

**Environmental Protection Agency**

**§ 91.322**

(3) Recheck the zero response. If it has changed more than 0.5 percent of full scale, repeat the steps given in paragraphs (b)(1) and (b)(2) of this section.

(4) Record the response of calibration gases having nominal concentrations

between 10 and 90 percent of full-scale concentration. A minimum of six evenly spaced points covering at least 80 percent of the 10 to 90 percent range (64 percent) is required (see following table).

Example calibration points (percent)	Acceptable for calibration?
20, 30, 40, 50, 60, 70 .....	No, range covered is 50 percent, not 64 percent.
20, 30, 40, 50, 60, 70, 80, 90 .....	Yes.
10, 25, 40, 55, 70, 85 .....	Yes.
10, 30, 50, 70, 90 .....	No, though equally spaced and entire range covered, a minimum of six points is needed.

(5) Generate a calibration curve. The calibration curve must be of fourth order or less, have five or fewer coefficients, and be of the form of equation (1) or (2). Include zero as a data point. Compensation for known impurities in the zero gas can be made to the zero-data point. The calibration curve must fit the data points within 2 percent of point or one percent of full scale, whichever is less.

$$y = Ax^4 + Bx^3 + Cx^2 + Dx + E \quad (1)$$

$$y = \frac{x}{Ax^4 + Bx^3 + Cx^2 + Dx + E} \quad (2)$$

y=concentration  
x=chart deflection

(6) Option. A new calibration curve need not be generated if:

- (i) A calibration curve conforming to paragraph (b)(5) of this section exists;
- (ii) The responses generated in paragraph (b)(4) of this section are within

one percent of full scale or two percent of point, whichever is less, of the responses predicted by the calibration curve for the gases used in paragraph (b)(4) of this section.

(7) If multiple range analyzers are used, the lowest range used must meet the curve fit requirements below 15 percent of full scale.

(c) *Linear calibration criteria.* If any range is within 2 percent of being linear, a linear calibration may be used. To determine if this criterion is met:

(1) Perform a linear least-square regression on the data generated. Use an equation of the form  $y=mx$ , where  $x$  is the actual chart deflection and  $y$  is the concentration.

(2) Use the equation  $z=y/m$  to find the linear chart deflection (designated as  $z$ ) for each calibration gas concentration (designated as  $y$ ).

(3) Determine the linearity (designated as percent  $L$ ) for each calibration gas by:

$$\text{percent } L = \frac{(zx)}{\text{Fullscale linear chart deflection}}(100)$$

(4) The linearity criterion is met if the percent  $L$  is less than  $\pm 2$  percent for each data point generated. For each emission test, use a calibration curve of the form  $Y=mx$ . The slope (designated as  $m$ ) is defined for each range by the spanning process.

**§91.322 Calibration of other equipment.**

Calibrate other test equipment as often as required by the manufacturer or as necessary according to good engineering practice.