

# EPA Method 21 Leak Detection Using ION Science PIDs



## Introduction

EPA Method 21 is the standard procedure for leak detection and fugitive emissions monitoring for VOCs. A continuously detecting meter is used to check joints and valves on pipelines and vessels, and if a significant leak is detected, repairs must be done. Any instrument can be used as long as it meets the specifications listed in Table 1. The ION Science MiniPID 2 PPM WR Sensor allows leak detectors to meet all these requirements.

**Table 1: Method 21 Instrument Specifications**

Section	Method 21 Specification	MiniPID 2_PPM WR <u>B</u> ased <u>D</u> etector
6.1	Detects compound	Measures most VOCs
6.2	Instrument range covers leak definition	0 - 10,000 ppm
6.2	Range w/dilution fitting covers leak definition	<a href="#">0 - 50,000 ppm</a> , easy to design dilutor to achieve this
6.3	Resolution $\pm 2.5\%$ of leak definition	Sensors offers this resolution
6.4	Pump flow rate 0.1-3.0 LPM	Easy to design detector with this flow rate
6.5	Probe diameter $\leq 1/4"$ o.d.	Easy to design detector with this probe diameter
6.6	Intrinsic safety class 1 division 1	Class 1 division 1
8.1.1	Response factor available for compound	<a href="#">ION</a> Science has response factor data on over 800 chemicals
8.1.1.2	Response factor <10	<10 for most compounds
8.1.2	Calibration frequency Initial and every 3 <a href="#">months</a> .	Easy daily or weekly calibration, can be extended up to every 3 months
8.1.2.2	Calibration precision $\pm 10\%$ of calibration gas conc.	$\pm 2\%$ of calibration gas conc. <a href="#">Sensor precision allows detector to easily achieve this.</a>
8.1.3.2	Response time $T_{90} \leq 30$ s	$T_{90} \leq 3$ s

### Leak Definition

Method 21 does not define the leak threshold, i.e., the concentration of VOC detected that, if exceeded, is declared a leak requiring repair. Other regulations define the threshold depending on the industry and/or chemical of concern. For example, 40 CFR, 60 Subpart VV, defines a leak as either 500 ppm or 10,000 ppm, depending on the type of valve or device.



### Calibration Gas and Concentration

There is a common misconception that Method 21 requires calibration with 10,000 ppm methane. This idea probably comes from paragraph 3.5, where 10,000 ppm methane is used as an example. However any calibration compound may be used (termed “reference compound” in the Method), and the concentration is preferably close to the leak definition, which could be 500 ppm, 10,000 ppm, or some other value defined by other regulations. Under Title V, most leak definitions have been reduced to 500 ppm or lower.

PIDs are most commonly calibrated with isobutylene. However, according to paragraph 8.1.1.2, isobutylene

can only be used if the response factor (RF) for the measured compound is  $<10$ . For example, if the measured VOC is benzene, with RF of 0.46, and the leak threshold is 500 ppm, then 1000 ppm isobutylene would be a good choice for calibration because it gives a response equivalent to about 460 ppm benzene, which is close to the leak definition.

The detector would then be programmed to read benzene directly after isobutylene calibration. However, if the measured compound is ethylene, with RF of 50, isobutylene cannot be used, but a cylinder of ethylene or nitrogen dioxide (RF=13) could be used for calibration, because the effective RF for ethylene is  $50/13 = 3.8$ .

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