

444

EMISSION MEASUREMENT CENTER PRELIMINARY TEST METHOD (PRE-002)
444

**Determination of Particulate Matter
(Screening Procedure)**

1. APPLICABILITY AND PRINCIPLE

1.1 Applicability. This method may be used on a case-by-case basis for determining the approximate concentration of particulate matter (PM) from stationary sources. If done correctly, the results may be as good as that obtained by Method 5. However, because isokineticity cannot be confirmed, this method should be used primarily as a screening method to determine concentration to ± 25 percent. The method is limited by the following conditions:

1.1.1 Temperatures above 900°F. This is the limit of the filter.

1.1.2 Flow rate above 5 cfm or sampling train vacuum above 5 in. Hg. The filter is subject to rupture at flow rates above these values.

1.1.3 Saturated wet gas streams. The filter may collapse when wet.

1.2 Principle. The PM is collected isokinetically using an in-stack filter and an in-stack orifice meter. The mass of PM is determined gravimetrically and the volume of sample is determined from the velocity measurements.

2. APPARATUS

Note: Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.1 Sampling Train. A schematic of the sampling train is shown in Figure 1. Most components of the train are available commercially; however, the orifice meter and possibly the nozzles may need to be fabricated. It is suggested that all components be designed and arranged to fit a 3-in. port.

2.1.1 Probe Nozzle. Same as in Section 2.1.1 of Method 5, except nozzles of about 3/8, 5/8, and 1/2 in. should be adequate. The nozzle shall be calibrated as described in Section 5.1.

2.1.2 Filter Holder. Stainless steel (316) with support base and clamp to provide a leak-tight fit for the fiber glass thimble filter.

2.3 Analysis.

2.3.1 Glass Beaker Covers.

2.3.2 Analytical Balance. To measure to ± 1.0 mg.

444
EMTIC CTM-002 EMTIC CONDITIONAL TEST METHOD
Page 3 444

2.3.3 Desiccator, Glass Beakers, Hygrometer, and Temperature Gauge. Same as in Method 5, Sections 2.3.2, 2.3.5, 2.3.6, and 2.3.7, respectively.

3. REAGENTS

3.1 Sampling.

3.1.1 Filters. Glass fiber thimble filters 1.2-in. ID by 3.9-in. length, having at least 99.9 percent efficiency for 0.3- μm particles. The filter should be of seamless construction with sufficient pliancy to allow a leak-tight fit in the filter holder. These filters should not be used above temperatures of 900°F.

3.1.2 Isopropyl Alcohol, 100 Percent. ACS reagent grade.

3.1.3 Water. Deionized distilled.

3.1.4 Sulfuric Acid, 50 Percent V/V. Slowly add concentrated H_2SO_4 to an equal volume of water.

3.2 Sample Recovery.

3.2.1 Acetone. Same as in Section 3.2 of Method 5.

4. PROCEDURE

4.1 Sampling.

4.1.1 Pretest Preparation.

4.1.1.1 The alkali content of the fiber glass thimble filters may be high enough to react with SO_3 and SO_2 to cause a positive bias. Therefore, pretreat these filters as follows: Soak the thimble filters in 50 percent sulfuric acid at 275°F for 2 hr. Soak in 100 percent isopropyl alcohol at 68°F for 30 min, and then in water at 176°F for 30 min. Oven dry at 601°F for 16 hr. Desiccate the thimble filters at $68 \pm 10^\circ\text{F}$ for at least 24 hr and weigh at intervals of at least 6 hr to a constant weight of ± 2 mg for two consecutive weighings. Do not expose the filters for more than 2 min to the laboratory atmosphere. Record this weight to the nearest mg.

4.1.1.2 Check the thimble filters visually for damage and pinhole leaks. Label a container for each individual filter and keep the filter in this container at all times except for sampling and weighing.

4.1.2 Preliminary Determinations.

4.1.2.1 Use Method 1 to select the sampling site and number of sampling points, except eight traverse points in round ducts (four on a diameter) and nine

444

4 444

traverse points in square or rectangular ducts may be used in all cases. Locate the traverse points according to Method 1, except adjust any point such that the filter holder or the orifice meter would not be outside of the duct.

4.1.2.2 Select a sampling time to collect at least 100 mg of samples at the level of the emission standard or a total gas sample volume of at least 100 dscf; sample for at least 2 min per point. Determine the stack temperature and velocity pressure to ensure that the temperature limit would not be exceeded and the proper nozzle size is selected. Measure the stack pressure.

4.1.3 Preparation of Sampling Train. Exercise care to prevent contamination of the sampling train. Place the tared thimble filter on the support base in the filter holder. Install the filter clamp around the filter at the base, and carefully tighten the clamp for a snug fit; be careful not to damage the filter. Keep the thimble filter centered on the support base so that it will not contact the interior filter holder surface. Check the filter for damage after tightening. Replace the filter holder cover and tighten. Set up the train as shown in Figure 1.

4.1.4 Train Fitness Check Procedure. The sampling train cannot be leak checked by closing off the inlet because the thimble filter is fragile and subject to rupture at the maximum vacuum level reached in this sampling train. Therefore, check all the components and connections on the assembled train for a proper and secure fit, especially the filter holder cover, hose clamps, and manometer tubing connections.

4.1.5 Sampling Train Operation.

4.1.5.1 Record all pertinent source and process data on the data sheet (see Figure 2). Because the sampling train does not include a volume meter, isokinetic sampling rates cannot be confirmed. Therefore, care must be taken to set the flow rate. Using the best estimate (from laboratory calibrations) of the orifice meter pressure (P_{om}), calculate the orifice meter differential pressure for isokinetic sampling using the equation in Section 6.3.

4.1.5.2 Before sampling, remove the nozzle cover and position and align the nozzle and probe at the first traverse point. Cover any openings between the probe extension and the port opening to prevent diluting the stack gas stream with outside air. To begin sampling, start the suction-blower and immediately set the rheostat to achieve isokinetic flow. Check the meter orifice vacuum (VAC) and readjust the sampling rate, if necessary.

conditions, dscf.

velocity, ft/min.

sampling time, min.

6.2 Orifice Calibration Coefficient.

$$K_m = \frac{V_d \left[\frac{P_{om} M}{f} \right]^{1/2}}{\left[\frac{f}{P_{om}} \right]^{1/2} H T_m}$$

6.3 Orifice Meter Differential Pressure.

$$\Delta H = 782.5 (C_p/K_m)^2 D_n^4 P (P_s/P_{om})$$

6.4 Stack Gas Velocity.

$$V_s = 5128.8 C_p \sqrt{\Delta H P_{om} / (P_s M)}$$

6.5 Sample Volume as Collected.

$$V_m = A_n V_s \Delta H$$

6.6 Dry Standard Sample Volume.

$$V_{m(std)} = (528 V_m P_s M_d) / (T_s P_b)$$

6.7 Total Particulate Weight.

$$m_t = m_{mfc} + m_{lc}$$

6.8 Particulate Concentration.

$$C_s = m_t / V_{m(std)}$$

7. BIBLIOGRAPHY

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2. Kelly, W.E. Development and Evaluation of an Alternate Particulate Test Procedure for Ammonium Nitrate Facilities. Environmental Protection Agency. Research Triangle Park, NC. April 1977.
3. Rom, Jerome J. Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment. Environmental Protection Agency, Research Triangle Park, NC. APTD-0576. March 1972.

4. Shigehara, R.T., Smith, W.S., and Todd, W.F. A Method of Interpreting Stack Sampling Data, Paper Presented at the 63rd Annual Meeting of the Air Pollution Association. St. Louis, MO. June 1970.
5. All dedicated source samplers who have risked life and limb and long term good health developing methods and equipment in harsh environments.