COMPLIANCE OF RAE SYSTEMS PIDS WITH EPA METHOD 21

INTRODUCTION

EPA Method 21 (40 CFR, 60 Appendix A) was implemented as a standard for selecting and using monitors for leak detection and monitoring fugitive emissions. Method 21 does not define leak thresholds; these are defined in other regulations. Tougher requirements have resulted in better monitoring equipment for determining VOC leaks.

CALIBRATING AT 10,000 PPM

There is a common misconception that Method 21 requires people to calibrate at 10,000 ppm. It does not. The confusion may arise from Paragraph 3.5, where the "reference compound" is defined as "the VOC species selected as an instrument calibration basis for specification of the leak definition concentration." Method 21 continues with an example: "If a leak definition concentration is 10,000 ppmv as methane, then any source emission that results in a local concentration that yields a meter reading of 10,000 on an instrument calibrated with methane would be classified as a leak. In this example the leak definition is 10,000 ppmv, and the reference compound is methane." The value of 10,000 ppm for methane is just an example. The actual "leak definition" to be used is detailed in other regulations such as 40 CFR, 60 Subpart VV, which defines a leak as either 500 ppm or 10,000 ppm, depending on the type of valve or device.

WHAT IS THE RECOMMENDED CAL GAS VALUE?

Paragraph 3.1 defines the calibration gas as "the VOC compound used to adjust the instrument meter reading to a known value. The calibration gas is usually the reference compound at a concentration approximately equal to the leak definition concentration." This does not define the gas type. A correct interpretation of this paragraph is that the calibration gas type and concentration is best defined by the regulation controlling the leak threshold. Under Title V, most leak definitions fell to 500 ppmv or less.

WHAT IS THE RECOMMENDED CALIBRATION GAS?

As indicated in paragraph 7.1, the preferred calibration gas is a standard cylinder of the chemical to be measured, at approximately the concentration of the leak definition. However, paragraph 7.4 allows calibrations to "be performed using a compound other than the reference compound....[if] a conversion factor is determined for the alternative compound so that the resulting meter readings during source surveys can be converted to reference compound results." RAE Systems has measured correction factors (CFs) for over 350 compounds (see Technical Note TN-106) and will determine the CF for you if your compound is not on the list.

Calibration on isobutylene is permitted if the CF is <10

Note that paragraph 8.1.1.2 requires that correction factors always be less than 10. This means one could calibrate on isobutylene and measure toluene leaks, because toluene's CF is 0.5 (which is <10).

What if the CF is >10?

Use a different calibration gas. For example, one could not calibrate on isobutylene and measure acrylic acid leaks because its CF is 12. But you can use ethylene to calibrate, whose CF is 9. The new CF for acrylic acid measurements with ethylene calibration is 12/9 = 1.3, which meets the criterion of being <10.

USING A RAE SYSTEMS PID FOR METHOD 21

Q: Can I use the MiniRAE 3000 for Method 21?

A: Usually. Method 21 is a regulation for selecting and using VOC leak detection devices and PIDs are among the suggested devices. However, it is important to understand th e regulation governing your leak threshold. This is not covered in Method 21. Do you know what your leak threshold is, and what the reference compound is? Check Technical Note TN-106 to see if the compound is detected by PID.

Q: My leak threshold is 500 ppmv toluene.

A: You can use a MiniRAE 3000. We recommend that you calibrate with isobutylene gas. While you could calibrate with toluene, it is a more expensive calibration gas and Method 21 allows for calibration with isobutylene.

Q: My leak threshold is 500 ppm acrylic acid.

A: You can use a MiniRAE 3000. You can't use isobutylene to calibrate, because the CF for acrylic acid is 12, but you can use ethylene to calibrate, as noted above.

RAE SYSTEMS COMPLIANCE WITH METHOD 21

The following specifications for RAE Systems photo-ionization detectors (PIDs) show their compliance with the specifications in EPA Method 21. The data for MultiRAE assume a PID is installed.

Section	Method 21 Specification	MiniRAE 2000	MiniRAE & MiniRAE Plus	MultiRAE & MultiRAE Plus
6.1	Detects compound	Responds to a broad range of organic compounds	Responds to a broad range of organic compounds	Responds to a broad range of organic compounds
6.2	Instrument Range Encompasses leak definition	0 to 10,000 ppm	0 to 2,000 ppm	0 to 2,000 ppm
6.2	Range w/Dilution Probe Encompasses leak definition	0 to 20,000 ppm	0 to 20,000 ppm	0 to 10,000 ppm
6.3	Instrument Resolution ± 2.5 % of leak definition	0.1 ppm (0 to 999.9 ppm) 1 ppm (1,000 to 10,000 ppm)	0.1 ppm (0 to 999.9 ppm) 1 ppm (1,000 to 2,000 ppm)	0.1 ppm (0 to 999.9 ppm) 1 ppm (200 to 2,000 ppm)
6.4	Pump Flow Rate 0.1 to 3.0 L/min	0.4 to 0.6 L/min	0.4 to 0.6 L/min	0.15 to 0.3 L/min
6.5	Probe Dimensions ≤1/4" O.D.	3/16" O.D.	3/16" O.D.	1/4" or 3/16" O.D.
6.6	Intrinsic Safety for Chemical Vapors Class 1, Division 1	Class 1 Div.1 Approved	Class 1 Div.1 Approved	Class 1 Div.1 Approved
8.1.1	Correction Factor available for measured compound	Over 350 compound CFs available for RAE PIDs	Over 350 compound CFs available for RAE PIDs	Over 350 compound CFs available for RAE PIDs
8.1.1.2	Response Factor Value <10	<10 for most compounds, using isobutylene cal. gas	<10 for most compounds, using isobutylene cal. gas	<10 for most compounds, using isobutylene cal. gas
8.1.1.3	Response Factor for Test Compound Measurable or Available	Pre-prog. with 100 comps. Available for >300 comps.	Available for >300 comps.	Pre-programmed with >60 compounds Available for >300 compounds
8.1.2	Cal. Precision Test Freq. Initial and every 3 months	Simple daily calibration	Simple daily calibration	Simple daily calibration
8.1.2.2	Calibration Precision ±10% of Cal. gas value	±2% of cal. gas value	±2% of cal. gas value	±3% of cal. gas value
8.1.3.2	Response Time ≤30 seconds to 90%	≤2 seconds to 90%	≤3 seconds to 90%	≤10 seconds to 90%

Section	Method 21 Specification	MiniRAE 3000	ppbRAE 3000	RAEGuard PID	RAEGuard 2 PID	MultiRAE (new family)
6.1	Detects compound	Responds to a broad range of organic compounds	Responds to a broad range of organic compounds	Responds to a broad range of organic compounds	Responds to a broad range of organic compounds	Responds to a broad range of organic compounds
6.2	Instrument Range Encompasses leak definition	0 to 15,000 ppm	0 to 10,000 ppm	0 to 1,000 ppm	0.01 to 100 ppm 0.1 to 1,000 ppm 1 to 1,000 ppm	0 to 5,000 ppm (0 to 1,000 ppm, Lite)
6.2	Range w/Dilution Probe Encompasses leak definition	No dilution probe	No dilution probe	No dilution probe	No dilution probe	No dilution probe
6.3	Instrument Resolution ± 2.5 % of leak definition	0.1 ppm (0 to 999.9 ppm) 1 ppm (1,000 to 15,000 ppm)	1 ppb (1 to 9999 ppb) 10 ppb (10 to 99 ppm) 0.1 ppm (100 to 999.9 ppm) 1 ppm (1000 to 9999 ppm)	10 ppb (0 to 20 ppm) 0.1 ppm (0 to 100 ppm) 1 ppm (1 to 1000) (Each range is for a different model #)	10 ppb, 0.1 ppm, and 1 ppm (depends on model)	0.1 ppm (0 to 5,000 ppm) 10 ppb (0 to 2,000 ppm, Pro) 1 ppm (0 to 1,000 ppm, Lite)
6.4	Pump Flow Rate 0.1 to 3.0 L/min	0.45 to 0.55 L/min	0.45 to 0.55 L/min	0.45 to 0.55 L/min	0.45 to 0.55 L/min	0.25 L/min
6.5	Probe Dimensions ≤1/4" O.D.	3/16" O.D.	3/16" O.D.	3/16" O.D.	3/16" O.D.	3/16" O.D.

Section	Method 21 Specification	MiniRAE 3000	ppbRAE 3000	RAEGuard PID	RAEGuard 2 PID	MultiRAE (new family)
6.6	Intrinsic Safety for Chemical Vapors Class 1, Division 1	Class 1 Div.1 Approved	Class 1 Div.1 Approved	Class 1 Div.1 Approved	Class 1 Div.1 Approved	Class 1 Div.1 Approved
8.1.1	Correction Factor available for measured compound	Over 350 compound CFs available for RAE PIDs	Over 350 compound CFs available for RAE PIDs	Over 350 compound CFs available for RAE PIDs	Over 350 compound CFs available for RAE PIDs	Over 350 compound CFs available for RAE PIDs
8.1.1.2	Response Factor Value <10	<10 for most compounds, using isobutylene cal. gas	<10 for most compounds, using isobutylene cal. gas	<10 for most compounds, using isobutylene cal. gas	<10 for most compounds, using isobutylene cal. gas	<10 for most compounds, using isobutylene cal. gas
8.1.1.3	Response Factor for Test Compound Measurable or Available	Pre-prog. with 222 comps. Available for >350 comps.	Pre-prog. with 222 comps. Available for >350 comps.	Pre-prog. with 222 comps. Available for >350 comps.	Pre-prog. with 222 comps. Available for >350 comps.	Pre-prog. with 222 comps. Available for >350 comps.
8.1.2	Cal. Precision Test Freq. Initial and every 3 months	Calibration check daily	Calibration check daily	Calibration check weekly	Calibration check weekly	Calibration check daily
8.1.2.2	Calibration Precision ±10% of Cal. gas value	±2% of cal. gas value	±2% of cal. gas value	±2% of cal. gas value	±2% of cal. gas value	±2% of cal. gas value
8.1.3.2	Response Time ≤30 seconds to 90%	≤3 seconds to 90%	≤3 seconds to 90%	≤3 seconds to 90% (depending on duty cycle)	≤3 seconds to 90% (depending on duty cycle)	≤3 seconds to 90%