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**Clean room garment - Methods
for sizing and counting particle
contaminants in and on clean
room garments**

ICS 19.120

Descriptors : clean rooms, clothing, uniforms, contaminants, particle size
measurement, particulate air pollutants

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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 Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently, JIS B 9923: 1986 has been revised and replaced with this Standard.

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Clean room garment—Methods for sizing and counting particle contaminants in and on clean room garments

1 Scope This Japanese Industrial Standard specifies the measuring methods for particles having diameter of 5 μm or over to and smaller than 50 μm , and of 50 μm or larger, and fibers 100 μm or larger in length, and for the number of separable particles having diameters of 0.5 μm or larger, 1 μm or larger, and 5 μm or larger attached in and on the stuff of clean room garments ⁽¹⁾ made of cloth used in clean rooms (hereafter referred to as “clean garments”).

Note ⁽¹⁾ The clean room garments mean working clothes for use in clean rooms comprising a continuous garments, a set of upper and lower garments, and a coat.

Remarks 1 The normative references to this Standard are as follows.

JIS B 8330 *Testing methods for turbo-fans blowers*

JIS B 9921 *Light scattering automatic particle counter*

JIS K 8593 *Petroleum ether*

JIS K 8839 *2-Propanol*

JIS K 8848 *Hexane*

JIS P 0138 *Trimmed sizes of paper*

JIS Z 8122 *Contamination control—Vocabulary*

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

2 Definitions The definitions of the main terms used in this Standard are as specified in JIS Z 8122.

3 Measuring environment The measuring environment for particles attached to clean garments shall have a cleanness equivalent or superior to that of the clean room in which the clean garment is used.

4 Kind of measuring methods The measuring methods shall be classified into the following two methods:

- (1) **Microscopic method** This method is performed as follows: Pass sufficiently clean air for 1 min at a rate of $14 \times 10^{-3} \text{ m}^3$ (14 l) per minute through an area of $0.960 \times 10^{-3} \text{ m}^2$ (960 mm^2) for each position of each sheet of the garment stuff at six specified positions of the garments. Then filter with a measuring membrane filter the air which has passed through the working garment and contains particles separable from the clean garment and collect the particles exfoliated from the garment on the filter surface, and count by a microscope the number of particles of 5 μm or over to and smaller than 50 μm and 50 μm or larger and the number of fibers of 100 μm or larger in length.

- (2) **Light scattering automatic particle counting method** This method is performed as follows: Move a part or the whole of the clean garment under prescribed conditions in a definite clean environment and thereby produce floating dust and measure the cleanness of the supplied air and discharged air by the counter specified in **JIS B 9921**. Thus, find the number of particles per unit volume of the particles exfoliated from the clean garment for respective particle diameter divisions of 0.5 μm or larger, 1 μm or larger, and 5 μm or larger from the change in concentration and the quantity of discharged air.

Remarks: The counter used for measuring the particle concentration of the supplied air and discharged air shall be the same one.

5 Microscopic method

5.1 Appliances used for measurement The following appliances shall be used for measurement.

- (1) **Measuring membrane filter** The measuring membrane filter used for collecting the particles and fibers exfoliated from the clean garment shall have a diameter of 47 mm, apertures of within 0.8 μm and a printed lattice consisting of 3.1 mm squares, and be black in colour.
- (2) **Filter holder with adapter** The filter holder with adapter shall consist of a set of filter holders in which a sheet of the stuff of the specimen clean garment can be fitted and conically clamped between a prefilter holder with a conical inner surface capable of accommodating an air filter and a filter holder with a conical outer surface for accommodating the measuring membrane filter, and there shall be no air leakage in the condition of the two filter holders being fastened together.

The effective filtering area on the measuring membrane filter shall be $929 \times 10^{-3} \text{ m}^2$ (929 mm^2).

- (3) **Tweezers** The tweezers shall have a flat end free from the danger of cutting the filter.
- (4) **Petri dish or slide glass** The petri dish or slide glasses used shall be capable of keeping the measuring membrane filter in a clean condition.
- (5) **Suction pump** The suction pump shall have a sucking capacity of $14 \times 10^{-3} \text{ m}^{-3}$ (14 l) per minute in the condition in which the stuff of the clean garment, measuring membrane filter, and critical orifice or flowmeter are attached.

Informative reference : A vacuum pump having a sucking capacity of 67 kPa {500 mm Hg} or larger may be used.

- (6) **Microscope** The microscope shall have a resolving power sufficient for measuring the minimum particle diameter of 5 μm , have a flat visual field, and meet the following requirements of (a) to (e).
- (a) The combined magnification of the microscope shall be 50 ± 10 and 100 ± 10 , and the magnification of the eyepiece shall be 10 and that of the objective shall be 5 and 10.

- (b) A biocular or monocular microscope shall be used, but a stereo-microscope shall not be used.
 - (c) The moving stage shall be capable of scanning the whole effective filtering area of the measuring membrane filter.
 - (d) The eyepiece micrometer shall have a scale of 10 mm length divided into 100 parts.
 - (e) The illuminator shall be able to illuminate from oblique directions, to change the brightness, to adjust the focus of the condenser lens, and in addition, to change the direction freely.
- (7) **Counter** The counter shall be able to count the number of particles by manual operation.
- (8) **Stage micrometer** The stage micrometer shall have a scale dividing a length of 1 mm into 100 parts.

5.2 Reagents The reagents shall be used after being filtered with a membrane filter with 0.45 μm apertures, and consist of the following:

Distilled water

Isopropyl alcohol The isopropyl alcohol used shall conform to Grade 1 of **JIS K 8839**.

Petroleum ether The petroleum ether used shall conform to guaranteed grade of **JIS K 8593**.

Remarks: As a substitute for petroleum ether, the guaranteed grade hexane of **JIS K 8848** may be used.

5.3 Measuring procedures

5.3.1 Verification and background measurement The verification and background measurement shall be performed as follows:

- (1) **Verification of eyepiece micrometer** Place the stage micrometer on the moving stage and make verification by examining, based on the stage micrometer, the number of micrometers to which the scale mark of the eyepiece micrometer corresponds, with respect to magnification of 50 and 100.

Remarks: The verification of the eyepiece micrometer shall be made cover its entire scale and not be limited to its portions.

- (2) **Background measurement** Measure the background according to the procedures of 5.3.2 to 5.3.5 without attaching the clean garment to the filter holder with adapter. Repeat this operation two times and take the average of the measured values as the background.

5.3.2 Preparatory operation The preparatory operation shall be performed as follows:

- (1) In the measurement of particles attached to the clean garment, the measurer shall wear a

garment for clean room properly by a method to prevent contact with the floor or other furniture.

- (2) Preliminarily clean the filter holder with adapter, tweezers, filter supporting base, and slide glasses at each measurement according to the following order:
 - (a) Remove oil by rinsing with petroleum ether.
 - (b) Thoroughly wash in warm water using a neutral detergent and then rinse with warm water two times.
 - (c) Rinse with filtered, distilled water two times.
 - (d) Remove water by rinsing with filtered isopropyl alcohol. Further, after rinsing with filtered petroleum ether, evaporate.
- (3) Take a sheet of measuring membrane filter out of the container using tweezers and rinse both surfaces with filtered petroleum ether.
- (4) Place the measuring membrane filter with its latticed surface upward on the filter supporting base and attach to the filter holder.
- (5) Connect the filter holder and the critical orifice or flowmeter to the suction pump by using a hose.
- (6) Where the specimen clean garment is packaged, take it out by cutting the package with a sharp cutting tool. In this case, never tear the package.
- (7) Hang the specimen clean garment with a clean hanger or the like at a position facilitating the collection of particles for measurement in a clean environment to prevent contamination during the collection of particles.

5.3.3 Collection of particles The collection of separable particles attached to the clean garment shall be performed as follows:

- (1) The positions for collecting particles separable from the clean garment shall be the 6 positions shown in Fig. 1.

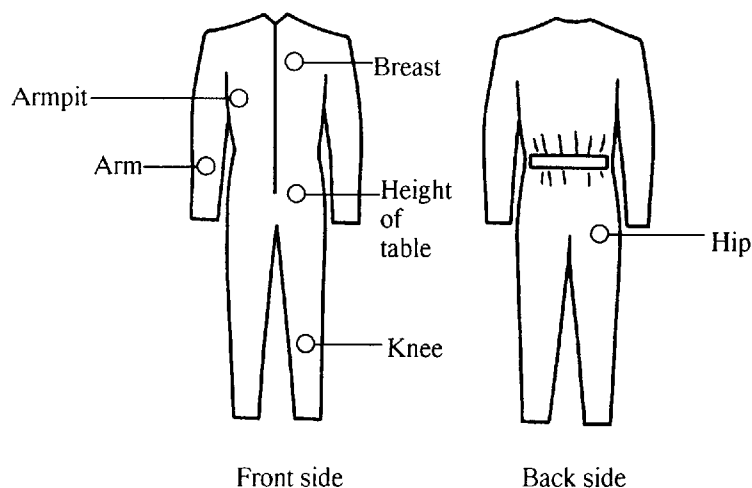


Fig. 1 Positions for collecting particles

- (2) At the respective collecting positions on the specimen clean garment, apply the outer surface of the filter holder attached with a measuring membrane filter (refer to Fig. 2) to the outer surface of the specimen clean garment.

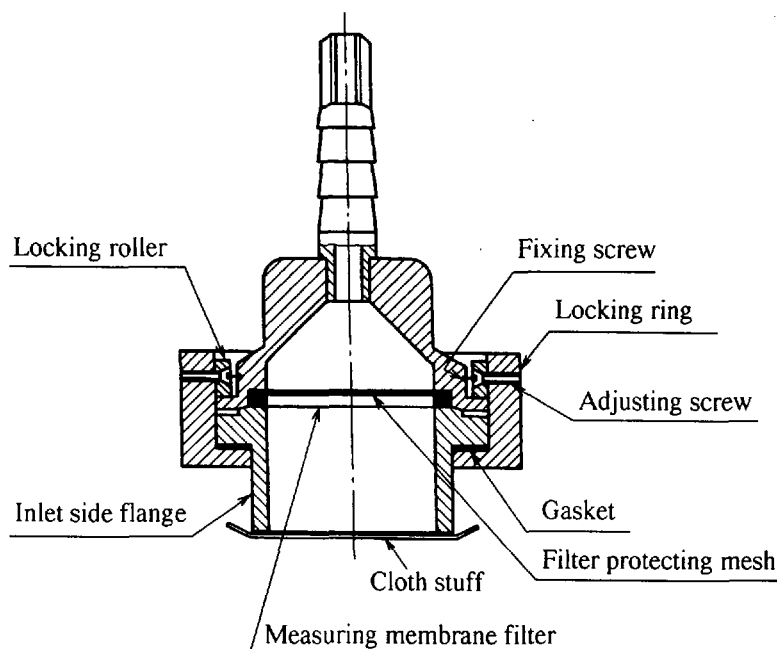


Fig. 2 Filter holder

- (3) The quantity of sucked air shall be the air quantity sucked in 1 min at a flow rate of $14 \times 10^{-3} \text{ m}^3$ per minute at each particle collecting position.

Remarks: Where a flowmeter is used between the filter holder and the vacuum source, the actual flow rate at the standard temperature and the standard pressure shall be determined by carrying out corrections for temperature and pressure.

In this case, the standard temperature shall be at 20 °C and the standard pressure at 101.325 kPa {1 atm.}.

5.3.4 Preservation of measuring membrane filter The measuring membrane filter on which the particles and fibers exfoliated from the clean garment have been collected shall be detached from the filter holder by using tweezers and kept held between clean slide glasses or placed in a petri dish for use as the microscope specimen.

5.3.5 Measurement Measurement shall be carried out according to the following procedures:

- (1) Place the measuring membrane filter carrying out collecting particles and fibrous particles (hereafter referred to as "sample") on the stage of the microscope. In this operation, make the lines of the lattice on the sample agree with the coordinate axes of the moving stage. Where the sample is preserved in a Petri dish, make measurement by detaching the cover as required.