

**PERFORMANCE SPECIFICATION PROCEDURE 2**  
**Performance Specification Test**

**A. Pretest Preparation**

1. Install the continuous emission monitoring system (CEMS) and prepare the reference method (RM) test site. See PSPs 2a, 2b, and 2c.
2. Prepare the CEMS for operation.

**B. Calibration Drift (CD) Test**

1. Select a time period when the affected facility will operate >50% of normal load, or as specified in an applicable subpart, for 7 consecutive days.
2. Determine the magnitude of the CD once each day (at 24-hr intervals) for 7 consecutive days at the low-level value (LLV) and HLV. If periodic automatic or manual adjustments are made to the CEMS zero and calibration settings, conduct the CD test immediately before these adjustments, or conduct it in such a way that the CD can be determined.
  - a. Introduce to the CEMS the reference gases, gas cells, or optical filters (these need not be certified).
  - b. Record the CEMS response and subtract this value from the reference value (see PDS 2).

**C. Relative Accuracy Test**

1. Select a time period when the affected facility will operate >50% of normal load, or as specified in an applicable subpart, for the test period. The RA test may be conducted during the CD test period.
2. For instruments that use common components to measure more than one effluent gas constituent, test all channels simultaneously.
3. Conduct at least nine sets of all necessary RM tests. Conduct each set (including diluent, if applicable, and moisture, if needed) within a period of 30 to 60 min. **Note:** If more than nine sets are taken, up to three sets of the test results may be rejected so long as the total number is  $\geq 9$ ; report all data, including the rejected data.
4. Use the following strategies for the RM tests. Mark the beginning and end of each RM test run (including the exact time of the day) on the CEMS chart recordings or other permanent record of output.

- a. For integrated samples, e.g., Method 6 and Method 4, make a sample traverse of at least 21 min, sampling for 7 min at each traverse point.
  - b. For grab samples, e.g., Method 7, take one sample at each traverse point, scheduling the grab samples so that they are taken within a 3-min period or are an equal interval of time apart over a 21-min (or less) period. A test run for grab samples must be made up of at least three separate measurements.
  - c. **Note:** If CEMS RA tests are conducted during new source performance standards performance tests, RM results obtained during CEMS RA tests may be used to determine compliance as long as the source and test conditions are consistent with the applicable regulations.
5. Correlate the CEMS and the RM test data as to the time and duration as follows:
    - a. Determine from the CEMS final output (the one used for reporting) the integrated average pollutant concentration or emission rate for each pollutant RM test period.
    - b. Consider system response time, if important, and confirm that the pair of results are on a consistent moisture, temperature, and diluent concentration basis.
    - c. Compare each integrated CEMS value against the corresponding average RM value. Use the following guidelines to compare the CEMS integrated average value against the RM values.
      - If the RM has an integrated sampling technique, use the RM results.
      - If the RM has a grab sampling technique, use the average from all grab samples taken during the test run. If the pollutant concentration is varying with time over the run, the arithmetic average of the CEMS value recorded at the time of each grab sample may be used.

**PERFORMANCE SPECIFICATIONS 2**  
**SO<sub>2</sub> and NO<sub>x</sub>**

**A. Performance Specifications**

1. Instrument Zero and Span: See PSP 2c.
2. Calibration Drift:  $\leq 2.5\%$  of span value. Determine CD for each pollutant or diluent monitor in the system in terms of concentrations.
3. Relative Accuracy:  $\leq 20\%$  of the mean value of the RM test data in terms of the units of the emission standard or 10% of the applicable standard, whichever is greater.
  - a. For SO<sub>2</sub> emission standards between 0.30 and 0.20 lb/million Btu, 15% of emission standard.
  - b. For SO<sub>2</sub> emission standards below 0.20 lb/million Btu, 20% of emission standard.

**B. Test Procedure**

1. Relative Accuracy Test. See PSP 2.
2. Reference Method. Unless otherwise specified in an applicable subpart of the regulations, the following or any approved alternative:
  - a. Method 6 for SO<sub>2</sub>
  - b. Method 7 for NO<sub>x</sub>
  - c. Method 4 for moisture
  - d. Method 3B for diluent.

**PERFORMANCE SPECIFICATION DATA SHEET 2**  
**Calibration Drift**

Client/Plant Name \_\_\_\_\_ Job # \_\_\_\_\_

City/State \_\_\_\_\_ Date/Time \_\_\_\_\_

Test Location \_\_\_\_\_ Personnel \_\_\_\_\_

Analyzer Type/ID# \_\_\_\_\_ Span \_\_\_\_\_

*Note: Indicate units.*

Day	Level	Date and time	Calibration value	Monitor value	Difference	% SV (≤2.5%)
1	Low-level					
	High-level					
2	Low-level					
	High-level					
3	Low-level					
	High-level					
4	Low-level					
	High-level					
5	Low-level					
	High-level					
6	Low-level					
	High-level					
7	Low-level					
	High-level					

\_\_\_ Facility at > 50% of normal load?

\_\_\_ Test conducted immediately before any zero and calibration adjustments?

**QA/QC Check**

Completeness \_\_\_ Legibility \_\_\_ Accuracy \_\_\_ Specifications \_\_\_ Reasonableness \_\_\_

Checked by: \_\_\_\_\_  
 Personnel (Signature/Date)

\_\_\_\_\_   
 Team Leader (Signature/Date)

**PERFORMANCE SPECIFICATION DATA SHEET 2 (Continued)**  
**Relative Accuracy**

Client/Plant Name \_\_\_\_\_ City/State \_\_\_\_\_ Job # \_\_\_\_\_

Test Location \_\_\_\_\_ Date/Time \_\_\_\_\_

Analyzer Type/ID# \_\_\_\_\_ Span \_\_\_\_\_ Personnel \_\_\_\_\_

Run No.	Date and Time	SO <sub>2</sub> (ppm)			NO <sub>x</sub> (ppm)			Diluent (%)		SO <sub>2</sub> (mass/GCV)			NO <sub>x</sub> (mass/GCV)		
		RM	M	Diff, d	RM	M	Diff, d	RM	M	RM	M	Diff, d	RM	M	Diff, d
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
Average, $\overline{RM}$ or $\overline{d}$															
Confidence Interval, CC															
Accuracy, RA															

*Note: Mass/GCV for steam generators; NO<sub>x</sub> RM samples are average of three samples; and RM and M data must be on consistent wet or dry basis.*

$$S_d = \sqrt{\frac{\sum_{i=1}^n d_i^2 - \frac{(\sum_{i=1}^n d_i)^2}{n}}{n-1}}$$

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}}$$

$$RA = \frac{|\overline{d}| + |CC|}{\overline{RM}} \times 100$$

**QA/QC Check**  
 Completeness \_\_\_\_\_

Legibility \_\_\_\_\_

Accuracy \_\_\_\_\_

Specifications \_\_\_\_\_

Reasonableness \_\_\_\_\_

Checked by \_\_\_\_\_

Personnel (Signature/Date)

\_\_\_\_\_  
 Test Leader (Signature/Date)

**PERFORMANCE SPECIFICATION PROCEDURE 2a**  
**Installation and Measurement Location**

*Note: The acceptability of a Continuous Emission Monitoring System (CEMS) location is determined by passing the relative accuracy (RA) test. Suggested measurement locations and points or paths that are most likely to provide data that will meet the RA requirements are listed below.*

**A. Overall**

Select a location that is

1.  $\geq 2 D_s$  downstream from the nearest control device, the point of pollutant generation, or other point at which a change in the pollutant concentration or emission rate may occur.
2.  $\geq 0.5 D_s$  upstream from the effluent exhaust or control device.

**B. Point CEMS**

Select a measurement point that is either

1.  $\geq 1.0$  meter from the stack or duct wall.
2. Within or centrally located over the centroidal area of the stack or duct cross section.

**C. Path CEMS**

Select an effective measurement path that is either

1. Totally within the inner area bounded by a line 1.0 meter from the stack or duct wall.
2. Have at least 70% of the path within the inner 50% of the stack or duct cross-sectional area.
3. Centrally located over any part of the centroidal area.

**PERFORMANCE SPECIFICATION PROCEDURE 2b**  
**Reference Method Measurement Location and Traverse Points**

**A. Procedure**

1. Select a Reference Method (RM) measurement point (the CEMS and RM locations need not be the same) that is
  - a.  $\geq 2 D_s$  downstream from the nearest control device, the point of pollutant generation, or other point at which a change in the pollutant concentration or emission rate may occur.
  - b.  $\geq 0.5 D_s$  upstream from the effluent exhaust or control device.
2. Establish a "measurement line" that passes through the centroidal area and in the direction of any expected stratification. If this line interferes with the CEMS measurements, displace the line up to 30 cm (or 5% of  $D_s$  of the cross section, whichever is less) from the centroidal area.
3. Locate three traverse points at 16.7, 50.0, and 83.3% of the measurement line.
4. Conduct all necessary RM tests within 3 cm (but no less than 3 cm from the stack or duct wall) of the traverse points.

**B. Alternatives**

1. Step A1a. When pollutant concentration changes are due solely to diluent leakage (e.g., air heater leakages) and pollutants and diluents are simultaneously measured at the same location,  $0.5 D_s$  may be used in lieu of  $2 D_s$ .
2. Step A3. If the measurement line is longer than 2.4 meters and pollutant stratification is not expected, the three traverse points may be on the line at 0.4, 1.2, and 2.0 meters from the stack or duct wall. This option must not be used after wet scrubbers or at points where two streams with different pollutant concentrations are combined.
3. Step A3. Other traverse points may be selected, provided that they can be shown to the satisfaction of the Administrator to provide a representative sample over the stack or duct cross section.

**PERFORMANCE SPECIFICATIONS PROCEDURE 2c**  
**Instrument Zero and Span**

**A. Equipment and Design Specifications**

1. **Data Recorder Scale.** The CEMS data recorder response range must include zero and a high-level value. Select the high-level value (HLV) as follows:
  - a. For uncontrolled emission (e.g., at the inlet of a flue gas desulfurization unit), select HLV between 1.25 and 2 times the average potential emission level, unless otherwise specified in an applicable subpart of the regulations.
  - b. For controlled emissions (including emissions in compliance with an applicable regulation), select the HLV between 1.5 times the pollutant concentration corresponding to the emission standard level and the span value.
  - c. Establish the data recorder output so that the HLV is read between 90% and 100% of the data recorder full scale. The calibration gas, optical filter, or cell values used to establish the data recorder scale should produce zero and HLV readings.
2. **Calibration Drift.** Design must allow the determination of calibration drift at zero and HLV.

**B. Alternatives**

1. Step A1a. A lower HLV may be used; however, emissions that exceed the full-scale limit of the CEMS must be measured in accordance with the requirements of applicable regulations.
2. Step A1c. The scale requirement may not be applicable to digital data recorders.
3. Step A1c. A calibration gas, optical filter, or cell value between 50% and 100% of HLV may be used in place of HLV, provided the data recorder full-scale requirements are met.
4. Step A2. The CEMS design may allow calibration drift determinations to be conducted at a low-level value (zero to 20% of HLV) and at a value between 50 and 100% of HLV.
5. Step A2. The Administrator may approve a single-point calibration-drift determination.

**PERFORMANCE SPECIFICATION PROCEDURE 2d**  
**Alternative Procedure**

*Note: This is an alternative to the RA procedure in section 7 of PS 2, if the criteria in paragraphs 60.13(c)(1) and (2) are met. Use of this procedure does not preclude the requirements to complete the CD tests nor any other requirements specified in the applicable regulation(s) for reporting CEMS data and performing CEMS drift checks or audits.*

1. Conduct a complete CEMS status check following the manufacturer's written instructions. Include operation of the light source, signal receiver, timing mechanism functions, data acquisition and data reduction functions, data recorders, mechanically operated functions (mirror movements, zero pipe operation, calibration gas valve operations, etc.), sample filters, sample line heaters, moisture traps, and other related functions of the CEMS, as applicable. Do not proceed until all parts of the CEMS are functioning properly.
2. Obtain reference cylinder gases or calibration cells that produce known responses at two measurement points within the following ranges:

Measurement Range

Measurement Point	Pollutant Monitor	Diluent Monitor for CO <sub>2</sub>	Diluent Monitor for O <sub>2</sub>
1	20-30% of span value	5-8% by volume	4-6% by volume
2	50-60% of span value	10-14% by volume	8-12% by volume

- a. Use certified cylinder gases, i.e., traceable to National Institute of Standards and Technology (NIST) gaseous standard reference material (SRM) or NIST/EPA approved gas manufacturer's certified reference material (CRM) following EPA traceability protocol Number 1. CRM's may be used directly as alternative RA cylinder gases. A list of gas manufacturers that have prepared approved CRM's is available from EPA.
  - b. Use calibration cells certified by the manufacturer to produce a known response in the CEMS, traceable to SRM or CRM gases or reference methods (the calibration cell certification procedure is subject to approval of the Administrator).
3. Operate each monitor in its normal sampling mode as nearly as possible.
    - a. When using cylinder gases, pass the cylinder gas through all filters, scrubbers, conditioners, and other monitor components used during normal sampling and as much of the sampling probe as practical.
    - b. When using calibration cells, do not bypass the CEMS components used in the normal sampling mode during the RA determination. These include light sources, lenses, detectors, and reference cells.
  4. Challenge each monitor (both pollutant and diluent, if applicable) with the reference cylinder gases or calibration cells three times at each point. Do not dilute gas from a cylinder when challenging the CEMS. Allow for a sufficient period of time to assure adsorption-desorption reactions on the CEMS surfaces have stabilized before taking readings.