

Source Test Procedure **ST-14**

OXYGEN, CONTINUOUS SAMPLING

Adopted January 20, 1982

REF: Regulations 9-3-301, 9-3-302

1. APPLICABILITY

1.1 This method is used to quantify emissions of oxygen. It determines compliance with Regulations 9-3-301, 9-3-302.

2. PRINCIPLE

2.1 A continuous representative gas sample is extracted from the sampling point and conditioned to remove water and particulate material. A small portion of the sample is passed through a fuel cell type oxygen analyzer which measures the electrical current generated by the oxidation reaction at the gas/fuel cell interface.

3. RANGE AND SENSITIVITY

3.1 The minimum measurable concentrations of oxygen is 0.1%.

3.2 The upper limit depends on the range of the instrument.

3.3 The sensitivity of the oxygen analyzer shall be $\pm 2\%$ of full scale.

4. INTERFERENCES

4.1 Halogens and halogenated compounds will cause a positive interference. Acid gases will consume the fuel cell and cause a slow calibration drift.

5. APPARATUS

5.1 Oxygen analyzer. Use a Teledyne Analytical Instruments Inc., Model 326 analyzer or its equivalent.

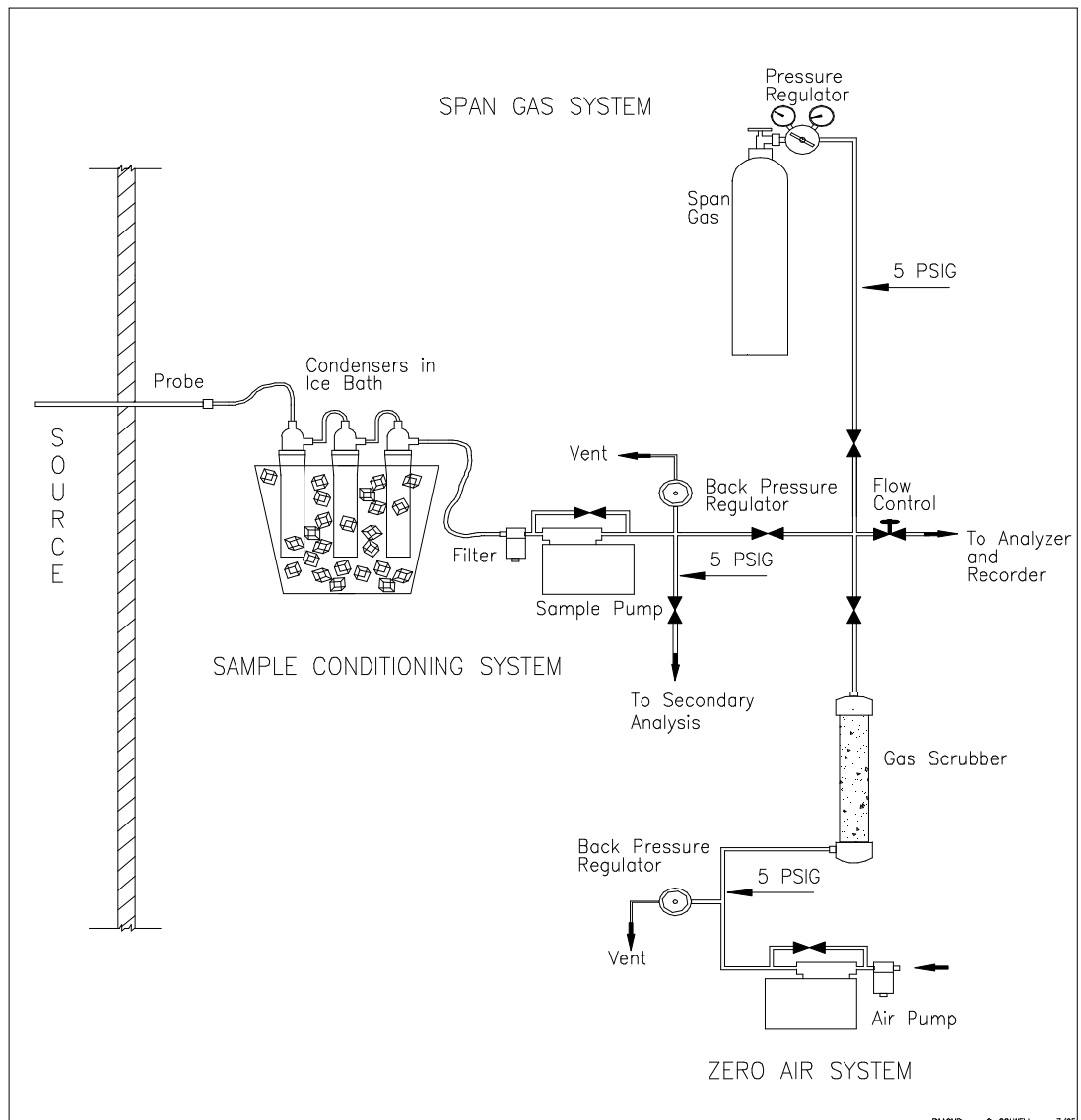
5.2 Chart Recorder. The recorder monitors and records the continuous output from the analyzer.

5.3 Sample conditioning, zero air, and span gas system. The assembly of this system is shown in Figure 14-1. The sample conditioning system provides a dry, particulate free gas flow to the instrument. The zero air system provides clean dry atmospheric air for instrument calibration. Except as specified, all materials which come in contact with either the sample or span gases must be constructed of Teflon or stainless steel.

5.4 Sample Probe. Use a borosilicate glass tube of sufficient length to traverse the stack being tested. If the stack temperature exceeds 425 °C (800 °F), use a quartz probe. Other probes are acceptable subject to approval by the Source Test Section.

5.5 Condensers. Use modified Greenberg-Smith impingers with the impaction plates removed and the inlet tube shortened to a length of 10 cm (4 inches), or equivalent.

- 5.6 Cooling System. Immerse the impingers in an ice bath during the test.
- 5.7 Particulate Filter. Use a Balston type 95 holder with a grade B filter, or equivalent, in the sample system.
- 5.8 Pumps. Use leak-free, Teflon-lined, diaphragm pumps in the sample and zero air systems. The pumps must have a capacity of at least 28 liters/min (1.0 CFM).
- 5.9 Back-pressure Regulator. Use a back-pressure regulator to maintain the sample and zero gas sample pressures to the instrument at five psig.
- 5.10 Gas Scrubber. Use a bed of silica gel, Ascarite (or soda-lime), and charcoal to remove moisture, carbon dioxide, and hydrocarbons from the zero air system.
- 5.11 Span Gas. The analyzer is spanned using dry air from the zero -gas system.

Figure 14-1**Sample Conditioning, Zero-Air, and Span-Gas Systems**

6. PRE-TEST PROCEDURES

- 6.1 Warm-up the instrument according to manufacturer's instructions.
- 6.2 Assemble the sampling system as shown in Figure-14-1.
- 6.3 Leak-test the sampling system by starting the pump, plugging the probe, and determining that the pressure to the analyzer falls to zero. Other leak-tests are acceptable subject to the approval of the Source Test Section.
- 6.4 Introduce cylinder nitrogen, into the analyzer and zero the instrument according to manufacturer's instructions.
- 6.5 Introduce span gas (ambient air is acceptable) into the analyzer and calibrate the instrument according to manufacturer's instructions.
- 6.6 Conduct a preliminary concentration traverse (according to ST-18) to determine if stratification of the stack gases exists. If the O₂ concentration at any point differs from the average concentration by more than 10%, traverse the stack during the test. If not, sample at any single point.
- 6.7 Set-up the chart recorder according to manufacturer's instructions.

7. SAMPLING

- 7.1 Each test run shall be of thirty minute duration when testing from continuous operations. Each test run at a batch process operation shall be for 90 % of the batch time or thirty minutes, whichever is less.
- 7.2 Introduce sample gas into the analyzer at the same flow rate used to calibrate the analyzer.
- 7.3 Maintain ice in the cooling system throughout the test.
- 7.4 Check the span before and after each test run. Record each step of the process clearly on the chart recording.
- 7.5 Do three test runs.

8. CALCULATIONS

- 8.1 Determine the time-averaged concentration of O₂ on a dry basis for each run from the chart recording.

9. REPORTING

- 9.1 These values are determined as auxiliary data for other procedures and shall be reported with those test results.