SAE International™ **SURFACE VEHICLE STANDARD**

SAE J1792-2 | REAF. APR2007

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Superseding J1792-2 AUG2002

Self-Propelled Sweepers—Air Flow Performance— Part 2: Suction/Blower Fan Performance

1. Scope—This SAE Standard establishes a test method and a definition for disclosing the performance of suction/blower fans when applied to self-propelled sweepers that solely use a pneumatic conveyance means for the collection and transfer of "sweepings" into a collection hopper.

1.1 Purpose—The purpose of the document describes a test practice for measuring the performance of suction/blower fans used in vacuum and regenerative air street sweepers. The measured performance considers the air volume movement versus the static depression developed by the fan across a spectrum of different operating conditions. The document also sets-out to propose a format for the presentation of the test results. The method in this document can be used to disclose or compare particular operating performance criteria under similar conditions.

1.2 Rationale—This document has been reaffirmed to comply with the SAE 5-Year Review policy.

2. Reference

2.1 Applicable Publication—The following publication forms a part of the specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J2130—Self-Propelled Sweepers

3. Definitions

3.1 Sweeper—A self-propelled vacuum or regenerative air street sweeper that is primarily designed to sweep material from highways, parking lots, airport complexes, industrial and construction sites, and during road maintenance work. The sweeper may use broom means to dislodge and direct material into a pneumatic collection mechanism that is the sole means to convey the swept material into a collection hopper.

3.2 Suction/Blower Fan—Centrifugal fan means for developing the required air movement/pressure employed in the sweeper's pneumatic conveyance mechanism.

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4. *Technical Requirements*

4.1 Apparatus Required—Manometer - Pitot tube - Tachometer - Thermometer - Barometer - Hygrometer (see note in 4.4) - test duct.

4.2 Method—The machine shall be set up in its optimum running condition according to the recommendations given in its operator's instruction manual. The hopper filter meshes shall be clean or may be removed. All air ducts shall be clean and free from debris. Wander hoses, drain off hoses, etc., shall be sealed and blanked-off. The suction pick-up nozzle and flexible conduit shall be removed and substituted with a test duct, a suggested test duct and blanking mechanism is shown in Figures 1 and 2.

It is important to monitor the engine and suction/blower fan speed during the test in order that it always runs at a constant speed. Ideally a digital tachometer connected to the engine or actual fan itself shall be used. An instrument giving a precise speed to the nearest revolution per minute is preferred. The running speed of the fan shall be set to a predetermined level for the test and recorded in the results.

The manometer and pitot tube used in the tests measurements shall be checked to ensure the pitot tube is clean and that the manometer and connecting tubes are perfectly sealed with no leakage to atmosphere. If an electronic manometer is used, first ensure that it is calibrated to zero pressure in the inert state. Two small holes shall be provided at 90 degrees to each other in the test duct large enough to permit the insertion of the pitot tube. These holes shall be located mid-way along the test duct to ensure minimum turbulence within the air-stream.

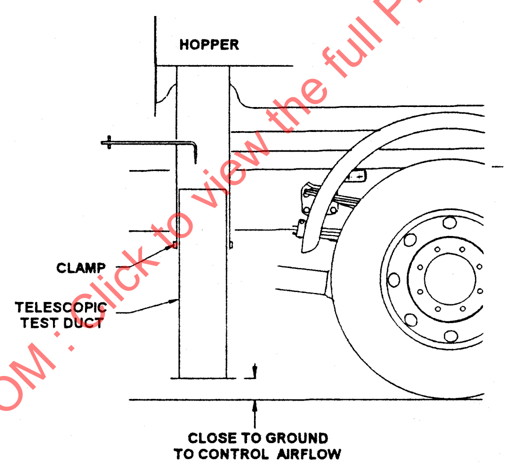


FIGURE 1—SUGGESTED TEST DUCT

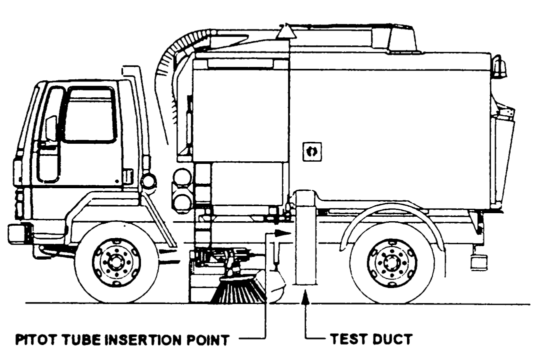


FIGURE 2—TEST DUCT SET-UP

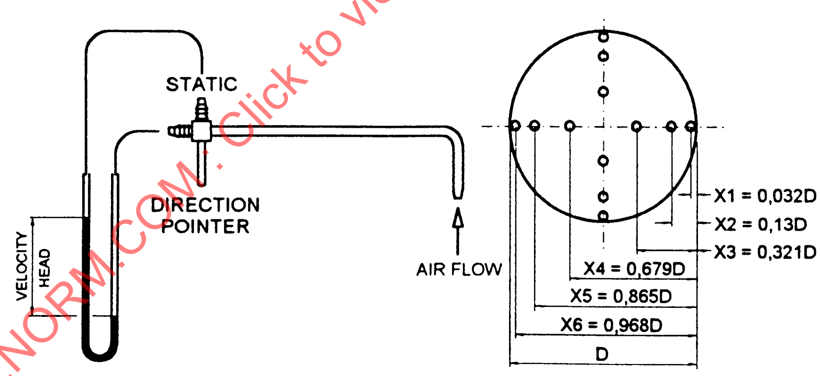
The ambient temperature shall be recorded before and after the tests in order that results may be corrected to a standard of 20 °C (68 °F). Barometric pressure shall also be recorded so that corrections may be made to a standard of 760 mm Hg or 1013 mb (norm at sea level). Corrections for temperature and barometric pressure will ensure that quantifiable comparative data is available to a common standard.

The pitot tube shall have a calibrated scale marked with six positions—refer to Figure 3, according to the internal size of the test duct being used. The pitot tube is then inserted into the test duct with the probe pointing into the air-stream within 5 degrees of the duct axis. Velocity head pressure readings are then read from the manometer at each of the twelve positions, six for each pass (or hole). Readings taken are the total velocity head (in millimeters water gauge), shown on the manometer. From these twelve results, the average velocity head and hence air flow velocity and volume shall be calculated based on the duct's cross-sectional area. Prior to and after the test pass, the static pressure within the 'eye' of the fan shall be recorded.

The test process shall be repeated a number of times, each time with the test duct inlet progressively blanked by moving it nearer to the ground to reduce and inhibit air flow into it. Each time the negative pressure within the 'eye' of the fan shall be recorded before and after each test pass.

Care must be taken while measuring the velocity head readings to ensure that the pitot tube is held parallel to the walls of the duct. This may be checked by reference to the direction pointer on the tail of the pitot tube (this points in the same direction to the pitot probe).

The static depression shall also be measured within the duct in order to make a correction for air density by connecting the side holes in the pitot tube only to the manometer, leaving the other side open to atmosphere. The total deflection (in millimeters water gauge) shall again then be read from the manometer. Note that in this application the reading will be a negative pressure and shall be used as such when applying the formulae for correction of duct depression.



D = Inside diameter of test duct

FIGURE 3—PITOT TUBE POSITIONS FOR A SIX-POINT PASS IN CIRCULAR DUCTS

4.3 Results Tabulation—The test results can be typically recorded in the format shown in Figure 4, the corrected values would be derived by the calculation methods given in 4.4.

Test No.	Fan Speed (rpm)	Uncorrected Pitot Velocity Head Readings (mm H_2O)													Corrected Values (20 °C/1013mb)			
		First Pass (first hole)						Second Pass (second hole)						Fan Inlet Pressure (mm H_2O)	Average Vel. Head (mm H_2O)	Test Duct Air Vel. (m/sec)	Test Duct Air Vol. (m^3/sec)	Fan Inlet Pressure (mm H_2O)
		x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}					
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FIGURE 4—RESULTS CALCULATION

4.4 Calculations—See Equations 1 to 6.

$$\text{Average velocity head (in mm } H_2O) = \sqrt{\frac{\Sigma x_n^2}{12}} \qquad \text{(Eq. 1)}$$

$$\text{Correction for temperature (correct to 20 °C)} = \frac{\text{ambient temp. (°C)} + 273}{293} \qquad \text{(Eq. 2)}$$

$$\begin{matrix}\text{Correction for barometric pressure} \\ \text{(correct to 1013 mb – sea level)}\end{matrix} = \frac{1013}{\text{barometric pressure (mb)}} \qquad \text{(Eq. 3)}$$

$$\begin{matrix}\text{Correction for duct depression} \\ \text{(correct to std. density)}\end{matrix} = \frac{10363}{10363 + \text{static depression (mm } H_2O) \text{ in test duct}} \qquad \text{(Eq. 4)}$$

$$\text{Air velocity in duct (m/s)} = \begin{matrix} 4.032 \times \sqrt{(1) \times (2) \times (3) \times (4)} \\ \text{(multiply by 196.8 to convert m/s to ft/min)}\end{matrix} \qquad \text{(Eq. 5)}$$

$$\text{Volume of conveying air } (m^3/s) = \begin{matrix} (5) \times \text{duct cross section } (m^2) \\ (\text{multiply by 2118.9 to convert } m^3/s \text{ to cfm}) \end{matrix} \qquad \text{(Eq. 6)}$$

NOTE—Corrections may also be made for relative humidity conditions. Usually the results shall be specified at 50% humidity. High humidity will result in lower air volume recordings due to lower density. The effect is often small and can therefore be ignored.