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Method of measuring performance for dust collectors

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

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Method of measuring performance for dust collectors

1 Scope This Japanese Industrial Standard specifies method of measuring performance for dust collectors used for separating dust from gas stream.

Remarks 1 The units and numerical values given in { } in this Standard are based on the traditional unit system and are appended for informative reference.

2 The normative references to this Standard are listed in Attached Table 1.

2 Items of measuring performance for dust collectors The items required for measuring performance for dust collectors should be suitably selected out of the following items:

- (1) Temperature, static pressure and composition of gas in the inlet and outlet ducts of dust collector
- (2) Gas flow rate in the inlet and outlet ducts of dust collector
- (3) Pressure loss of dust collector
- (4) Dust concentration of the gas in the inlet and outlet ducts of dust collector
- (5) Dust flow rate in the inlet and outlet ducts of dust collector
- (6) Collection efficiency or penetration of dust collector
- (7) Specific gravity and particle size distribution of dust in the inlet and outlet ducts of dust collector and collected dust
- (8) Apparent electric resistivity of dust in the inlet duct of dust collector or collected dust
- (9) Quantity of used water and liquid-gas flow rate ratio in dust collector
- (10) Quantity and quality of drainage from dust collector
- (11) Power consumption of dust collector
- (12) Noise of dust collector

3 Definitions Main terms to be used in this Standard shall conform to JIS B 9909.

4 General rules of measuring method The measurement of each item specified in clause 2 shall be conducted by selecting the time when, as a rule, the operating conditions of dust collector and dust generating source are stable.

Further, if there is periodicity in the operating conditions, the measurement should

be conducted at least for the longer term than one period. Referring to the measuring items (1) to (7), their measurements are to be conducted at the inlet and outlet ducts over the same period of time, and their measuring points should be selected, as a rule, according to the provisions of JIS Z 8808. Moreover, the measuring positions should be selected as near as possible to the dust collector, but not so as to affect the accuracy of the measurement and the performance of the dust collector.

5 Measuring method of gas temperature, static pressure and composition in inlet and outlet ducts of dust collector

5.1 Measuring method of temperature Measuring method of gas temperature shall be conducted by means of liquid-in-glass thermometer or electrical thermometer at each measuring point, conforming to JIS Z 8704 or JIS Z 8705, and the results obtained shall be averaged.

5.2 Measuring method of static pressure Static pressure at each measuring point shall be measured by using a Pitot-static tube, and the results obtained shall be averaged. When two static pressure taps are provided on the right and left sides of duct wall, and their readings of the static pressure do not differ so much, then the averaged value may be adoptable.

5.3 Method of analyzing gas composition Gas analysis shall be conducted conforming to the provisions specified in JIS K 0103, JIS K 0104, JIS K 2301, JIS Z 8808, etc.

6 Measuring method of gas flow rate in inlet and outlet ducts of dust collector The gas flow rate shall be measured by means of orifice or nozzle specified in JIS Z 8808 and JIS B 8330, and shall be expressed by converting into any one of the following conditions.

- (1) Wet gas flow rate at the condition of temperature and pressure in the inlet and outlet ducts
- (2) Dry gas flow rate at the condition of temperature and pressure in the inlet and outlet ducts
- (3) Wet gas flow rate at the standard condition [temperature 0 °C, pressure 101.3 kPa {760 mmHg}]
- (4) Dry gas flow rate at the standard condition
- (5) Wet gas flow rate at the specified condition
- (6) Dry gas flow rate at the specified condition

7 Calculating method of pressure loss in dust collector The pressure loss shall be expressed by the difference of the mean total pressures of flow gas between the inlet and outlet ducts of dust collector, and obtained from the total pressure and velocity of flow gas measured with the Pitot tube at each measuring point in the following ways:

$$\Delta p = \bar{p}_{ti} - \bar{p}_{to} + p_H$$

$$\bar{p}_{ti} = \frac{p_{ti1}v_{i1} + p_{ti2}v_{i2} + \dots + p_{tin}v_{in}}{v_{i1} + v_{i2} + \dots + v_{in}}$$

$$\bar{p}_{to} = \frac{p_{to1}v_{o1} + p_{to2}v_{o2} + \dots + p_{ton}v_{on}}{v_{o1} + v_{o2} + \dots + v_{on}}$$

$$p_H = (\rho_a - \rho)gH$$

where Δp : pressure loss (kPa){mmH₂O or kgf/m²}

p_t : total pressure of gas ; that is $p_t = p + p_d$ in which p is static pressure and p_d is dynamic pressure.

Further, if the density of gas is

ρ (kg/m³), and the gas velocity is v (m/s), then $p_d = \frac{\rho}{2}v^2$.

$\bar{p}_t$: mean total pressure in duct (kPa){mmH₂O or kgf/m²}

$p_{t1}, p_{t2}, \dots, p_{tn}$: total pressure of gas at each measuring point in duct (kPa){mmH₂O or kgf/m²}

$v_1, v_2, \dots, v_n$: gas velocity at each measuring point in duct (m/s).

Suffix "i" indicates various quantities at the inlet duct, while "o" indicates that at the outlet duct.

p_H : correction value due to buoyancy of high temperature gas (kPa){mmH₂O or kgf/m²}

ρ_a : density of atmosphere (kg/m³)

g : acceleration of gravity (m/s²)

H : difference of altitude of measuring points at the inlet and outlet ducts (m)

Further, concerning the difference of the mean total pressures of the inlet and outlet ducts, the static pressure difference may be used by correcting the dynamic pressure difference due to the difference between the measuring sectional areas of the inlet and outlet ducts, as follows :

$$\bar{p}_{ti} - \bar{p}_{to} = p_i - p_o + \frac{\rho}{2}v_i^2 \left[1 - \left(\frac{A_i}{A_o} \right)^2 \right]$$

where p_i, p_o : mean static pressure of inlet and outlet respectively (kPa){mmH₂O or kgf/m²}

A_i, A_o : sectional area of measuring section of inlet and outlet respectively (m²)

ρ : mean value of density of gases at inlet and outlet (kg/m³)