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**Methods of measurement for airborne
dust concentration in welding
environment**

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Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

In the event of any doubts arising as to the contents,
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Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
3.1 General definitions	2
3.2 Sampling definitions	3
4 Types of measuring methods for mass concentration of airborne particles	4
5 Measurement of mass concentration of airborne particles in the working environment	4
5.1 General	4
5.2 Measuring methods for mass concentration of respirable airborne particles	6
5.3 Measuring method for mass concentration of total airborne particles	12
6 Measurement of personal exposure mass concentration of airborne particles	13
6.1 General	13
6.2 Measuring method for personal exposure mass concentration of respirable airborne particles	13
6.3 Measuring method for personal exposure mass concentration of total airborne particles	17
7 Chemical analysis of sample	18
8 Record of measurement results	19
Annex JA (normative) Expression of measurement results	20
Annex JB (informative) Comparison table between JIS and corresponding International Standard	22

Foreword

This Japanese Industrial Standard has been 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 The Japan Welding Engineering Society (JWES)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS Z 3950** : 2005), which has been technically revised.

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Methods of measurement for airborne dust concentration in welding environment

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 10882-1** : 2011, Edition 2, with some modifications of the technical contents to incorporate the method of airborne particle concentration measurement commonly adopted for welding environment in Japan.

Annex JA is unique to **JIS** and not given in the corresponding International Standard. The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies the procedure for sampling and mass concentration measurement of airborne dust particles in the breathing zone of a person who performs welding and allied processes (the operator) and in the working environment.

NOTE 1 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 10882-1 : 2011 *Health and safety in welding and allied processes — Sampling of airborne particles and gases in the operator's breathing zone — Part 1 : Sampling of airborne particles* (MOD)

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

NOTE 2 Typical allied processes include thermal cutting, grinding, chipping or other works related to welding.

2 Normative references

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

JIS B 7551 *Variable area flowmeters*

JIS K 0083 *Methods for determination of metals in flue gas*

JIS Z 3001 (all parts) *Welding and allied processes — Vocabulary*

JIS Z 3920 *Methods for chemical analysis of welding fumes*

JIS Z 8813 *Measuring methods for suspended particulate matter concentration in*

air-general requirements

JIS Z 8814 Low volume air samplers

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions, and those given in JIS Z 3001 (all parts) apply.

3.1 General definitions

3.1.1

chemical agent

any chemical element or compound, on its own or admixed, as it occurs in the natural state or as produced, used or released

3.1.2

breathing zone

space around the operator's nose and mouth from which breath is taken

Note 1 to entry Technically the breathing zone corresponds to a hemisphere (generally accepted to be 30 cm in radius) extending in front of the human face, centred on the mid point of a line joining the ears. The base of the hemisphere is a plane through this line, the top of the head and the larynx. This technical description is not applicable when respiratory protective equipment is used.

3.1.3

exposure

situation in which airborne particles are present in the air and inhaled by a person

3.1.4

time-weighted average (TWA) concentration

concentration of airborne particles in the atmosphere, averaged over a reference period

3.1.5

total airborne particles

particles collected without the use of particle sizing equipment at a flow velocity of 50 cm/s to 80 cm/s at the sampler inlet

3.1.6

unit workplace

section in a workplace of interest that is necessary for working environment air measurement, and that is determined based on the range of activities of the worker during work, distribution of harmful substances and the like

Note 1 to entry The term is defined in Article 2, paragraph (1), item (i) of the Working Environment Measurement Standards (Public Notice of

Ministry of Labour No. 46, issued on 22 April 1976).

3.2 Sampling definitions

3.2.1

air sampling

process of taking a portion from the working environment air to supply it for airborne particle concentration measurement or analysis

3.2.2

respirable airborne particles

particles which pass through a particle sizing equipment with a 50 % efficiency cut-off at 4 μm particle diameter

3.2.3

limit value

reference value for concentration of airborne particles in air

Note 1 to entry Relevant criteria in Japan are “standard control concentration” defined in Working Environment Evaluation Standards (Public Notice of Ministry of Labour No. 79, issued in 1988) and “threshold limit value” recommended by Japan Society for Occupational Health, and those in the U.S.A. are PEL (Permissible Exposure Limit) defined by OSHA (Occupational Safety and Health Administration, Department of Labor) and TLVs (Threshold Limit Values) recommended by ACGIH (American Conference of Governmental Industrial Hygienists).

3.2.4

personal exposure mass concentration of airborne particles

time-weighted average mass concentration of airborne particles in the breathing zone

3.2.5

mass concentration of airborne particles in the working environment

mass of airborne particles existing in unit volume of air in the workplace under measurement

3.2.6

relative settling diameter

diameter of spherical particles of density 1 g/cm^3 having a behaviour in the air equivalent to that of the particles of interest

3.2.7

permeability, P

rate of airborne particles passing a particle sizing equipment

3.2.8

systematic sampling method

method to select the measuring points at regular intervals and without a bias in the unit workplace

3.2.9

particle sizing equipment

equipment for separating the airborne particles in the air into coarse particles and respirable particles

3.2.10

mass concentration conversion factor, *K* value

factor used to convert the relative concentration measured per 1 min by a relative dust concentration monitor to a mass concentration

4 Types of measuring methods for mass concentration of airborne particles

The airborne particles concentration measurement involves either the measurement in the working environment or of personal exposure of an operator. Types of measuring methods for each measurement are shown in Table 1.

Table 1 Types of measuring methods for mass concentration of airborne particles

Measurement	Measured particles	Types of measuring method	
Measurement in the working environment (Clause 5)	Respirable airborne particles (5.2)	Method by filtration sampler with particle sizing equipment	5.2.1
		Method by light-scattering type relative dust concentration monitor	5.2.2
		Method by piezo-balance type dust monitor	5.2.3
	Total airborne particles (5.3)	Method by filtration sampler	5.3
Measurement of personal exposure (Clause 6)	Respirable airborne particles (6.2)	Method by filtration sampler with particle sizing equipment	6.2.1
		Method by light-scattering type relative dust concentration monitor	6.2.2 6.2.3
	Total airborne particles (6.3)	Method by filtration sampler	6.3

5 Measurement of mass concentration of airborne particles in the working environment

5.1 General

The measurement of airborne particle mass concentration in the working environment for determining the airborne particle concentration distribution in the unit workplace shall be in accordance with **a)** to **e)** below.

a) Definition of range of unit workplace, based on **1)** and **2)** below :

- 1) range of activities of the worker during work;
- 2) stratification of the workplace based on the distribution of harmful substances or the like.

b) Matters concerning sampling

1) Matters to be considered when setting the sampling positions

The following requirements shall be fulfilled in setting the sampling positions :

- selection of the measuring points is not artificial;
- the measuring points are distributed as uniformly as possible over the whole section of the unit workplace.

2) Setting the sampling positions and the number of measurements

Setting the sampling positions and the number of measurements shall be as follows :

- at least five measuring points shall be selected according to the systematic sampling method;
- the measuring points shall be at least 50 cm but not higher than 150 cm above the intersections of the longitudinal and lateral lines drawn on the floor at equal intervals of 6 m or under;
- the number of the measuring points may be less than five if the area of the unit workplace is remarkably narrow (approximately 30 m² or less) and if it is evident that the airborne particles concentration is approximately uniform in the unit workplace (the geometric standard deviation of the measured values from the past working environment air measurements is approximately 1.2 or less). In this case, measurement shall be repeated at each measuring point until five or more measured values in total are obtained for one unit workplace, while ensuring that the number of measurements repeated is the same for all measuring points.
- the time interval between measurements at different measuring points or between repeated measurements at the same measuring point shall be all equal.

c) Measurement Measurements of respirable airborne particles and total airborne particles shall be carried out according to **5.2** and **5.3**, respectively.

d) Timing of measurements The measurements shall be carried out during the period of time when work activities are normally performed.

e) Measured value The measured value shall be expressed as the geometrical average and geometrical standard deviation of measurements.