[6560-01]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 915-5]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Aluminum Industry

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule and notice of public hearing.

SUMMARY: The proposed amendments would require primary aluminum plant performance tests to be conducted at least once each month, allow potroom emissions to be above the level of the current standard (but not above a higher limit of 1.25 kg/Mg (2.5 lb/ton)) if an owner or operator can establish that the emission control system was properly operated at the time the excursion above the current standard occurred, revise the reference method for determining fluoride emissions from potroom roof monitors, and clarify some provisions in the existing standard. These amendments are being proposed in response to arguments raised by four aluminum companies who filed petitions for review of the standard of performance. The intended effect of the proposed amendments is to account for the inherent variability of fluoride emissions from the aluminum reduction process and to require monitoring of fluoride emissions to insure proper operation and maintenance of the pollution control systems.

A public hearing will be held to provide interested persons an opportunity for oral presentation of data, views, or arguments concerning the proposed standards.

DATES: *Comments.* Comments must be received on or before November 20, 1978. *Public hearing.* The public hearing will be held on October 16, 1978, beginning at 9:30 a.m. and ending at 4:30 p.m. *Request to speak at hearing.* Persons wishing to attend the hearing or present oral testimony should contact EPA by October 11, 1978.

ADDRESSES: *Comments.* Comments should be submitted to Jack R. Farmer, Chief, Standards Development Branch (MD-13), Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711.

Public hearing. The public hearing will be held at Waterside Mall, Room 3906, 401 M Street SW., Washington, D.C. 20460. Persons wishing to present oral testimony should notify Mary Jane Clark, Emission Standards and Engineering Division (MD-13), Environmental Protection Agency, Research Triangle Park, N.C. 27711, telephone 919-541-5271.

Standard support document. The support document for the proposed amendments may be obtained from the U.S. EPA Library (MD-35), Research Triangle Park, N.C. 27711, telephone 919-541-2777. Please refer to Primary Aluminum Background Information: Proposed Amendments (EPA-450/2-78-025a).

Docket. The docket, number OAQPS-78-10, is available for public inspection and copying at the EPA Central Docket Section (A-130), Room 2903B, Waterside Mall, 401 M Street SW., Washington, D.C. 20460.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Director, Emission Standards and Engineering Division (MD-13), Environmental Protection Agency, Research Triangle Park, N.C. 27711, telephone 919-541-5271.

SUPPLEMENTARY INFORMATION:

PROPOSED AMENDMENTS

It is proposed to amend Subpart S—Standards of Performance for Primary Aluminum Plants by requiring that performance tests be performed at least once each month during the life of an affected facility. Previously, performance tests were required only as provided in 40 CFR 60.8(a) (i.e., within 60 days after achieving the maximum production rate, but not later than 180 days after initial start- up and at other times as may be required by the Administrator under section 114 of the Clean Air Act). The proposed amendments would also allow potroom emissions to be above the level of the current standard (0.95 kg/Mg (1.9 lb/ton) for prebake plants and 1.0 kg/Mg (2.0 lb/ton) for Soderberg plants), but not above 1.25 kg/Mg (2.5 lb/ton), if an owner or operator can establish that the emission control system was properly operated and maintained at the time the excursion above the current standard occurred. Emissions may not be above 1.25 kg/Mg under any condition. Other amendments would (1) clarify Reference Method 14 procedures; (2) clarify the definition of "potroom group;" (3) replace English and metric units of measure with the International System of Units (SI); (4) allow the owner or operator of a new facility to apply to the Administrator for an exemption from the monthly testing requirement for primary and anode bake plant emissions; and (5) clarify the procedure for determining the rate of aluminum production for fluoride emission calculations.

BACKGROUND

A standard of performance for new primary aluminum plants was promulgated on January 26, 1976 (41 FR 3826), and shortly thereafter petitions for review were filed by four U.S. aluminum companies. The principal argument raised by the petitioners was that the standard was too stringent and could not be consistently complied with by modern, well-controlled facilities. (Facilities which commenced construction prior to October 23, 1974, are not affected by the standard.) Following discussions with the petitioning aluminum companies, EPA conducted an emission test program at the Anaconda Aluminum Co. plant in Sebree, Ky. The Sebree plant is the newest primary aluminum plant in the United States, and its emisssion control system conforms with what EPA has defined as the best technological system of continuous emission reduction for new facilities. The purpose of the test program was to aid EPA in its reevaluation of the standard by expanding the emission data base. The test results were available in August of 1977 and indicated that there is some probability that the result of a performance test conducted at a modern, well-controlled plant would be above the existing standard. EPA has concluded that this justifies revising the standard.

RATIONALE

EPA's decision to amend the existing standard is based primarily on the results of the Sebree test program. The test results may be summarized as follows: (1) The measured emissions were variable, ranging from 0.43 to 1.37 kg/Mg (0.85 to 2.74 lb/ton) for single test runs; and (2) emission variability appeared to be inherent in the production process and beyond the control of plant personnel. Since the Sebree plant represents the latest technology for the aluminum industry, EPA expects that new plants covered by the standard may also exhibit emission variability.

An analysis performed by EPA on the results of the nine Sebree test runs indicates that there is about an 8-percent probability that a performance test would violate the current standard. (A performance test is defined in 40 CFR 60.8(f) as the arithmetic mean of three separate test runs, except in situations where a run must be discounted or canceled and the Administrator approves using the arithmetic mean of two runs.) The petitioners have estimated chances of violation ranging from about 2.5 to 10 percent. Although the Sebree data base is not large enought to permit a thorough statistical analysis, EPA believes it is adequate to demonstrate a need for revising the current standard.

EPA considered a number of possible solutions to the emission variability problem including raising the level of the current standard, allowing a certain number of monthly tests to exceed the current standard based on an expected failure rate, and specifying an equipment standard in place of the current emission standard. These and other possible solutions were rejected because they did not satisfy the following criteria: The revised standard (1) must be enforceable, (2) must provide for the variability of emissions, and (3) must not allow emission levels to be higher than indicated by the Sebree plant, which employs the best system of emission reduction.

The solution EPA proposes is to amend Subpart S to allow a performance test to be above the current standard provided the owner or operator submits to EPA a report clearly demonstrating that the emission control system was properly operated and maintained during the excursion above the standard. The report would be used as evidence that the high emission level resulted from random and uncontrollable emission variability, and that the emission variability was entirely beyond the control of the owner or operator of the affected facility. Under no circumstances, however, would performance test results be allowed above 1.25 kg/Mg (2.5 lb/ton). EPA believes that emissions from a plant equipped with the proper control system which is properly operated and maintained would be below 1.25 kg/Mg at all times.

Within 15 days of receipt of the results of a performance test which fall between the current standard and 1.25 kg/Mg, the owner or operator of the affected facility would be required to submit a report to the Enforcement Division of the appropriate EPA Regional Office indicating that all necessary control devices were on-line and operating properly during the performance test, describing the operation and maintenance procedures followed, and setting forth any explanation for the excess emissions. EPA requests comments on additional criteria to be used by the Regional Offices to determing whether the control devices were properly operated and maintained during the performance test.

The proposed amendments would also require, following the initial performance test required under 40 CFR 60.8(a), additional performance testing at least once each month during the life of the affected facility. During visits to existing plants, EPA personnel have observed that the emission control systems are not always operated and maintained as well as possible. EPA believes that good operation and maintenance of control systems is essential and expects the monthly testing requirement to help achieve this goal. The Administrator has the authority under section 114 of the Clean Air Act to require additional testing if necessary.

It is important to emphasize that the following operating and maintenance procedures are exemplary of good control of emissions and should be implemented at all times: (1) Hood covers should fit properly and be in good repair; (2) if equipped with an adjustable air damper system, the hood exhaust rate for individual pots should be increased whenever hood covers are removed from a pot (the exhaust system should not be overloaded by placing too many pots on high exhaust); (3) hood covers should be replaced as soon as possible after each potroom operation; (4) dust entrainment should be minimized during materials handling operations and sweeping of the working aisles; (5) only tapping crucibles with functional aspirator air return systems (for returning gases under the collection hooding) should be used; and (6) the primary control system should be regularly inspected and properly maintained. EPA believes that the proposed amendments are clearly achievable provided the control system is properly designed and installed and, as a minimum, the six procedures noted above are emplemented.

The proposed amendments affect not only prebake designs, such as the Sebree plant, but also Soderberg plants. Available data for existing plants indicate that Soderberg and prebake plants have similar emission variability. Thus, EPA feels justified in extrapolating its conclusions about the Sebree prebake plant to cover Soderberg designs. It is unlikely that any new Soderberg plant will be built due to the high cost of emission control for these designs. However, existing Soderberg plants may be modified to such an extent that they would be subject to these regulations.

Under the proposed amendments anode bake plants would be subject to the monthly testing requirement, but emissions would not be allowed under any circumstances to be above the level of the current bake plant standard. Since there is no evidence that bake plant emissions are as variable as potroom emissions, there is no need to excuse excursions above the bake plant standard.

The proposed amendments would allow the owner or operator of a new plant to apply to the Administrator for an exemption from the monthly testing requirement for the primary control system and the anode bake plant. EPA believes that the testing of these systems as often as once each month may be unreasonable given that (1) The contribution of primary and bake plant emissions to the total emission rate is minor, averaging about 2.5 and 5 percent, respectively; (2) primary and bake plant emissions are much less variable than secondary emissions; and (3) the cost of primary and bake plant emissions sampling is high. An application to the Administrator for an exemption from monthly testing would be required to include (1) evidence that the primary and bake plant emissions have low variability; (2) an alternative testing schedule; and (3) a representative value for primary emissions to be used in total fluoride emission calculations.

EPA estimates the costs associated with monthly performance testing to average about $4,000 for primary tests, $5,000 for secondary tests, and $4,000 for bake plant tests. These estimates assume that (1) Testing would be performed by plant personnel; (2) each monthly performance test would consist of the average of 3 24-hour runs; (3) sampling would be performed by two crews working 13-hour shifts; (4) primary control system sampling would be performed at a single point in the stack; and (5) Sebree inhouse testing costs would be representative of average costs for other new plants. Although these assumptions may not hold for all situations, EPA believes they provide a representative estimate of what testing costs would be for new plants.

Also amended is the procedure for determining the rate of aluminum production. Previously, the rate was based on the weight of metal tapped during the test period. However, since the weight of metal tapped does not always equal the weight of metal produced, undertapping or overtapping during a test period would result in erroneous porduction rates. EPA believes it would be more reasonable to judge the weight of metal produced according to the average weight of metal tapped during a 30-day period (720 hours) prior to and including the test date. The 3-day period would allow for overtapping and undertapping to average out, and this would give a more accurate estimate of the true production rate.

Other amendments would (1) clarify the definition of potroom group to cover situations where two potroom segments are ducted to a common control system; (2) incorporate use of the International System of Units (SI); and (3) make minor editorial changes in the regulations.

METHOD 14

The proposed amendments to Reference Method 14 would update the test method to reflect EPA's experiences at the Sebree test program. Also, the amendments would make Method 14 consistent with recent revisions of Methods 1 through 8 (42 FR 41754) The intended effect of the proposed amendments is to clarify testing procedures and to improve the reliability of the test method.

The principal amendments would be as follows: (1) More detailed anemometer specifications and calibration procedures would be delineated; (2) a performance check of each anemometer and each recorder (or counter) would be required following each test series (i.e., following each series of test runs as required for a performance test under 40 CFR 60.8(f)); (3) data adjustment procedures would be included for anemometers and recorders (or counters) that fail the performance check; (4) to be consistent with the new definition of "potroom group" more specific guidelines would be included for both the location of the sampling manifold and the number and location of the propeller anemometers; (5) for convenience, each Method 14 test run could be divided into "sub-runs"; (6) the use of a separate Method 13 train for each sub-run would be allowed, provided that the sampling nozzle size for all trains is the same; (7) a procedure would be included for calculating the fluoride concentration when more than one sampling train is used; (8) the tester would be allowed greater freedom as to the method by which velocity estimates are made for setting isokinetic flow; (9) the limits of acceptable isokinetic results would be more clearly defined, and a data adjustment procedure would be included for cases where the results are outside these limits; (10) the number and location of points for the Method 13 sampling runs would be determined according to the revised Method 1; (11) the use of a Type S pitot tube for making manifold intake nozzle adjustments would be disallowed; (12) the use of a differential pressure gauge conforming to the specifications of the revised Method 2 would be required for manifold intake nozzle velocity measurements; and (13) calibration of the thermocouple would be required after each test series, using the procedure outlined in the revised Method 2.

Due to the complexity of the amendments, the entire test method has been rewritten and is presented in revised form.

PUBLIC HEARING

A public hearing will be held to discuss the proposed standards in accordance with section 307(d)(5) of the Clean Air Act. Persons wishing to make oral presentations should contact EPA at the address above. Any member of the public may file a written statement with EPA before, during, or within 30 days after the hearing. Written statements should be addressed to Mr. Jack R. Farmer at the address above.

A verbatim transcript of the hearing and written statements will be available for public inspection and copying during normal working hours at EPA's Central Docket Section in Washington, D.C. (address same as above).

MISCELLANEOUS

The docket is an organized and complete file of all the information submitted to or otherwise considered by EPA in the development of this rulemaking. The principal purposes of the docket are (1) to allow members of the public and industries involved to identify and participate in the rulemaking process, and (2) to serve as the record for judicial review. The docket is required under section 307(d) of the Clean Air Act, as amended, and is available for public inspection and copying at the address above.

The proposed amendments would not alter the applicability date of Subpart S. Subpart S applies to all new primary aluminum plants for which construction or modification began after the original proposal date (October 23, 1974).

As prescribed by section 111 of the Clean Air Act, promulgation of the original standard of performance (41 FR 3826) was preceded by the Administrator's determination that primary aluminum plants contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. In accordance with section 117 of the act, publication of the original proposed standard (39 FR 37739) was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies. The Administrator will welcome comments on all aspects of the proposed regulation, including economic and technological issues, and on the revised test method.

It should be noted that standards of performance for new sources established under section 111 of the Clean Air Act reflect:

> [T]he degree of emission limitation and the percentage reduction achievable through application of the best technological system of continuous emission reduction which (taking into consideration the cost of achieving such emission reduction, any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated (section 111(a)(1).)

Although there may be emission control technology available that can reduce emissions below those levels required to comply with standards of performance, this technology might not be selected as the basis of standards of performance due to costs associated with its use. Accordingly, standards of performance should not be viewed as the ultimate in achievable emission control. In fact, the act requires (or has potential for requiring) the imposition of a more stringent emission standard in several situations.

For example, applicable costs do not necessarily play as prominent a role in determining the "lowest achievable emission rate" for new or modified sources located in nonattainment areas, i.e., those areas where statutorily-mandated health and welfare standards are being violated. In this respect, section 173 of the act requires that a new or modified source constructed in an area which exceeds the National Ambient Air Quality Standard (NAAQS) must reduce emissions to the level which reflects the "lowest achievable emission rate" (LAER), as defined in section 171(3), for such category of source. The statute defines LAER as that rate of emissions which reflects:

> (A) The most stringent emission limitation which is contained in the implementation plan of any State for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable or
>
> (B) The most stringent emission limitation which is achieved in practice by such class or category of source, whichever is more stringent.

In no event can the emission rate exceed any applicable new source performance standard (section 171(3).)

A similar situation may arise under the prevention of significant deterioration of air quality provisions of the act (Part C). These provisions require that certain sources (referred to in section 169(1)) employ "best available control technology" (as defined in section 169(3)) for all pollutants regulated under the act. Best available control technology (BACT) must be determined on a case-by-case basis, taking energy, environmental and economic impacts, and other costs into account. In no event may the application of BACT result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard established pursuant to section 111 (or 112) of the act.

In all events, State implementation plans (SIP's) approved or promulgated under section 110 of the act must provide for the attainment and maintenance of National Ambient Air Quality Standards designed to protect public health and welfare. For this purpose, SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources.

Finally, States are free under section 116 of the act to establish even more stringent emission limits than those established under section 111 or those necessary to attain or maintain the NAAQS under section 110. Accordingly, new sources may in some cases be subject to limitations more stringent than EPA's standards of performance under section 111, and prospective owners and operators of new sources should be aware of this possibility in planning for such facilities.

The major costs incurred by the proposed amendments are associated with the periodic emission testing requirement. EPA believes that these costs are reasonable and would have a negligible impact on: (1) Potential inflationary or recessionary effects; (2) competition with respect to small business; (3) consumer costs; and (4) energy use. The Administrator has determined that the proposed amendments are not "substantial" and do not require preparation of an Economic Impact Assessment.

Dated: September 8, 1978.

DOUGLAS M. COSTLE,
Administrator.

It is proposed to amend Part 60 of Chapter I, Title 40 of the Code of Federal Regulations as follows:

Subpart A—General Provisions

1. Section 60.8 is amended by revising paragraph (d) to read as follows:

§ 60.8 Performance tests.

* * * * *

(d) The owner or operator of an affected facility shall provide the Administrator 30 days prior notice of any performance test, except as specified under other subparts, to afford the Administrator the opportunity to have observers present.

* * * * *

Subpart S—Standards of Performance for Primary Aluminum Plants

2. Section 60.191 is amended by deleting paragraph (i) and by revising paragraphs (d) and (f) as follows:

§ 60.191 Definitions.

* * * * *

(d) "Potroom group" means an uncontrolled potroom, a potroom which is controlled individually, or a group of potrooms or potroom segments ducted to a common control system.

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(f) "Aluminum equivalent" means an amount of aluminum which can be produced from a Mg of anodes produced by an anode bake plant as determined by § 60.195(g).

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3. Section 60.192 is amended by revising paragraph (a) and adding paragraph (b) to read as follows:

§ 60.192 Standards for fluorides.

(a) On and after the date on which the initial performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases containing total fluorides, as measured according to § 60.8, above:

(1) 1.0 kg/Mg (2.0 lb/ton) of aluminum produced for potroom groups at Soderberg plants; except that emissions between 1.0 kg/Mg and 1.25 kg/Mg (2.5 lb/ton) will be considered in compliance if the owner or operator demonstrates that exemplary operation and maintenance procedures were used with respect to the emission control system and that proper control equipment was operating at the affected facility during the performance test;

(2) 0.95 kg/Mg (1.9 lb/ton) of aluminum produced for potroom groups at prebake plants; except that emissions between 0.95 kg/Mg and 1.25 kg/Mg (2.5 lb/ton) will be considered in compliance if the owner or operator demonstrates that exemplary operation and maintenance procedures were used with respect to the emission control system and that proper control equipment was operating at the affected facility during the performance test; and

(3) 0.05 kg/Mg (0.1 lb/ton) of aluminum equivalent for anode bake plants.

(b) Within 15 days of receipt of the results of a performance test which fall between the 1.0 kg/Mg and 1.25 kg/Mg levels in paragraph (a)(1) of this section or between the 0.95 kg/Mg and 1.25 kg/Mg levels in paragraph (a)(2) of this section, the owner or operator shall submit a report indicating whether all necessary control devices were on-line and operating properly during the performance test, describing the operation and maintenance procedures followed, and setting forth any explanation for the excess emissions, to the Director of the Enforcement Division of the appropriate EPA Regional Office.

4. Section 60.195 is amended as follows:

(a) By redesignating paragraphs (a) through (g) as (c) through (i) respectively;

(b) By deleting in redesignated paragraphs (g)(1), (h), and (i) the words "metric ton" wherever they appear and inserting in their place "Mg;"

(c) By deleting "(a)" in redesignated paragraph (e) and inserting in its place "(c);"

(d) By deleting the word "tons" in redesignated paragraph (g)(3) and inserting in its place "Mg;"

(e) By deleting "§ 60.195(d)" in redesignated paragraph (h) and inserting in its place "§ 60.195(f);"

(f) Be deleting "§ 60.195(e)" in redesignated paragraph (i) and inserting in its place "§ 60.195(g);"

(g) By adding new paragraphs (a) and (b), and by revising redesignated paragraph (f) as follows:

§ 60.195 Test methods and procedures.

(a) Following the initial performance test as required under §60.8(a), an owner or operator shall conduct a performance test at least once each month during the life of the affected facility, except when malfunction prevent representative sampling, as provided under § 60.8(c). The owner or operator shall give the Administrator at least 7 days advance notice of each test. The Administrator may require additional testing under section 114 of the Clean Air Act.

(b) An owner or operator may petition the Administrator to establish an alternative testing requirement that requires testing less frequently than once each month for a primary control system or an anode bake plant. If the owner or operator shows that emissions from the primary control system or the anode bake plant have low variability during day-to-day operations, the Administrator may establish such an alternative testing requirement. The alternative testing requirement shall include a testing schedule and, in the case of a primary control system, the method to be used to determine primary control system emissions for the purpose of performance tests. The Administrator shall publish the alternative testing requirement in the FEDERAL REGISTER.

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(f) The rate of aluminum production is determined by dividing 720 hours into the weight of aluminum tapped from the affected facility during a period of 30 days prior to and including the final run of a performance test.

* * * * *

(Sec. 111, 114, 301(a) of the Clean Air Act as amended (42 U.S.C. 7411, 7414, 7601(a)).)

APPENDIX A—REFERENCE METHODS

5. Method 14 is revised to read as follows:

14—DETERMINATION OF FLUORIDE EMISSIONS FROM POTROOM ROOF MONITORS OF PRIMARY ALUMINUM PLANTS

1. *Principle and applicability.*

1.1 *Principle*—Gaseous and particulate fluoride roof monitor emissions are drawn into a permanent sampling manifold through several large nozzles. The sample is transported from the sampling manifold to ground level through a duct. The gas in the duct is sampled using Method 13A or 13B—Determination of Total Fluoride Emissions from Stationary Sources. Effluent velocity and volumetric flow rate are determined with anemometers permanently located in the roof monitor.

1.2 *Applicability*—This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards.

2. *Apparatus.*

2.1 *Velocity measurement apparatus.*

2.1.1 *Anemometers*—Propeller anemometers, or equivalent. Each anemometer shall meet the following specifications: (1) Its propeller shall be made of polystyrene, or similar material of uniform density. To insure uniformity of performance among propellers, it is desirable that all propellers be made from the same mold; (2) the propeller shall be properly balanced, to optimize performance; (3) when the anemometer is mounted horizontally, its threshold velocity shall not exceed 15 m/min (50 fpm); (4) the measurement range of the anemometer shall extend to at least 600 m/min (2,000 fpm); (5) the anemometer shall be able to withstand prolonged exposure to dusty and corrosive environments; one way of achieving this is to continuously purge the bearings of the anemometer with filtered air during operation; (6) all anemometer components shall be properly shielded or encased, such that the performance of the anemometer is uninfluenced by potroom magnetic field effects; (7) a known relationship shall exist between the electrical output signal from the anemometer generator and the propeller shaft rpm, at minimum of three rpm settings between 60 and 1800 rpm; note that one of the three rpm settings shall be within 25 percent of 60 rpm. Anemometers having other types of output signals (e.g., optical) may be used, subject to the appoval of the Administrator. If other types of anemometers are used, there must still be a known relationship (as described above) between output signal and shaft rpm; also, each anemometer must be equipped with a suitable readout system.

2.1.2 *Installation of anemometers*—2.1.2.1 If the affected facility consists of a single, isolated potroom (or potroom segment), install at least one anemometer for every 85 meters of roof monitor length. If the length of the roof monitor divided by 85 meters is not a whole number, round the fraction to the nearest whole number to determine the number of anemometers needed. For monitors that are less than 130 m in length, use at least two anemometers. Divide the monitor cross-section into as many equal areas as anemometers and locate an anemometer at the centroid of each equal area.

2.1.2.2 If the affected facility consists of two or more potrooms (or potroom segments) ducted to a common control device, install anemometers in each potroom (or segment) that contains a sampling manifold. Install at least one anemometer for every 85 meters of roof monitor length of the potroom (or segment). If the potroom (or segment) length divided by 85 is not a whole number, round the fraction to the nearest whole number to determine the number of anemometers needed. If the potroom (or segment) length is less than 130 m, use at least two anemometers. Divide the potroom (or segment) monitor cross-section into as many equal areas as anemometers and locate an anemometer at the centroid of each equal area.

2.1.2.3 At least one anemometer shall be installed in the immediate vicinity (i.e., within 10 m) of the center of the manifold (see § 2.2.1). Make a velocity traverse of the width of the roof monitor where an anemometer is to be placed. This traverse may be made with any suitable low velocity measuring device, and shall be made during normal process operating conditions. Install the anemometer at a point of average velocity along this traverse.

2.1.3 *Recorders*—Recorders, equipped with suitable auxiliary equipment (e.g. transducers) for converting the output signal from each anemometer to a continuous recording of air flow velocity, or to an integrated measure of volumetric flowrate. For the purpose of recording velocity, "continuous" shall mean one readout per 15-minute or shorter time interval. A constant amount of time shall elapse between readings. Volumetric flow rate may be determined by an electrical count of anemometer revolutions. The recorders or counters shall permit identification of the velocities or flowrate measured by each individual anemometer.

2.1.4 *Pitot tube*—Standard-type pitot tube, as described in § 2.7 of Method 2, and having a coefficient of 0.99 ± 0.01.

2.1.5 *Pitot tube (optional)*—Isolated, Type S pitot tube, as described in § 2.1 of Method 2. The pitot tube shall have a known coefficient, determined as outlined in § 4.1 of Method 2.

2.1.6 *Differential pressure gauge.*—Inclined manometer or equivalent, as described in § 2.2 of Method 2.

2.2 *Roof monitor air sampling system.* 2.2.1 *Sampling ductwork*—A minimum of one manifold system shall be installed for each 'potroom group' (as defined in Subpart S, § 60.191). The manifold system and connecting duct shall be permanently installed to draw an air sample from the roof monitor to ground level. A typical installation of duct for drawing a sample from a roof monitor to ground level is shown in figure 14-1. A plan of a manifold system that is located in a roof monitor is shown in figure 14-2. These drawings represent a typical installation for a generalized roof monitor. The dimensions on these figures may be altered slightly to make the manifold system fit into a particular roof monitor, but the general configuration shall be followed. There shall be eight nozzles, each having a diameter of 0.40 to 0.50 meters. Unless otherwise specified by the Administrator, the length of the manifold system from the first nozzle to the eighth shall be 35 meters or eight percent of the length of the potroom (or potroom segment) roof monitor, whichever is greater. The duct leading from the roof monitor manifold shall be round with a diameter of 0.30 to 0.40 meters. As shown in figure 14-2, each of the sample legs of the manifold shall have a device, such as a blast gate or valve, to enable adjustment of flow into each sample nozzle.

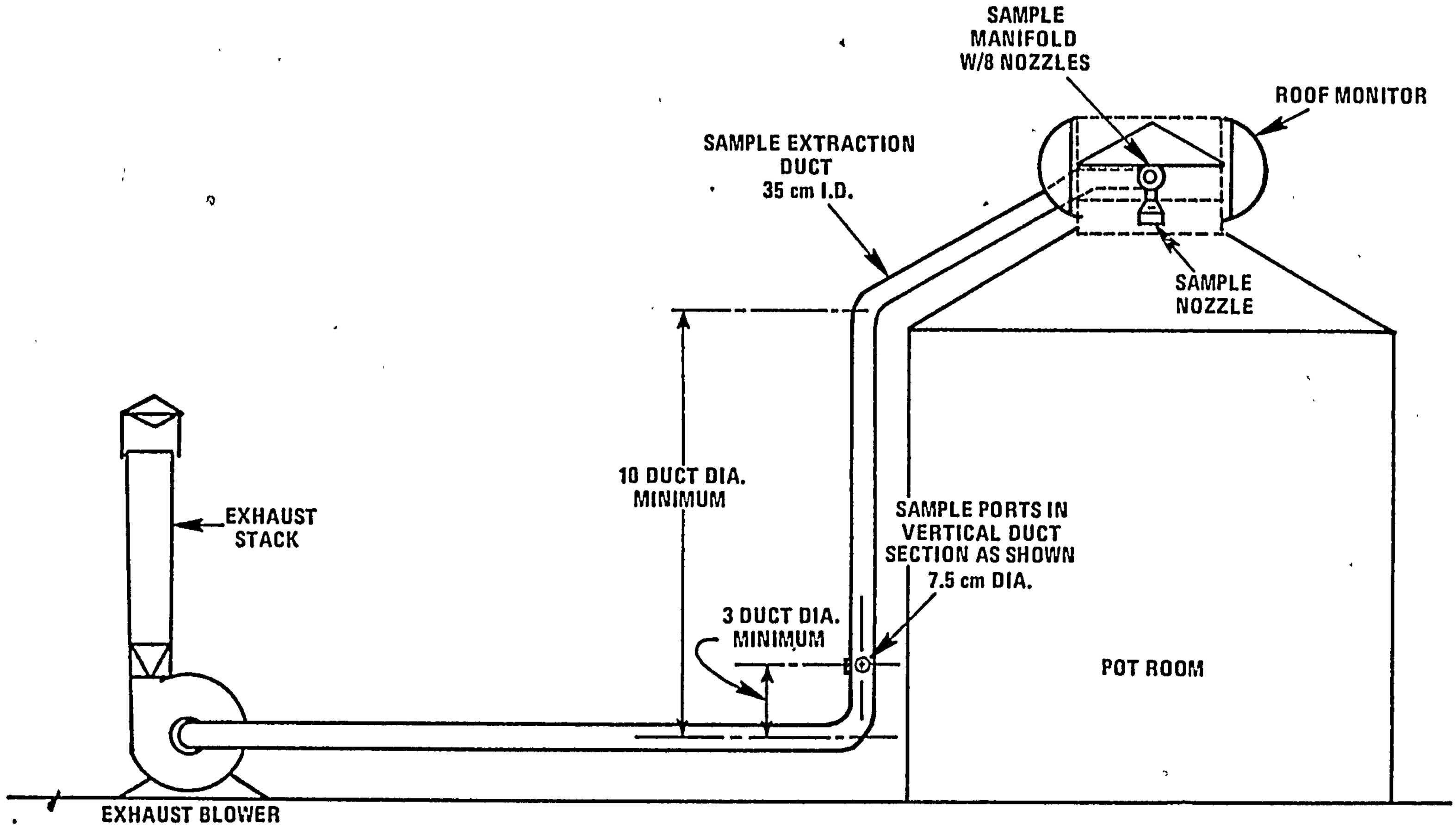

Figure 14-1. Roof monitor sampling system.

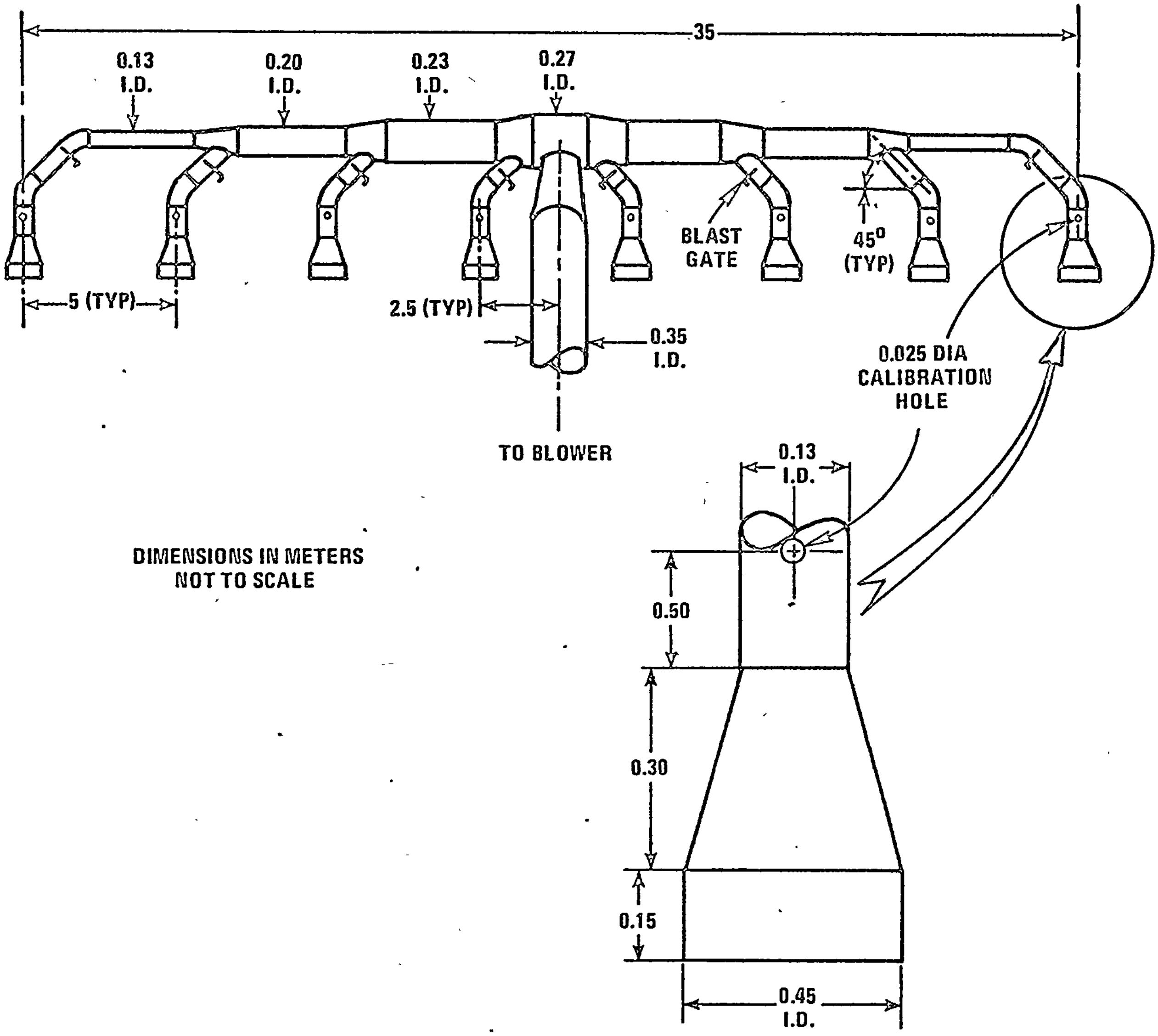

Figure 14-2. Sampling manifold and nozzles.

The manifold shall be located in the immediate vicinity of one of the propeller anemometers (see § 2.1.2.3) and as close as possible to the midsection of the potroom (or potroom segment). Avoid locating the manifold near the end of a potroom or in a section where the aluminum reduction pot arrangement is not typical of the rest of the potroom (or potroom segment). Center the sample nozzles in the throat of the roof monitor (see fig. 14-1). Construct all sample-exposed surfaces within the nozzles, manifold and sample duct of 316 stainless steel. Aluminum may be used if a new ductwork system is conditioned with fluoride-laden roof monitor air for a period of six weeks prior to initial testing. Other materials of construction may be used if it is demonstrated through comparative testing that there is no loss of fluorides in the system. All connections in the ductwork shall be leak free.

Locate two sample ports in a vertical section of the duct between the roof monitor and exhaust fan. The sample ports shall be at least 10 duct diameters downstream and three diameters upstream from any flow disturbance such as a bend or contraction. The two sample ports shall be situated 90° apart. One of the sample ports shall be situated so that the duct can be traversed in the plane of the nearest upstream duct bend.

2.2.2 *Exhaust fan*—An industrial fan or blower shall be attached to the sample duct at ground level (see fig. 14-1). This exhaust fan shall have a capacity such that a large enough volume of air can be pulled through the ductwork to maintain an isokinetic sampling rate in all the sample nozzles for all flow rates normally encountered in the roof monitor.

The exhaust fan volumetric flow rate shall be adjustable so that the roof monitor air can be drawn isokinetically into the sample nozzles. This control of flow may be achieved by a damper on the inlet to the exhauster or by any other workable method.

2.3 *Temperature measurement apparatus.* 2.3.1 *Thermocouple*—Install a thermocouple in the roof monitor near the sample duct. The thermocouple shall conform to the specifications outlined in § 2.3 of Method 2.

2.3.2 *Signal Transducer*—Transducer, to change the thermocouple voltage output to a temperature readout.

2.3.3 *Thermocouple Wire*—To reach from roof monitor to signal transducer and recorder.

2.3.4 *Recorder*—Suitable recorder to monitor the output from the thermocouple signal transducer.

2.4 *Sampling train*—Use the train described in Methods 13A and 13B.

3. *Reagents.*

3.1 *Sampling and analysis.* Use reagents described in Method 13A or 13B.

4. *Calibration.*

4.1 *Propeller anemometers.* 4.1.1 *Initial calibration*—Anemometers which meet the specifications outlined in § 2.1.1 need not be calibrated, provided that a reliable performance curve relating anemometer signal output to air velocity (covering the velocity range of interest) is available from the manufacturer. For the purposes of this method, a "reliable" performance curve is defined as one that has been derived from primary standard calibration data, with the anemometer mounted vertically. "Primary standard" data are obtainable by: (1) Direct calibration of one or more of the anemometers by the National Bureau of Standards (NBS); (2) NBS-traceable calibration; or (3) Calibration by direct measurement of fundamental parameters such as length and time (e.g., by moving the anemometers through still air at measured rates of speed, and recording the output signals). If a reliable performance curve is not available from the manufacturer, such a curve shall be generated, using one of the three methods described immediately above.

4.1.2 *Recalibration*—Extended field use of propeller anemometers can cause deterioration of some of the anemometer components, thus affecting performance. Therefore, a performance-check of each anemometer shall be made before (optional) and after (mandatory) each test series. The performance-check shall be done as outlined in § 4.1.2.1 through 4.1.2.3, below. Alternatively, the tester may use any other suitable method, subject to the approval of the Administrator, that takes into account the signal output, propeller condition and threshold velocity of the anemometer.

4.1.2.1 Check the signal output of the anemometer by using an accurate rpm generator (see fig. 14-3) or synchronous motors to spin the propeller shaft at each of the three rpm settings described in § 2.1.1 above (specification No. 7), and measuring the output signal at each setting. If, at each setting, the output signal is within ±5 percent of its original value, the anemometer can continue to be used. If the anemometer performance is unsatisfactory, the anemometer shall either be replaced or repaired.

4.1.2.2 Check the propeller condition, by visually inspecting the propeller, making note of any significant damage or warpage; damaged or deformed propellers shall be replaced.

4.1.2.3 Check the anemometer threshold velocity as follows: With the anemometer mounted as shown in figure 14-4(A), fasten a known weight (a straight-pin will suffice) to the anemometer propeller, at a fixed distance from the center of the propeller shaft. This will generate a known torque; for example, a 0.1 g weight, placed 10 cm from the center of the shaft, will generate a torque of 1.0 g-cm. If the known torque causes the propeller to rotate downward, approximately 90° (see fig. 14-4(B)), then the known torque is greater than or equal to the starting torque; if the propeller fails to rotate approximately 90°, the known torque is less than the starting torque. By trying different combinations of weight and distance, the starting torque of a particular anemometer can be satisfactorily estimated. Once an estimate of the starting torque has been obtained, the threshold velocity of the anemometer (for horizontal mounting) can be estimated from a graph such as figure 14-5. If the horizontal threshold velocity is acceptable [<16.7m/min (55 fpm), when this technique is used], the anemometer can continue to be used. If the threshold velocity of an anemometer is found to be unacceptably high, the anemometer shall either be replaced or repaired.

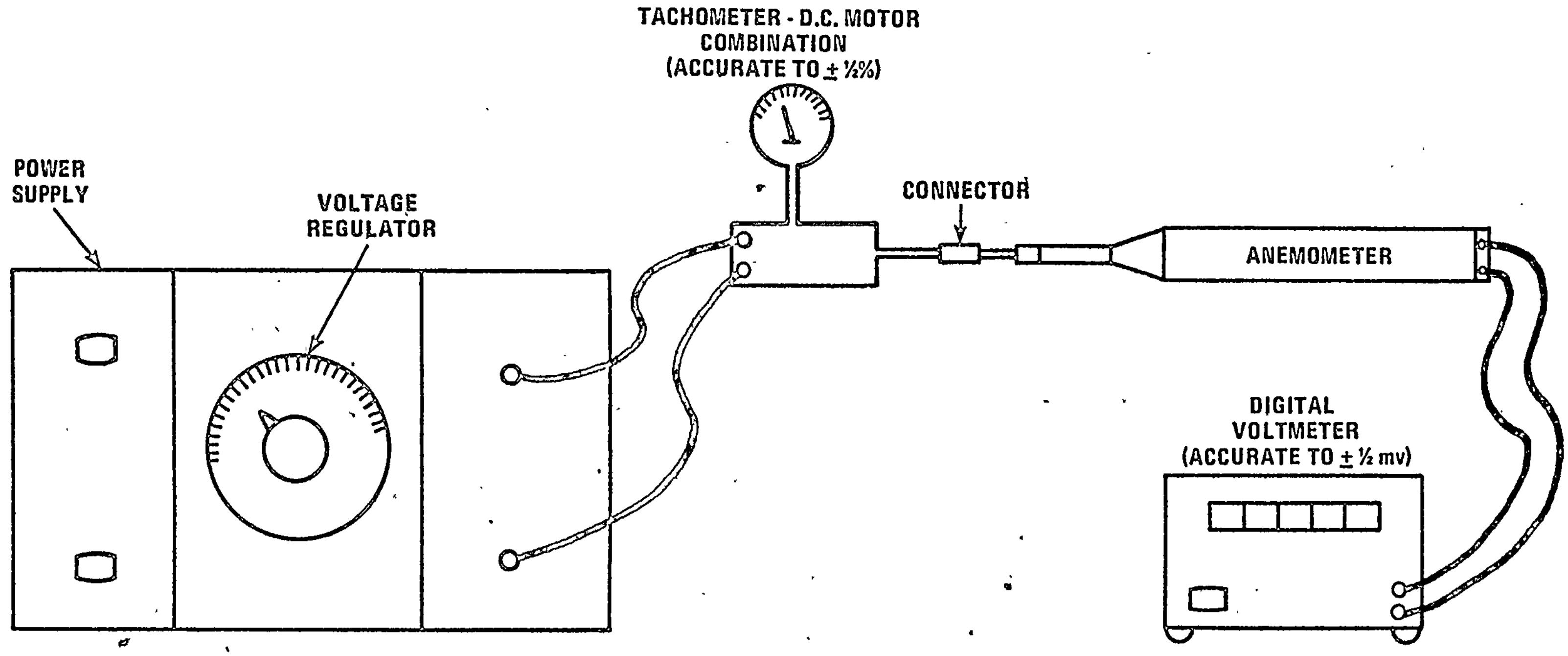

Figure 14-3. Typical RPM generator.

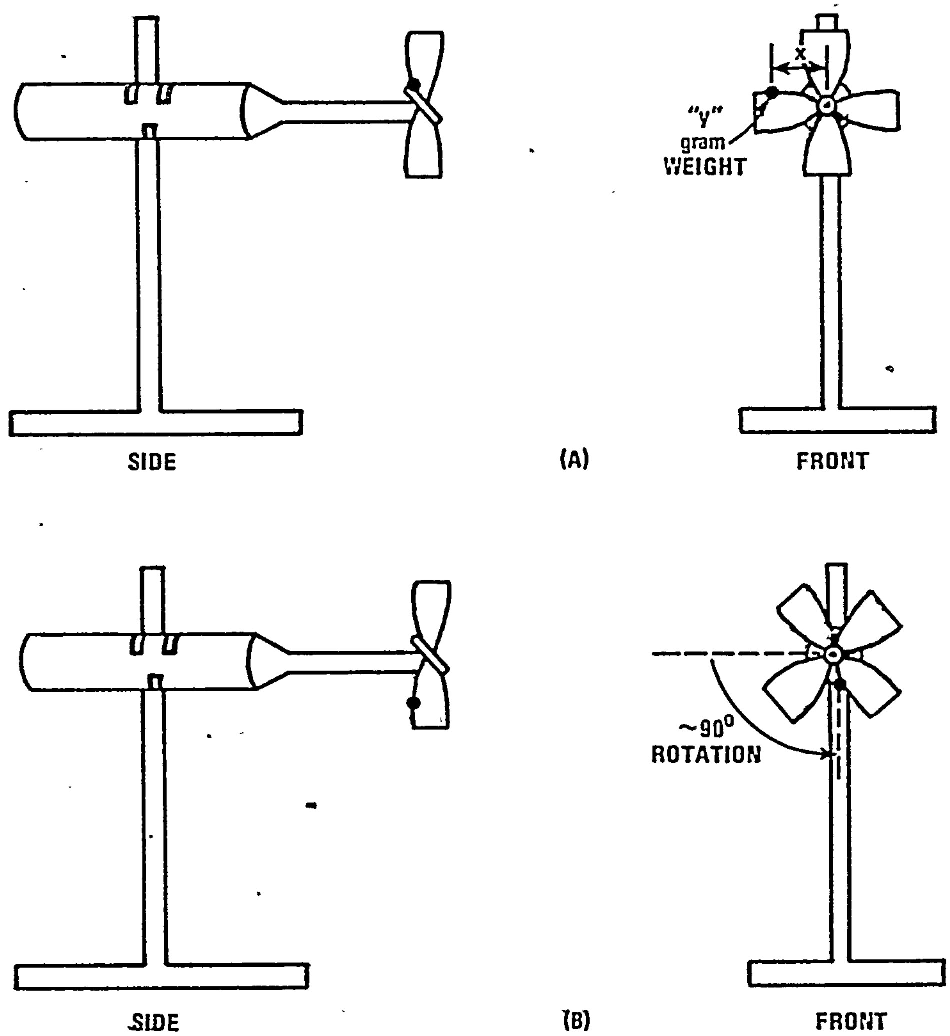

Figure 14-4. Check of anemometer starting torque. A "y" gram weight placed "x" centimeters from center of propeller shaft produces a torque of "xy" g-cm. The minimum torque which produces a 90° (approximately) rotation of the propeller is the "starting torque."

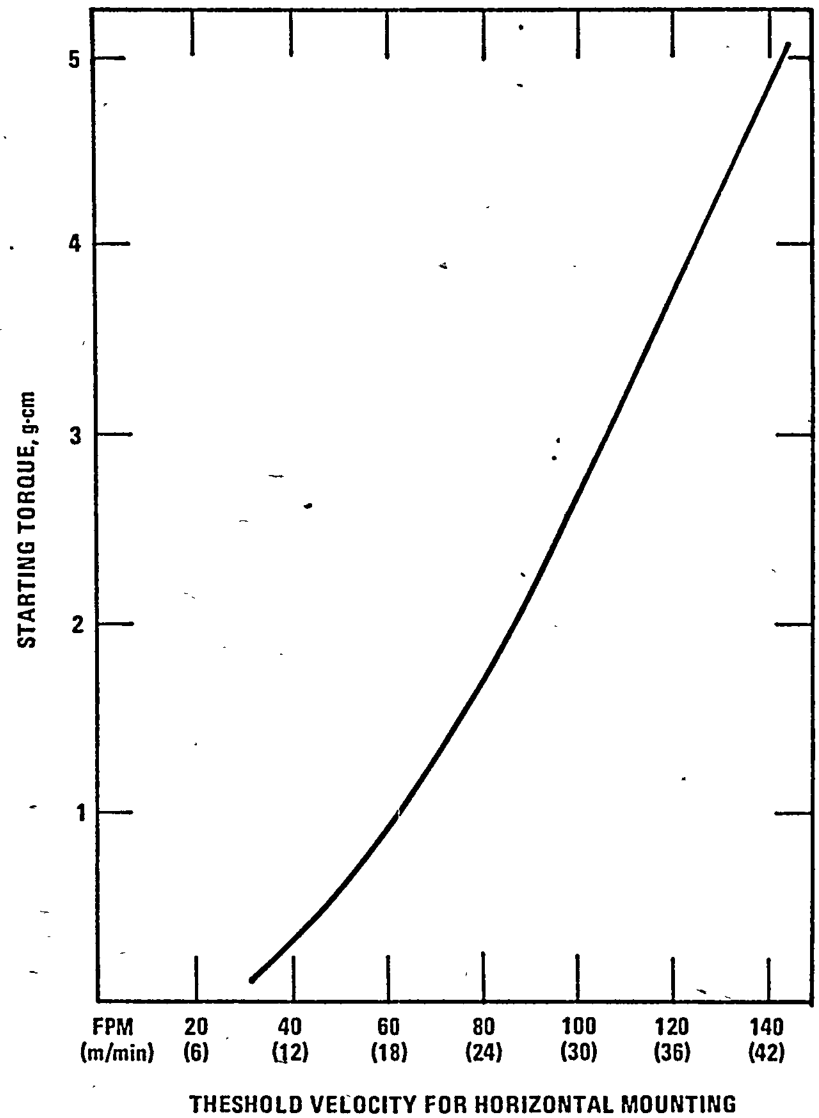

Figure 14-5. Typical curve of starting torque vs horizontal threshold velocity for propeller anemometers. Based on data obtained by R.M. Young Company, May, 1977.

4.1.2.4 If an anemometer fails the post-test performance-check (i.e., if repair or replacement of any anemometer components is necessary), proceed as follows: (1) Calibrate the anemometer (before repairing it), using one of the three methods described in section 4.1.1, above. Alternatively, the anemometer may be calibrated against another propeller anemometer that meets the specifications of section 2.1.1 (a detailed procedure is described in Citation 1 of section 7); (2) referring to the calibration curve obtained in step (1), recalculate (for each run) the average velocity (v) for the anemometer, using the data print-out obtained during the test series; (3) Compare each recalculated value of v against the reported value. If the recalculated value of v is less than the reported value, no adjustment in the reported overall average velocity for the run shall be made. If, however, the recalculated value of v exceeds the reported value, replace the reported value of v with the recalculated value, and then recompute the overall average velocity (and total flowrate).

NOTE.—If the anemometer located in the section of the roof monitor containing the sampling manifold fails the performance check, additional emission rate adjustments may be necessary (see section 6.1).

4.2 *Manifold Intake Nozzles.*—Adjust the exhaust fan to draw a volumetric flow rate (refer to equation 14-1) such that the entrance velocity into each manifold nozzle approximates the average effluent velocity in the roof monitor. Measure the velocity of the air entering each nozzle by inserting a standard pitot tube into a 2.5 cm or less diameter hole (see fig. 14-2) located in the manifold between each blast gate (or valve) and nozzle. Note that a standard pitot tube is used, rather than a type S, to eliminate possible velocity measurement errors due to cross-section blockage in the small (0.13 m diameter) manifold leg ducts. The pitot tube tip shall be positioned at the center of each manifold leg duct. Take care to insure that there is no leakage around the pitot tube, which could affect the indicated velocity in the manoifold leg. If the velocity of air being drawn into each nozzle is not the same, open or close each blast gate (or valve) until the velocity in each nozzle is the same. Fasten each blast gate (or valve) so that it will remain in this position and close the pitot port holes. This calibration shall be performed when the manifold system is installed.

NOTE.—It is recommended that this calibration be repeated at least once a year.

4.3 *Thermocouple.*—After each test series, the thermocouple shall be calibrated, using the procedures outlined in section 4.3 of method 2.

4.4 *Recorders and/or Counters.*—After each test series, check the calibration of each recorder and/or counter that was used (see section 2.1.3). Check the recorder or counter calibration at a minimum of three points, approximately spanning the range of velocities observed during the test series. use the calibration procedures recommended by the manufacturer, or other suitable procedures (subject to the approval of the Administrator). If a recorder or counter is found to be out of calibration, by an average amount greater than 5 percent for the three calibration points, proceed as follows: (1) Based on the results of the post-test calibration check, recalculate (for each run) the average velocity (*v*) for the anemometer that was connected to the recorder during the test series. If a particular recalculated value of v is less than the reported value, no adjustment in the reported overall average velocity for the run shall be made. If, however, the recalculated value of v is greater than the reported value, replace the reported value of v with the recalculated value, and recompute the overall average velocity (and total flowrate).

NOTE.—If the malfunctioning recorder or counter was connected to the anemometer in the section of the roof monitor containing the sampling manifold, additional emission rate adjustments may be necessary (see § 6.1).

5. *Procedure.*

5.1 *Roof Monitor Velocity Determination.* 5.1.1 *Velocity estimate(s) for setting isokinetic flow*—To assist in setting the flow in the manifold sample nozzles to isokinetic, the anticipated average velocity in the section of the roof monitor containing the sampling manifold shall be estimated prior to each test run. The tester may use any convenient means to make this estimate (e.g., the velocity indicated by the anemometer in the section of the roof monitor containing the sampling manifold may be continuously monitored during the 24-hour period prior to the test run.

If there is question as to whether a single estimate of average velocity is adequate for an entire test run (e.g., if velocities are anticipated to be significantly different during different potroom operations), the tester may opt to divide the test run into two or more "sub-runs," and to use a different estimated average velocity for each sub-run (see § 5.3.2.2).

5.1.2 *Velocity determination during a test run.*—During the actual test run, record the velocity or volumetric flowrate readings of each propeller anemometer in the roof monitor. readings shall be taken for each anmometer every 15 minutes or at shorter equal time intervals (or continuously).

5.2 *Temperature recording.* Record the temperature of the roof monitor every 2 hours during the test run.

5.3 *Sampling.* 5.3.1 *Preliminary air flow in duct.*—During the 24 hours preceding the test, turn on the exhaust fan and draw roof monitor air through the manifold duct to condition the ductwork. Adjust the fan to draw a volumetric flow through the duct such that the velocity of gas entering the manifold nozzles approximates the average velocity of the air exiting the roof monitor in the vicinity of the sampling manifold.

5.3.2 *Isokinetic sample rate adjustment(s)*—5.3.2.1 *Initial adjustment.*—Prior to the test run (or first sub-run, if applicable; see §§ 5.1.1 and 5.3.2.2), adjust the fan to provide the necessary volumetric flowrate in the sampling duct, so that air enters the manifold sample nozzles at a velocity equal to the appropriate estimated average velocity determined under § 5.1.1. Equation 14-1 gives the correct stream velocity needed in the duct at the sampling location, in order for sample gas to be drawn isokinetically into the manifold nozzles. Nest, verify that the correct average stream velocity has been achieved, by performing a pitot tube traverse of the sample duct (using either a standard or type S pitot tube); use the procedure outlined in method 2.

$$V_d = \frac{8\,(D_n)^2}{(D_d)^2}\,(V_m)\,\frac{1\ \text{minute}}{60\ \text{sec}} \qquad \text{(Equation 14-1)}$$

Where:

V_d=Desired velocity in duct at sampling location, meters/sec.
D_n=Diameter of a roof monitor manifold nozzle, meters.
D_d=Diameter of duct at sampling location, meters.
V_m=Average velocity of the air stream in the roof monitor, meters/minute, as determined under § 5.1.1.

5.3.2.2 *Adjustments during run.*—If the test run is divided into two or more "sub-runs" (see § 5.1.1), additional isokinetic rate adjustment(s) may become necessary during the run. Any such adjustment shall be made just before the start of a sub-run, using the procedure outlined in § 5.3.2.1 above.

NOTE.—Isokinetic rate adjustments are not permissible during a sub-run.

5.3.3 *Sample train operation.*—Sample the duct using the standard fluoride train and methods described in methods 13A and 13B. Determine the number and location of the sampling points in accordance with method 1. A single train shall be used for the entire sampling run. Alternatively, if two or more sub-runs are performed, a separate train may be used for each sub-run; note, however, that is this option is chosen, the area of the sampling nozzle shall be the same (±2 percent) for each train. If the test run is divided into sub-runs, a complete traverse of the duct shall be performed during each sub-run.

5.3.4 *Time per run.*—Each test run shall last 8 hours or more; if more than one run is to be performed, all runs shall be of approximately the same (±10 percent) length. If question exists as to the representativeness of an 8-hour test, a longer period may be selected. Conduct each run during a period when all normal operations are performed underneath the sampling manifold. During the test period, all pots in the potroom group shall be operated such that emissions are representative of normal operating conditions in the potroom group.

5.3.5 *Sample recovery.*—Use the sample recovery procedures described in method 13A or 13B.

5.4 *Analysis.*—Use the analysis procedures described in method 13A or 13B.

6. *Calculations.*

6.1 *Isokinetic sampling check.* 6.1.1 Calculate the mean velocity (V_m) for the sampling run, as measured by the anemometer in the section of the roof monitor containing the sampling manifold. If two or more sub-runs have been performed, the tester may opt to calculate the mean velocity for each sub-run.

6.1.2 Using equation 14-1, calculate the expected average velocity (V_d) in the sampling duct, corresponding to each value of V_m obtained under § 6.1.1.

6.1.3 Calculate the actual average velocity (v_s) in the sampling duct for each run or sub-run, according to equation 2-9 of method 2, and using data obtained from method 13.

6.1.4 Express each value of v_s from § 6.1.3 as a percentage of the corresponding V_d value from § 6.1.2.

6.1.4.1 If v_s is less than or equal to 120 percent of V_d, the results are acceptable (note that in cases where the above calculations have been performed for each sub-run, the results are acceptable if the average percentage for all sub-runs is less than or equal to 120 percent)

6.1.4.2 If v_s is more than 120 percent of V_d, multiply the reported emission rate by the following factor:

$$1 + \frac{\frac{100\, v_s}{V_d} - 120}{200}$$

6.2 *Average velocity of roof monitor gases.* Calculate the average roof monitor velocity using all the velocity or volumetric flow readings from § 5.1.2.

6.3 *Roof monitor temperature.* Calculate the mean value of the temperatures recorded in § 5.2.

6.4 *Concentration of fluorides in roof monitor air (in mg F/m³).* 6.4.1 If a single sampling train was used throughout the run, calculate the average fluoride concentration for the roof monitor using equation 13A-5 of method 13A.

6.4.2 If two or more sampling trains were used (i.e., one per sub-run), calculate the average fluoride concentration for the run, as follows:

$$\bar{C}_s = \frac{\sum_{i=1}^{n} (F_t)_i}{\sum_{i=1}^{n} (V_{m(std)})_i} \qquad \text{(Equation 14-2)}$$

where:

C_s=Average fluoride concentration in roof monitor air, mg F/dscm.

$(F_t)_i$=Total fluoride mass collected during a particular sub-run, mg F (from equation 13A-4 of method 13A or equation 13B-1 of method 13B).

$(V_{m(std)})_i$=Total volume of sample gas passing through the dry gas meter during a particular sub-run, dscm (see equation 13A-1 of method 13A).

n=Total number of sub-runs.

6.5 Average volumetric flow from the roof monitor of the potroom(s) (or potroom segment(s)) containing the anemometers is given by equation 14-3.

$$Q_m = \frac{V_{mt}\,(A)\,(M_d)\,P_m\,(293°K)}{(T_m + 273°)\,(760\text{ mm Hg})} \qquad \text{(Equation 14-3)}$$

where:

Q_m=Average volumetric flow from roof monitor at standard conditions on a dry basis, m³/min.

A=Roof monitor open area, m².

V_{mt}=Average velocity of air in the roof monitor, meters/minute, from § 6.2.

P_m=Pressure in the roof monitor; equal to barometric pressure for this application, mm Hg.

T_m=Roof monitor temperature, °C, from § 6.3.

M_d=Mole fraction of dry gas, which is given by:

$$M_d = \frac{100-100(B_{ws})}{100}$$

NOTE.—B_{ws} is the proportion by volume of water vapor in the gas stream, from equation 13A-3, method 13A.

7. *Bibliography.*

1. A Simplified Procedure for Conducting Post-Test Calibration Checks of Propeller Anemometers. U.S. Environmental Protection Agency, Emission Measurement Branch. Research Triangle Park, N.C. July 1978.

2. Shigehara, R. T. A Guideline for Evaluating Compliance Test Results (Isokinetic Sampling Rate Criterion). U.S. Environmental Protection Agency, Emission Measurement Branch. Research Triangle Park, N.C. August 1977.

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