

## Environmental Protection Agency

## § 92.121

form  $y=mx$  is to be used. The slope ( $m$ ) is defined for each range by the spanning process.

### § 92.121 Oxides of nitrogen analyzer calibration and check.

(a) *Quench checks; NO<sub>x</sub> analyzer.* (1) Perform the reaction chamber quench check for each model of high vacuum reaction chamber analyzer prior to initial use.

(2) Perform the reaction chamber quench check for each new analyzer that has an ambient pressure or "soft vacuum" reaction chamber prior to initial use. Additionally, perform this check prior to reusing an analyzer of this type any time any repairs could potentially alter any flow rate into the reaction chamber. This includes, but is not limited to, sample capillary, ozone capillary, and if used, dilution capillary.

(3) Quench check as follows:

(i) Calibrate the NO<sub>x</sub> analyzer on the lowest range that will be used for testing.

(ii) Introduce a mixture of CO<sub>2</sub> calibration gas and NO<sub>x</sub> calibration gas to the CL analyzer. Dynamic blending may be used to provide this mixture. Dynamic blending may be accomplished by analyzing the CO<sub>2</sub> in the mixture. The change in the CO<sub>2</sub> value due to blending may then be used to determine the true concentration of the NO<sub>x</sub> in the mixture. The CO<sub>2</sub> concentration of the mixture shall be approximately equal to the highest concentration experienced during testing. Record the response.

(iii) Recheck the calibration. If it has changed more than  $\pm 1$  percent of full scale, recalibrate and repeat the quench check.

(iv) Prior to testing, the difference between the calculated NO<sub>x</sub> response and the response of NO<sub>x</sub> in the presence of CO<sub>2</sub> (step in paragraph (a)(3)(ii) of this section must not be greater than 3.0 percent of full-scale. The calculated NO<sub>x</sub> response is based on the calibration performed in step in paragraph (a)(3)(i) this section.

(b) *Oxides of nitrogen analyzer calibration.* (1) Every 30 days, perform a converter-efficiency check (see paragraph (b)(2) of this section) and a linearity

check (see paragraph (b)(3) of this section).

(2) Converter-efficiency check. The apparatus described and illustrated in Figure B121-1 of this section is to be used to determine the conversion efficiency of devices that convert NO<sub>2</sub> to NO. The following procedure is to be used in determining the values to be used in the equation below:

(i) Follow the manufacturer's instructions for instrument startup and operation.

(ii) Zero the oxides of nitrogen analyzer.

(iii) Connect the outlet of the NO<sub>x</sub> generator to the sample inlet of the oxides of nitrogen analyzer which has been set to the most common operating range.

(iv) Introduce into the NO<sub>x</sub> generator-analyzer system a span gas with a NO concentration equal to approximately 80 percent of the most common operating range. The NO<sub>2</sub> content of the gas mixture shall be less than 5 percent of the NO<sub>x</sub> concentration.

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

(vi) Turn on the NO<sub>x</sub> generator O<sub>2</sub> (or air) supply and adjust the O<sub>2</sub> (or air) flow rate so that the NO indicated by the analyzer is about 10 percent less than indicated in step in paragraph (b)(2)(v) of this section. Record the concentration of NO in this NO+O<sub>2</sub> mixture.

(vii) Switch the NO<sub>x</sub> 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 step in paragraph (b)(2)(v) of this section. There must be at least 10 percent unreacted NO at this point. Record the concentration of residual NO.

(viii) Switch the oxides of nitrogen analyzer to the NO<sub>x</sub> mode and measure total NO<sub>x</sub>. Record this value.

(ix) Switch off the NO<sub>x</sub> generation, but maintain gas flow through the system. The oxides of nitrogen analyzer will indicate the total NO<sub>x</sub> in the NO+O<sub>2</sub> mixture. Record this value.

(x) Turn off the NO<sub>x</sub> generator O<sub>2</sub> (or air) supply. The analyzer will now indicate the total NO<sub>x</sub> in the original NO

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in N<sub>2</sub> mixture. This value should be no more than 5 percent above the value indicated in step in paragraph (b)(2)(iv) of this section.

(xi) Calculate the efficiency of the NO<sub>x</sub> converter by substituting the concentrations obtained into the following equation:

$$(A) \text{ Percent Efficiency} = (1 + (a - b) / (c - d)) (100)$$

where:

a=concentration obtained in paragraph (b)(2)(viii) of this section.

b=concentration obtained in paragraph (b)(2)(ix) of this section.

c=concentration obtained in paragraph (b)(2)(vi) of this section.

d=concentration obtained in paragraph (b)(2)(vii) of this section.

(B) The efficiency of the converter shall be greater than 90 percent. Adjustment of the converter temperature may be necessary to maximize the efficiency. If the converter does not meet the conversion-efficiency specifications, repair or replace the unit prior to testing. Repeat the procedures of this section with the repaired or new converter.

(3) Linearity check. For each range used, check linearity as follows:

(i) With the operating parameters adjusted to meet the converter efficiency check and the quench checks, zero the analyzer.

(ii) Span the analyzer using a calibration gas that will give a response of approximately 90 percent of full-scale concentration.

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

(iv) Record the response of calibration gases having nominal concentrations of 30, 60 and 90 percent of full-scale concentration. It is permitted to use additional concentrations.

(v) 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.

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

(vii) Determine the linearity (%L) for each calibration gas by:

$$\text{Percent L} = (100)(z - x) / (\text{Full-scale chart deflection})$$

(viii) The linearity criterion is met if the %L is less than ±2 percent of each data point generated. For each emission test, a calibration curve of the form  $y=mx$  is to be used. The slope ( $m$ ) is defined for each range by the spanning process.

(ix) If the %L exceeds ±2 percent for any data point generated, repair or replace the analyzer or calibration bottles prior to testing. Repeat the procedures of this section with the repaired or replaced equipment or gases.

(x) Perform a converter-efficiency check (see paragraph (b)(2) of this section).

(xi) The operating parameters are defined as "optimized" at this point.

(4) Converter checking gas. If the converter quick-check procedure is to be employed, paragraph (b)(5) of this section, a converter checking gas bottle must be named. The following naming procedure must occur after each converter efficiency check, paragraph (b)(2) of this section.

(i) A gas bottle with an NO<sub>2</sub> concentration equal to approximately 80 percent of the most common operation range shall be designated as the converter checking gas bottle. Its NO concentration shall be less than 25 percent of its NO<sub>2</sub> concentration, on a volume basis.

(ii) On the most common operating range, zero and span the analyzer in the NO<sub>x</sub> mode. Use a calibration gas with a concentration equal to approximately 80 percent of the range for spanning.

(iii) Introduce the converter checking gas. Analyze and record concentrations in both the NO<sub>x</sub> mode (X) and NO mode (Y).

(iv) Calculate the concentration of the converter checking gas using the results from step in paragraph (b)(4)(iii) of this section and the converter efficiency from paragraph (b)(2) of this section as follows:

$$\text{Concentration} = ((X - Y)(100)) / (\text{Efficiency}) + Y$$

(5) Converter quick-check.

(i) Span the analyzer in the normal manner (NO<sub>x</sub> mode) for the most common operating range.

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(ii) Analyze the converter checking gas in the NO<sub>x</sub> mode, record the concentration.

(iii) Compare the observed concentration with the concentration assigned under the procedure in paragraph (b)(4) of this section. If the observed concentration is equal to or greater than 90 percent of the assigned concentration, the converter operation is satisfactory.

(c) *Initial and periodic calibration.* Prior to its introduction into service and monthly thereafter, the chemiluminescent oxides of nitrogen analyzer shall be calibrated on all normally used instrument ranges. Use the same flow rate as when analyzing samples. Proceed as follows:

(1) Adjust analyzer to optimize performance.

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

(3) Calibrate on each normally used operating range with NO-in-N<sub>2</sub> calibra-

tion gases with nominal concentrations of 15, 30, 45, 60, 75 and 90 percent of that range. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 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 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

(d) If a stainless steel NO<sub>2</sub> to NO converter is used, condition all new or replacement converters. The conditioning consists of either purging the converter with air for a minimum of 4 hours or until the converter efficiency is greater than 90 percent. The converter must be at operational temperature while purging. Do not use this procedure prior to checking converter efficiency on in-use converters.

FIGURE TO § 92.121

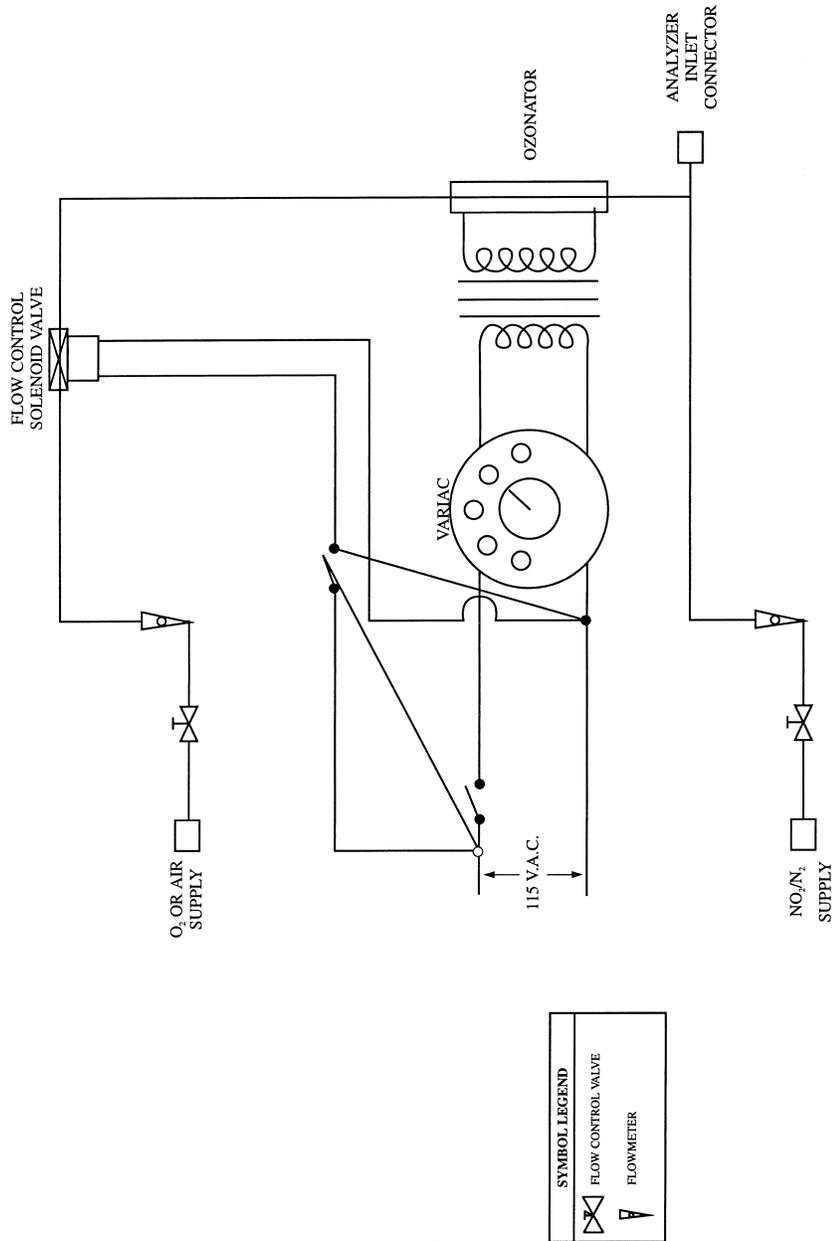


Figure B121-1 NOx CONVERTER EFFICIENCY DETECTOR