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

(4) For each range calibrated, if the deviation from a least-squares best-fit straight line is two percent or less of the value at each data point, calculate concentration values by use of a single calibration factor for that range. If the deviation exceeds two percent at any point, use the best-fit non-linear equation which represents the data to within two percent of each test point to determine concentration.

(d) Oxygen interference optimization. Choose a range where the oxygen interference check gases will fall in the upper 50 percent. Conduct the test, as outlined in this paragraph, with the oven temperature set as required by the instrument manufacturer. Oxygen interference check gas specifications are found in § 91.312(d).

(1) Zero the analyzer.

(2) Span the analyzer with the 21 percent oxygen blend.

(3) Recheck zero response. If it has changed more than 0.5 percent of full scale repeat paragraphs (d)(1) and (d)(2) of this section to correct the problem.

(4) Introduce the 5 percent and 10 percent oxygen interference check gases.

(5) Recheck the zero response. If it has changed more than ±1 percent of full scale, repeat the test.

(6) Calculate the percent of oxygen interference (designated as percent O_2 I) for each mixture in paragraph (d)(4) of this section according to the following equation:

$$\text{percent } O_2 \text{ I} = (B - \text{Analyzer response (ppm C)})/B \times 100$$

$$\text{analyzer response} = \left(\frac{A}{\text{\% of fullscale analyzer response due to A}}\right) \times (\text{\% of fullscale analyzer response due to B})$$

Where:

A=hydrocarbon concentration (ppmC) of the span gas used in paragraph (d)(2) of this section.

B=hydrocarbon concentration (ppmC) of the oxygen interference check gases used in paragraph (d)(4) of this section.

(7) The percent of oxygen interference (designated as percent O_2 I) must be less than ±three percent for all required oxygen interference check gases prior to testing.

(8) If the oxygen interference is greater than the specifications, incrementally adjust the air flow above and below the manufacturer's specifications, repeating paragraphs (d)(1) through (d)(7) of this section for each flow.

(9) If the oxygen interference is greater than the specification after adjusting the air flow, vary the fuel flow and thereafter the sample flow, repeating paragraphs (d)(1) through (d)(7) of this section for each new setting.

(10) If the oxygen interference is still greater than the specifications, repair or replace the analyzer, FID fuel, or burner air prior to testing. Repeat this section with the repaired or replaced equipment or gases.

[61 FR 52102, Oct. 4, 1996, as amended at 70 FR 40451, July 13, 2005]

§ 91.317 Carbon monoxide analyzer calibration.

(a) Calibrate the NDIR carbon monoxide analyzer described in this section.

(b) Initial and periodic interference check. Prior to its introduction into service and annually thereafter, check the NDIR carbon monoxide analyzer for response to water vapor and CO_2.

(1) Follow good engineering practices for instrument start-up and operation.

Adjust the analyzer to optimize performance on the most sensitive range to be used.

(2) Zero the carbon monoxide analyzer with either purified synthetic air or zero-grade nitrogen.

(3) Bubble a mixture of three percent CO_2 in N_2 through water at room temperature and record analyzer response.

(4) An analyzer response of more than one percent of full scale for ranges above 300 ppm full scale or more than three ppm on ranges below 300 ppm full scale requires corrective action. (Use of conditioning columns is one form of corrective action which may be taken.)

(c) Initial and periodic calibration. Calibrate the NDIR carbon monoxide analyzer prior to its introduction into service and monthly thereafter.

(1) Adjust the analyzer to optimize performance.

(2) Zero the carbon monoxide analyzer with either purified synthetic air or zero-grade nitrogen.

(3) Calibrate on each used operating range with carbon monoxide-in-N_2 calibration gases having nominal concentrations between 10 and 90 percent of that range. A minimum of six evenly spaced points covering at least 80 percent of the 10 to 90 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.

(4) Additional calibration points may be generated. For each range calibrated, if the deviation from a least-squares best-fit straight line is two percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds two percent at any point, use the best-fit non-linear equation which represents the data to within two percent of each test point to determine concentration.

§91.318 Oxides of nitrogen analyzer calibration.

(a) Calibrate the chemiluminescent oxides of nitrogen analyzer as described in this section.

(b) Initial and periodic interference. Prior to its introduction into service, and monthly thereafter, check the chemiluminescent oxides of nitrogen analyzer for NO_2 to NO converter efficiency. Figure 2 in appendix B of this subpart is a reference for the following paragraphs:

(1) Follow good engineering practices for instrument start-up and operation. Adjust the analyzer to optimize performance.

(2) Zero the oxides of nitrogen analyzer with purified synthetic air or zero-grade nitrogen.

(3) Connect the outlet of the NO_X generator to the sample inlet of the oxides of nitrogen analyzer which has been set to the most common operating range.

(4) Introduce into the NO_X generator analyzer-system an NO-in-nitrogen (N_2) mixture with an NO concentration equal to approximately 80 percent of the most common operating range. The NO_2 content of the gas mixture must be less than 5 percent of the NO concentration.

(5) With the oxides of nitrogen analyzer in the NO mode, record the concentration of NO indicated by the analyzer.

(6) Turn on the NO_X generator O_2 (or air) supply and adjust the O_2 (or air) flow rate so that the NO indicated by the analyzer is about 10 percent less than indicated in paragraph (b)(5) of this section. Record the concentration of NO in this NO+O_2 mixture as value "c."

(7) Switch the NO_X generator to the generation mode and adjust the generation rate so that the NO measured on the analyzer is 20 percent of that measured in paragraph (b)(5) of this section. There must be at least 10 percent unreacted NO at this point. Record the concentration of residual NO as value "d."

(8) Switch the oxides of nitrogen analyzer to the NO_X mode and measure total NO_X. Record this value as "a."

(9) Switch off the NO_X generator but maintain gas flow through the system.