm to over 2,000 cm.

LFH

(Liquid Filled)

WHY USE PERMEATION TUBES?

Permeation tubes offer 5 big benefits. They extend technical capabilities, improve measurement accuracy, allow user controllable mixtures, lower cost and are convenient to use.

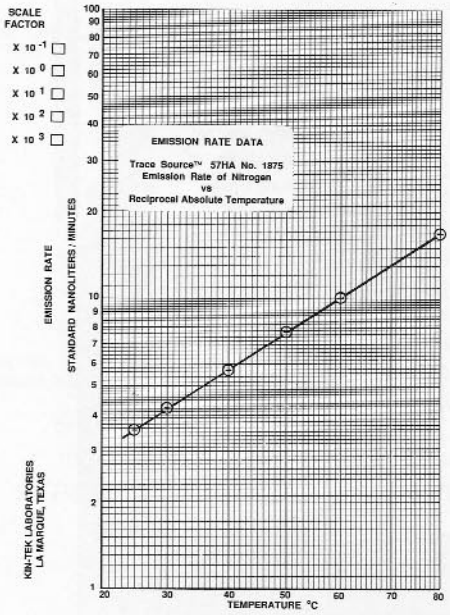
Technical capabilities are extended because of the inherent advantages of dynamically blending a mixture and using it while it is still fresh. Accurate, extremely low concentration mixtures (ppb and pptr) can be produced because adsorption effects are avoided. Moreover, these mixtures can contain very polar (methanol or water) or reactive (HCl) compounds. Even mixtures of compounds that react with each other, such as HCN and Ammonia, or H_2S and air are possible.

Measurement accuracy is improved because the permeation tube's output is traceable to fundamental measurements (temperature & weight), and is not dependent on analysis by instruments which themselves are subject to calibration accuracy. Additionally, the tube output can be reverified at any time by the user.

With permeation tubes the mixtures are user controllable. Concentration can be varied by changing the dilution flow rate or the operating temperature of the tube. Also, the matrix gas can be changed to suit the application.

Operating costs are lowered because a single tube can produce a wide range of mixtures. By nature, the more you use a permeation tube, the lower the cost per sample. Storage life is long, and very little space is required. Permeation tubes stored in one small refrigerator can take the place of a large room full of gas bottles and their attendant handling problems.

Permeation tubes are a convenient way to get low concentration mixtures. You can set them up quickly, handle them safely, and make changes as your application requires with a minimum of trouble. They are easily transported from one location to another for on-site comparisons, field calibrations, or shared use.



Emission Rate Data Covers Full Operating Temperature Range (Supplied with Series 57, LFH, and ULED sources)

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