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**Light scattering liquid-borne particle
counter**

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In the event of any doubts arising as to the contents,
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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 of revision of Japanese Industrial Standard submitted by the Japan Air Cleaning Association (JACA)/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 B 9925:1997** is replaced with this Standard.

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Light scattering liquid-borne particle counter

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 21501-2** published in 2007, while modifying some of its technical contents so as to make them easier to understand, as well as to enhance the usability of this Standard.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard describes a calibration and verification method for a light scattering liquid-borne particle counter (hereafter referred to as “particle counter”), which is used to measure the size and number or particle number concentration of particles suspended in liquid. The particle counter specified in this Standard performs single particle measurements, and the typical size range of particles measured by it in the method specified in this Standard is between 0.1 μm and 10 μm in particle size.

NOTE 1 Instruments that conform to this Standard are used for the determination of the cleanliness of pure water and evaluation of cleanliness of chemicals in accordance with **JIS K 0230**.

NOTE 2 The particle size measured by the particle counter is not the actual particle size—it is the light scattering equivalent diameter of the calibration particles suspended in pure water.

The particle size is a diameter of particle and is also called the particle diameter.

NOTE 3 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 21501-2:2007 Determination of particle size distribution—Single particle light interaction methods—Part 2: Light scattering liquid-borne particle counter (MOD)

The symbols which denote the degree of correspondence in the contents in the corresponding International Standard and **JIS** are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standard (including amendments) indicated below shall be applied.

JIS Z 8103	<i>Glossary of terms used in measurement</i>
JIS Z 8122	<i>Contamination control—Terminology</i>
JIS Z 8901	<i>Test powders and test particles</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS Z 8103** and **JIS Z 8122** and the following apply.

3.1 calibration particle

mono-disperse spherical particle with a known mean particle size, e.g. polystyrene latex (PSL) test particle 1, that is specified in **JIS Z 8901**

3.2 size setting

the selection range of a particle counter when it measures the particle number concentration or number of particles by selecting only the larger particle than the specific particle size

The size setting is expressed by the particle size value.

3.3 counting efficiency

ratio of the measured result of a particle counter to that of a reference instrument using the sample which is pure water suspended with calibration particles

3.4 minimum detectable particle size

the smallest particle size that the particle counter is capable of indicating

3.5 pulse height analyzer, PHA

instrument that analyzes the distribution of pulse heights

3.6 size resolution

measure of the ability of an instrument to distinguish between particles of different sizes

3.7 false count rate

count indicated on the counter, even though there is no particle of a size within the measurable range in the measured liquid

3.8 coincidence loss

the counting loss of particles caused when a large number of particles passing at one time through a particle detecting area, or due to processing time of electrical circuit

The higher the particle number concentration contained in the sample is, the greater the coincidence loss that is expected.

3.9 maximum particle number concentration

the maximum particle number concentration at which measurement is possible and which is specified for each individual particle counter

NOTE : This value needs to be uniquely specified for each individual particle counter because the increase of particle number concentration leads to greater coincidence loss, rendering the indication unreliable.

3.10 flow cell

a transparent flow passage used for irradiation of light beams to the sample liquid

4 Measurement principle

When light is irradiated to particles, since particles scatter the light by which they are hit, the size of particles can be measured from the amount of light that is lost due to this scattering, and the number of particles can be counted from the number of pulses of light scattering when particles pass through the luminous flux. More concretely, the sample liquid is introduced into the particle counter through the sample introduction opening at a certain rate and is made to pass through irradiation region of light. The light scattered by individual particles is converged to a photoelectric sensing element and converted to pulse-shaped electric signal. The pulse height of pulse signal is proportional to the scattered quantity of light. The particle size is selected according to the analysis of the value of pulse height by utilizing a definite relation between the scattered quantity of light and the size of floating particles, and the number of pulse-shaped signals is counted by comparing the pulse height value with the set value corresponding to particle size, and the number of particles for every size setting is obtained.

5 Basic constitution

The particle counter consists of a light source unit, irradiation optical system, liquid introducing system, flow cell, scattered light receiving optical system, photoelectric conversion unit, pulse height analyzing unit, display unit as shown in figure 1. In some particle counters, the liquid introducing system and/or the display part are/is not included in the counter.

Further, it shall be possible to take out the information with which peak height distribution of calibration particle can be created.

NOTE : The types of liquid introducing systems include the compression type using air pressure or the like, the suction type which draws liquids by means of a syringe or the like, and the self-flowing type which introduces liquids from the distribution pipe by utilizing the pressure in the pipe.

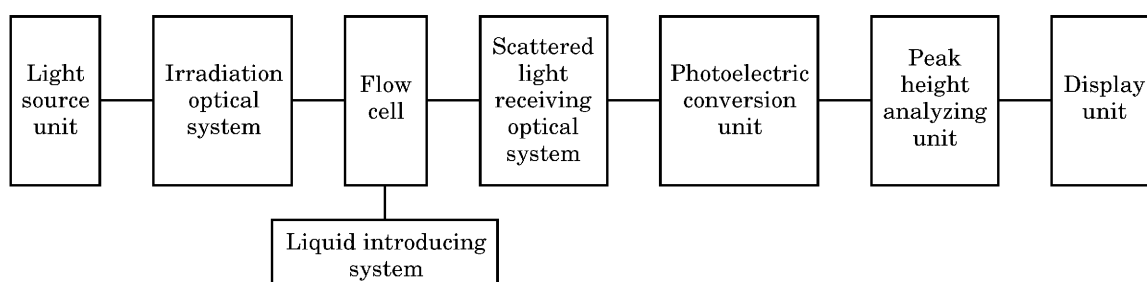


Figure 1 Example of constitution

6 Performance

6.1 Size calibration

Size calibration should be performed in accordance with 7.1.

6.2 Verification of size setting

The reported particle size range setting error of the particle counter shall be equal to or less than $\pm 15\%$ when the test is carried out by the method described in 7.2. The particle size to be the object here is the minimum detectable size or the particle size stated in the specifications.

6.3 Counting efficiency

The counting efficiency, when tested in accordance with 7.3, shall be $(50 \pm 30)\%$ for calibration particles with a size close to the minimum detectable size, and it shall be $(100 \pm 30)\%$ for calibration particles with a size of 1.5 times to 3 times larger than the minimum detectable particle size.

NOTE : If the calibration particle of the particle size strictly equal to the minimum detectable size can not be obtained due to unavailability on the market or for other reasons, a calibration particle of larger but the nearest possible particle size that is available may be used instead.

6.4 Size resolution

The size resolution, when tested in accordance with 7.4, shall not be greater than 10 %.

6.5 False count rate

The false count rate, which is tested in accordance with 7.5, shall be determined by measuring the number of particles in counts per unit volume at the minimum detectable size range and should be reported in the specifications or the like.

6.6 Maximum particle number concentration

The coincidence loss for the maximum particle number concentration shall be calculated by equation (4) given in 7.6, and shall be not greater than 10 %.

NOTE : When the particle number concentration is higher than the maximum particle number concentration, the number of uncounted particles increases because of an enhanced probability of multiple particles existing in the sensing volume and/or saturation of the electronic system.

6.7 Sampling flow rate

The range of sampling flow rate shall be stated in the specifications or the like. The user shall check, by the test specified in 7.7, that the sampling flow rate is within the range of standard uncertainty stated in the specifications, etc.

6.8 Sampling time

The standard uncertainty in the duration of sampling time, when it is tested in accordance with 7.8, shall be equal to or less than $\pm 1\%$ of the preset value.