INTERNATIONAL STANDARD

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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

Hygiène et sécurité en soudage et techniques connexes — Échantillonnage des particules en suspension et des gaz dans la zone respiratoire des opérateurs —

Partie 1: Échantillonnage des particules en suspension

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10882-1 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 9, *Health and safety*.

This second edition cancels and replaces the first edition (ISO 10882-1:2001), which has been technically revised.

ISO 10882 consists of the following parts, under the general title *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*

— *Part 2: Sampling of gases*

Requests for official interpretations of any aspect of this part of ISO 10882 should be directed to the Secretariat of ISO/TC 44/SC 9 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Introduction

The health of workers in many industries is at risk through exposure by inhalation to airborne particles generated by welding and allied processes (welding fume) and other airborne particles generated by welding-related operations, e.g. grinding. Industrial hygienists and other public health professionals need to determine the effectiveness of measures taken to control workers' exposure to these harmful substances and this is generally achieved by making personal exposure measurements.

This part of ISO 10882 specifies a sampling method for welding fume and airborne particles generated by welding-related operations for the purpose of making personal exposure measurements in the operator's breathing zone. It is intended to be of benefit to: agencies concerned with health and safety at work, industrial hygienists and other public health professionals, industrial users of welding and allied processes and their workers, and analytical laboratories.

It has been assumed in the drafting of this part of ISO 10882 that the execution of its provisions, and the interpretation of the results obtained, is entrusted to appropriately qualified and experienced people.

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

1 Scope

This part of ISO 10882 specifies a procedure for sampling airborne particles in the breathing zone of a person who performs welding and allied processes (the operator). It also provides details of relevant standards that specify required characteristics, performance requirements and test methods for workplace air measurement, and augments guidance provided in EN 689 on assessment strategy and measurement strategy. This part of ISO 10882 also specifies a procedure for making gravimetric measurements of personal exposure to airborne particles generated by welding and allied processes (welding fume) and other airborne particles generated by welding-related operations. Additionally, it provides references to suitable methods of chemical analysis, specified in other standards, to determine personal exposure to specific chemical agents present in welding fume and other airborne particles generated by welding-related operations.

The general background level of airborne particles in the workplace atmosphere influences personal exposure and therefore the role of fixed-point sampling is also considered.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15767, *Workplace atmospheres — Controlling and characterizing uncertainty in weighing collected aerosols*

EN 482:2006, *Workplace atmospheres — General requirements for the performance of procedures for the measurement of chemical agents*

EN 689, *Workplace atmospheres — Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy*

EN 13205, *Workplace atmospheres — Assessment of performance of instruments for measurement of airborne particle concentrations*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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, including release as waste, by any work activity, whether or not produced intentionally and whether or not placed on the market

[Council Directive 98/24/EC[19], Art. 2 a)]

3.1.2
breathing zone
space around the nose and mouth from which breath is taken

NOTE 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.

[EN 1540:—[15]]

3.1.3
exposure
〈inhalation〉 situation in which a chemical (or biological) agent is present in the air that is inhaled by a person

[EN 1540:—[15]]

3.1.4
occupational exposure limit value
limit of the time-weighted average of the concentration of a chemical agent in the air within the breathing zone of a worker in relation to a specified reference period

[Council Directive 98/24/EC[19], Art. 2 d)]

NOTE Limit values are mostly set for reference periods of 8 h, but can also be set for shorter periods or concentration excursions. Limit values for gases and vapours are stated in terms independent of temperature and air pressure variables in millilitres per cubic metre and in terms dependent on those variables in milligrams per cubic metre for a temperature of 20 °C and a pressure of 101,3 kPa. Limit values for airborne particles as well as mixtures of particles and vapours are given in milligrams per cubic metre or multiples of that unit for actual environmental conditions (temperature, pressure) at the workplace. Limit values of fibres are given in number of fibres per cubic metre or number of fibres per cubic centimetre for actual environmental conditions (temperature, pressure) at the workplace.

3.1.5
reference period
specified period of time for which the occupational exposure limit value of a chemical or biological agent applies

NOTE The reference period is usually 8 h for long term measurements and 15 min for short term measurements.

[EN 1540:—[15]]

3.1.6
time-weighted average concentration
TWA concentration
concentration of a chemical agent in the atmosphere, averaged over a reference period

[ISO/TR 25901:2007[12]]

3.1.7
total airborne particles
all particles surrounded by air in a given volume of air

NOTE Because all measuring instruments are size selective to some extent, it is often impossible to measure the total airborne particle concentration.

[ISO 7708:1995[5]]

3.1.8
work pattern
sequence of activities carried out by the worker during the period under consideration

3.1.9
workplace
designated area or areas in which the work activities are carried out

[EN 1540:—[15]]

3.2 Sampling definitions

3.2.1
aerosol sampler
(airborne) particle sampler
(airborne) particulate sampler
sampler that is used to transport airborne particles to a collection substrate

NOTE 1 The term aerosol sampler is commonly used although it is not in line with the definition of aerosol given in EN 1540:—[15], 2.2.4.

NOTE 2 The transport can be either active or passive.

[EN 1540:—[15]]

3.2.2
(air) sample
product of the process of air sampling

NOTE An air sample is frequently considered to include the collection substrate(s) as well as the collected chemical and/or biological agents; or sometimes it is considered to be the fractional part of a larger volume of air.

[EN 1540:—[15]]

3.2.3
(air) sampling
process consisting of the separation of chemical and/or biological agents from air onto a collection substrate, or the withdrawal or isolation of a fractional part of a larger volume of air

[EN 1540:—[15]]

3.2.4
collected sample
airborne particles collected on the sampling media (e.g. filter, foam or impaction plate) for subsequent analysis

NOTE Sample deposits in other parts of the sampler such as inner walls are only included in the collected sample where the method description includes specific instructions for the recovery of such deposits.

[EN 15051:2006[17]]

3.2.5
collection substrate
sampling substrate
collection medium
sampling medium
medium on which airborne chemical and/or biological agents are collected for subsequent analysis

NOTE Filters, polyurethane foams and sampling cassettes are examples of collection substrates for airborne particles.

[EN 1540:—[15]]

3.2.6
inhalable fraction
mass fraction of total airborne particles which is inhaled through the nose and mouth

NOTE The inhalable fraction depends on the speed and direction of the air movement, on the rate of breathing and other factors.

[ISO 7708:1995[5]]

3.2.7
inhalable sampler
aerosol sampler that is used to collect the inhalable fraction

[EN 1540:—[15]]

3.2.8
key component of a welding fume
component of a welding fume that has the greatest occupational hygienic significance and therefore requires the most stringent control measures to ensure that a welder is not exposed to an excessive level of the substance concerned, i.e. it is the component whose limit value is exceeded at the lowest welding fume concentration

[ISO 15011-4:2006[6]]

3.2.9
personal sample
product of the process of personal sampling

[EN 1540:—[15]]

3.2.10
personal sampler
personal sampling device
sampler, attached to a person, that collects gases, vapours or airborne particles in the breathing zone to determine exposure to chemical and/or biological agents

[EN 1540:—[15]]

3.2.11
personal sampling
process of (air) sampling carried out using a personal sampler

[EN 1540:—[15]]

3.2.12
respirable fraction
mass fraction of inhaled particles which penetrate to the unciliated airways

[ISO 7708:1995[5]]

3.2.13
respirable sampler
aerosol sampler that is used to collect the respirable fraction

[EN 1540:—[15]]

3.2.14
sampler
(air) sampler
device for separating chemical and/or biological agents from the surrounding air

NOTE (Air) samplers are generally designed for a particular purpose, e.g. for sampling gases and vapours or for sampling airborne particles.

3.2.15
screening measurements of time-weighted average concentration
measurements performed to obtain basic information on the exposure level in order to decide whether an exposure problem exists and if so, to further investigate it

NOTE 1 Screening measurements of time-weighted average concentration can also be used to determine if exposure is well below or well above the limit value.

NOTE 2 Adapted from EN 482:2006.

3.2.16
screening measurements of variation of concentration in time/and or space
measurements performed to provide information on the likely pattern of concentration of chemical agents

NOTE 1 Screening measurements of variation of concentration in time/and or space can be used to identify locations and periods of elevated exposure and to set the duration and frequency of sampling for measurements for comparison with limit values. Emission sources can be located and the effectiveness of ventilation or other technical measures can be estimated.

NOTE 2 Adapted from EN 482:2006.

3.2.17
worst case measurements
screening measurements of time-weighted average concentration made to identify work activity during which highest exposure occurs

NOTE Adapted from EN 482:2006.

3.3 Welding terms

3.3.1
filler material
welding consumable added during welding to form the weld

[ISO/TR 25901:2007[12]]

EXAMPLES Welding rods, wire, stick electrodes.

3.3.2
harness
assembly that provides a means of maintaining a welder's face shield in position on the head

[EN 175:1997[13]]

3.3.3
headband
that part of the harness to which the welder's face shield is fixed and which surrounds the head, or that part of the welder's goggles or welder's spectacles which secures the goggles or spectacles onto the head

[EN 175:1997[13]]

3.3.4
operator
person who performs welding and allied processes

3.3.5
operator's breathing zone
restricted breathing zone, behind a face shield

NOTE It is essential to sample as near as possible to the operator's nose and mouth when measuring exposure to welding fume because of the very steep concentration gradients that occur in the immediate vicinity of the plume. Sample behind a welder's face shield, when one is worn, since it is the air in this region that is inhaled.

3.3.6
welder's face shield
welder's shield worn on the head and in front of the face, usually secured in position by a harness to give protection to the eyes and face when fitted with the appropriate filter(s)

[EN 175:1997[13]]

3.3.7
welder's goggles
device, held in position usually by a headband, enclosing the orbital cavity, into which radiation arising from welding and allied processes can penetrate only through filter(s) and, where provided, filter cover(s)

[EN 175:1997[13]]

3.3.8
welder's hand shield
welder's shield held in the hand to give protection to the eyes and face when fitted with the appropriate filter(s)

[EN 175:1997[13]]

3.3.9
welder's shield
welding protector providing protection of the face, eyes and throat of the operator, being equipped with an appropriate ocular protection filter

[CEN/TR 14599:2005[16]]

3.3.10
welder's spectacles
frame, with lateral protection, holding suitable filters in front of the eyes, to give them protection

NOTE It may usually be held in position with sidearms or a headband fitting.

[EN 175:1997[13]]