# Technical/Application Article 03

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## 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 Tiger PID meets all these requirements.

Table 1. Method 21 Instrument Specifications

| Section | Method 21 Specification | Tiger PID Specification |
|---|---|---|
| 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 | 0-50,000 ppm |
| 6.3 | Resolution ±2.5% of leak definition | 0.1 ppm (0-999.9 ppm)<br>1 ppm (1000-10,000 ppm) |
| 6.4 | Pump flow rate 0.1-3.0 LPM | 0.25 LPM |
| 6.5 | Probe Diameter ≤1/4" o.d. | 1/8" o.d. |
| 6.6 | Intrinsic Safety Class 1 Division 1 | Class 1 Division 1 |
| 8.1.1 | Response Factor available for compound | Over 800 Factors programmable |
| 8.1.1.2 | Response Factor <10 | <10 for most compounds |
| 8.1.2 | Calibration Frequency<br>Initial and every 3 mos. | Easy daily or weekly calibration, can be extended up to monthly |
| 8.1.2.2 | Calibration Precision ±10% of calibration gas conc. | ±2% of calibration gas conc. |
| 8.1.3.2 | Response Time $t_{90}$ ≤30 s | $t_{90}$ ≤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 Tiger would then be programmed to read benzene directly after isobutylene calibration. However, if the measured compound is ethylene oxide, with RF of 15, isobutylene cannot be used, but a cylinder of ethylene oxide or ethylene (RF=8) could be used for calibration, because the effective RF for ethylene is 15/8 = 1.9.

**Tiger Datalog Options**

The Tiger has 128 zones that can be labeled from a computer to identify each measurement site. The user can select the zone with the ⊞ key and then scroll to the single point datalog key □ and hit enter to record when the highest reading is observed. Alternatively, use the peak hold key ⩚ to let the instrument capture the highest reading, and record the result manually.

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