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**Determination of airborne fibrous
particles — Part 1 : Optical microscopy
method and scanning electron
microscopy method**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Testing Center for Construction Materials (JTCCM)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS K 3850-1** : 2000 is replaced with this Standard.

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JIS K 3850 consists of the following 4 parts under the general title “*Determination of airborne fibrous particles*”:

Part 1 : Optical microscopy method and scanning electron microscopy method

Part 2 : Direct-transfer transmission electron microscopy method

Part 3 : Indirect-transfer transmission electron microscopy method

Part 4 : Determination of asbestos plant emissions—Method by fibre count measurement

Determination of airborne fibrous particles—Part 1 : Optical microscopy method and scanning electron microscopy method

1 Scope This Japanese Industrial Standard specifies the measuring method for airborne fibrous particles. Depending on the kind of airborne fibrous particles, many of which exist, a suitable microscope from among the following is used: phase contrast microscope, phase contrast dispersion microscope, scanning electron microscope or transmitted electron microscope. This part of **JIS K 3850** specifically deals with measuring methods by means of phase contrast microscope, phase contrast dispersion microscope and scanning electron microscope.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this part of **JIS K 3850**. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 1481 *Determination of asbestos in building material products*

JIS B 7551 *Variable area flowmeters*

JIS K 3802 *Technical terms for membranes and membrane processes*

JIS K 8034 *Acetone*

JIS R 3702 *Cover glasses for microscopes*

JIS R 3703 *Slide glasses for microscope*

JIS Z 8122 *Contamination control—Terminology*

JIS Z 8401 *Guide to the rounding of numbers*

3 Terms and definitions For the purposes of this part of **JIS K 3850**, the terms and definitions given in **JIS K 3802** and **JIS Z 8122**, and the following shall apply.

3.1 fibrous particles particles of at least 3 aspect ratio (length/width) which float in the air (see **JIS A 1481**)

3.2 asbestos fibrous silicate minerals (chrysotile) belonging to a serpentine group and fibrous silicate minerals (amosite, crocidolite, tremolite, actinolite and anthophyllite) belonging to an amphibole group among minerals forming rock (see **JIS A 1481**)

3.3 fibre concentration the number of fibrous particles contained in the air of a specific volume (cm³ or L)

Its unit is expressed by f/cm³ (f/cm³ or f/ml) or f/L.

This is called the total fibre concentration since the fibrous particles counted with the phase contrast microscope include organic fibres and inorganic fibres other than asbestos. In the case where the organic fibres are made to disappear through the

use of low temperature incinerator and only the inorganic fibres are left, this concentration is referred to as inorganic fibre concentration.

3.4 polycarbonate filter a filter for collecting particles wherein uniform micropores of 0.02 μm to 2.0 μm diameter are provided on a polycarbonate-made membrane

3.5 backup filter a filter placed on the back side of a collecting filter for reinforcement, prevention of contamination and the like when airborne particles are collected with a collecting filter

NOTE : A glass fibre filter, an acetylacetate membrane filter and the like are used.

3.6 glass fibre filter a woven cloth wherein thin glass fibres of about 0.2 μm to 10 μm diameter are laminated

NOTE : There are glass fibre filters of various kinds of collecting efficiency as a particle collecting filter.

3.7 eyepiece graticule a circular transparent glass plate which is installed near the eyepiece of a phase contrast microscope, and projects necessary information (the range for limiting a visual field, standard scale and the like) in the visual field so that the observation and counting with the microscope can be easily carried out

NOTE : Various eyepiece graticules are available according to the purpose.

4 Classification of measuring methods The method for measuring fibrous particles shall be classified according to each principle as follows. For obtaining the asbestos fibre concentration, the method of counting by means of a phase contrast dispersion microscope in **6.2** or that of a scanning electron microscope in **6.3** shall be used.

a) **Measuring method using phase contrast microscope** The object of this phase contrast microscope and the summary of its procedure are as follows.

- 1) **Object of determination** This determination method is the general method to determine the airborne fibrous particles by using a phase contrast microscope, and the results obtained is expressed by the total fibre concentration.
- 2) **Summary** Fibrous particles floating in the air are collected with the filter specified in **5.1 a)**, and the filter is made transparent by permeation of acetone vapor. Thereafter, the number of fibrous particles on the filter is counted with the phase contrast microscope to measure the fibre concentration.

b) **Phase contrast dispersion microscopy method** The object and summary of determination of phase contrast dispersion microscopy method shall be as follows.

- 1) **Object of determination** This determination method is the method to obtain the fibre concentration by using a phase contrast dispersion microscope based on the index of refraction of asbestos. When the index of refraction of fibrous particles to be object is known, it can be used to obtain the fibre concentration.

- 2) **Summary of determination** This determination method is as follows: the fibrous particles suspending in the air are collected in the filter specified in 5.1 a) and the filter is fixed. Then the filter is incinerated by using a low temperature incinerator and the immersion liquid corresponding to the index of refraction of asbestos is dropped on it. The number of asbestos on the slide glass is counted and the fibre concentration of asbestos is determined. The fibre concentration to be the object can be also obtained by using the immersion liquid corresponding to the index of refraction of the fibrous particles to be the object.

Moreover, when the fibrous particles specified in 6.1.3 a) are counted without utilizing the index of refraction of fibrous particles, this determination method can obtain the results as the total fibrous particles.

- c) **Measuring method using scanning electron microscope** The object and summary of determination of measuring method using scanning electron microscope shall be as follows.

- 1) **Objective range** This is a method of measuring fibrous particles such as asbestos or the like by means of a scanning electron microscope. This is effective especially when asbestos and other fibres are counted while they are being identified, or when fibres finer than those measured with a phase contrast microscope are contained.
- 2) **Summary** Fibrous particles floating in the air are collected with the filter specified in 5.1 a), and converted to an observation sample by a scanning electron microscope. The class, number, size and the like of asbestos and other fibres on the observation sample are measured with a scanning electron microscope.

5 Collection of airborne fibrous particles

5.1 Sample collector The construction of the sample collector shall be as shown in figure 1 and that of personal sample collector, as shown in figure 2. The components of the sample collector are shown in the following.

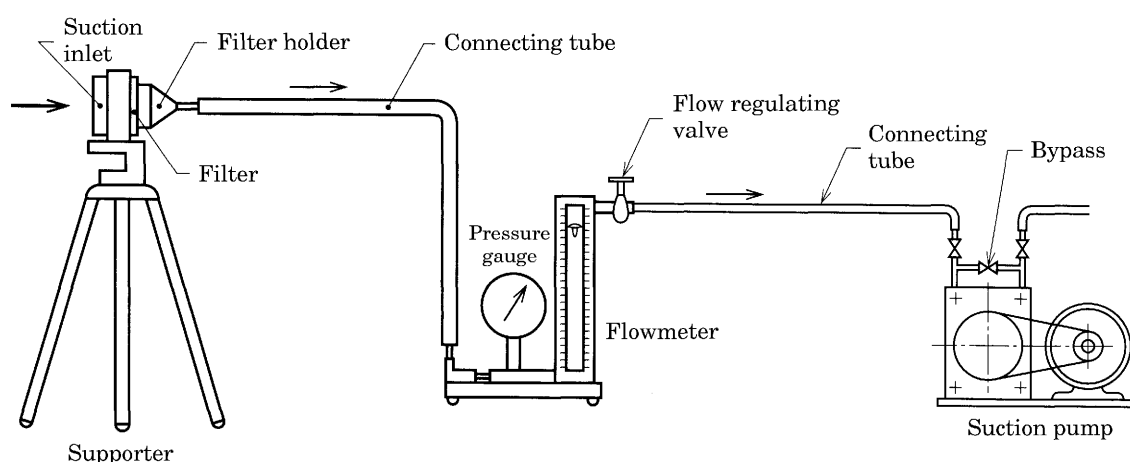


Figure 1 Structure of sample collector

- a) **Filter** A filter shall be the filter (membrane filter) of cellulose ester of ≥ 99 % of collection efficiency to particles of $0.3\text{ }\mu\text{m}$ diameter.

Further, in the case of the polycarbonate filter method of the scanning electron microscope method specified in **6.3.2 a)**, it shall be the filter wherein gold or carbon is vacuum-evaporated onto a polycarbonate filter of $0.8\text{ }\mu\text{m}$ pore diameter.

NOTE : The membrane filter used for measurement of asbestos is generally that of $0.8\text{ }\mu\text{m}$ pore diameter.

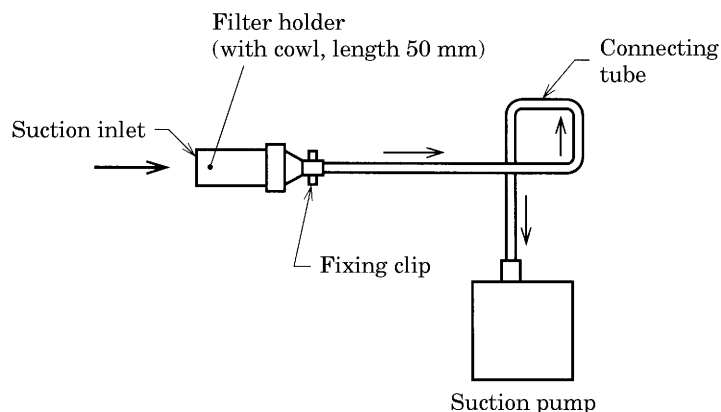


Figure 2 Example of construction of personal sample collector

- b) **Filter holder** A filter holder corresponding to the size of a filter shall be used, which is so constructed that the filter can be easily detached or attached and perfectly sealed.

Examples of open face type filter holder with cowl and open face type filter holder are shown in figures 3 and an example of disposable open face type filter holder is shown in figure 4.

- 1) The type 2 of the open face filter holder given in figure 4 has a filter holder which helps to protect the filter from sudden contamination. The suction nozzle is preferably made of plastics to which fibres are not likely to stick by influences of static electricity.
 - 2) When the open face type filter holder type 2 given in figure 4 is used, cares shall be taken for deformation, breakage and the like of filter paper as a backup.
 - 3) When the polycarbonate filter is used, a glass fibre filter or a membrane filter shall be used as a backup filter for the purposes of reinforcement and prevention of contamination.
- c) **Flowmeter** As the flowmeter, the variable area flowmeter specified in **JIS B 7551** or a flowmeter that has been calibrated by a reference flowmeter shall be used.
- d) **Suction pump** The suction pump shall have the intended suction volume and suction pressure, be free from pulsation, and withstand continuous operation for a long time.