SLOVENSKI STANDARD
oSIST prEN ISO 21904-2:2019

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Zdravje in varnost pri varjenju in sorodnih tehnikah - Oprema za zajem in ločevanje varilnega dima - 2. del: Zahteve za preskušanje in označevanje učinkovitosti ločevanja (ISO/DIS 21904-2:2019)

Health and safety in welding and allied processes - Equipment for capture and separation of welding fume - Part 2: Requirements for testing and marking of separation efficiency (ISO/DIS 21904-2:2019)

Sicherheit und Gesundheitsschutz beim Schweißen und bei verwandten Verfahren - Anforderungen, Prüfung und Kennzeichnung von Luftreinigungssystemen - Teil 2: Anforderungen an Prüfung und Kennzeichnung des Abscheidegrades (ISO/DIS 21904-2:2019)

Hygiène et sécurité en soudage et techniques connexes - Exigences, essais et marquage des équipements de filtration d'air - Partie 2: Exigences relatives aux essais et marquage de l'efficacité de séparation (ISO/DIS 21904-2:2019)

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Health and safety in welding and allied processes — Equipment for capture and separation of welding fume —

Part 2: Requirements for testing and marking of separation efficiency

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 21904-series can be found on the ISO website.

Requests for official interpretations of any aspect of this document 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

It is common practice in the fabrication industry to control exposure to welding fume using local exhaust ventilation equipment that, following capture and separation of the fume, returns the extracted air to the workplace or exhausts it to the atmosphere. It is important that such equipment has high separation efficiency so that as little fume as possible is recirculated or exhausted. This part of ISO 21904 has therefore been promulgated to specify requirements and a test method for determining the efficiency of welding fume separation equipment.

Health and safety in welding and allied processes — Equipment for capture and separation of welding fume —

Part 2: Requirements for testing and marking of separation efficiency

1 Scope

This part of ISO 21904 specifies a method for testing equipment for the separation of welding fume in order to determine whether its separation efficiency meets specified requirements.

The method specified does not apply to testing of filter cartridges independent of the equipment in which they are intended to be used.

This part of ISO 21904 applies to equipment that is manufactured after its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2602, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

ISO 15011-1, *Health and safety in welding and allied processes — Laboratory method for sampling fume and gases — Part 1: Determination of fume emission rate during arc welding and collection of fume for analysis*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21904-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
free-standing unit
separation equipment with an integrated fan

3.2
modular system
separation equipment consisting of a scaleable filter system with the same filter elements and conditions normally connected to a single fan

4 Principle

The method is based on the methods specified in EN 1093-6[10] and EN 1093-7.[11] Under test the welding fume separation equipment is charged by welding fume generated by a welding process. The

welding fume concentration in the incoming and exhausted air of the separation unit is measured. The welding fume separation equipment under test is operated under defined conditions, according to its intended use.

The emission rate of the welding fume source is measured and used subsequently to calculate the concentration of fume generated during a test period when separation efficiency is measured.

Before separation efficiency measurements are made, welding fume separation equipment is charged for a period of 30 min using the welding fume source.

For equipment with filters that are not intended to be cleaned, the concentration of fume passing through the separation equipment during a 30 min period is measured and used together with the fume concentration calculated from the fume emission rate to determine the separation efficiency.

For equipment with cleanable filters, an additional separation efficiency measurement is performed after a further welding period without measurement and filter cleaning. The average of the two separation efficiencies is calculated.

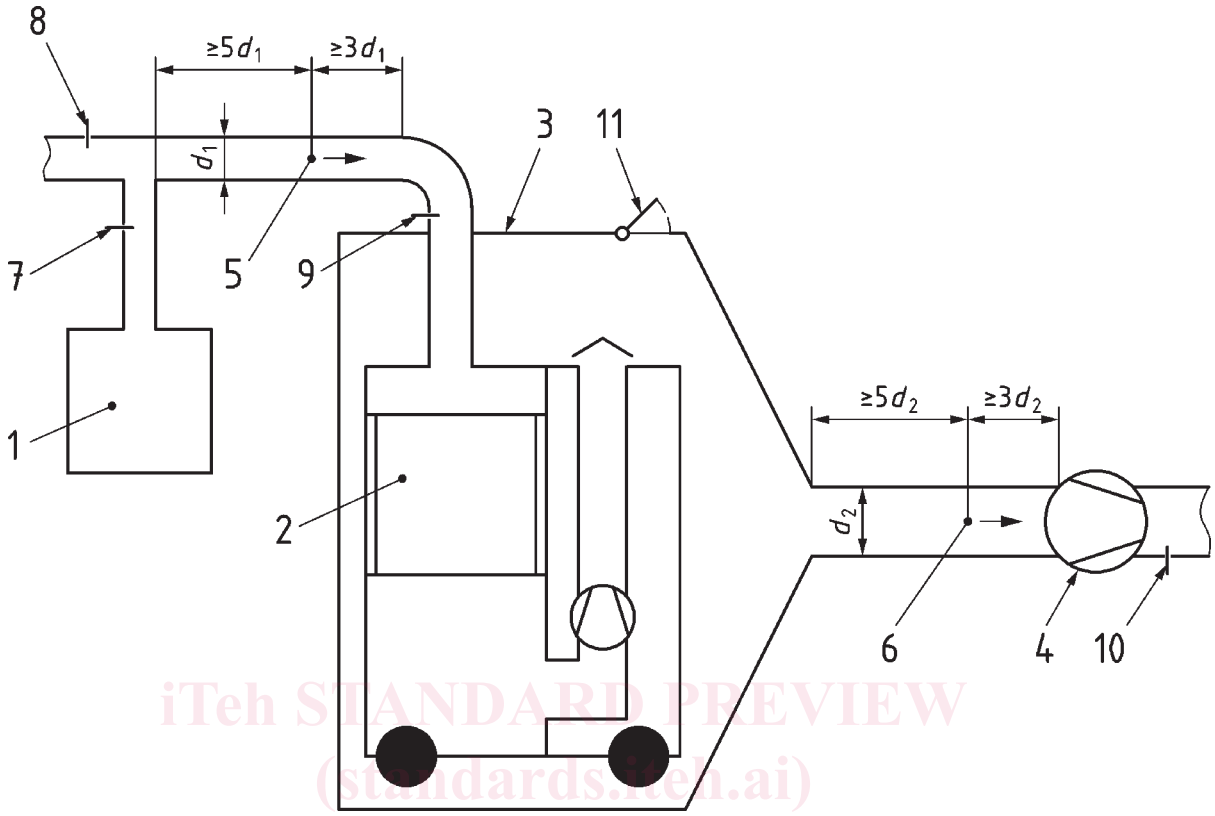
Two tests are performed and the average, the 95 % one-sided confidence interval and the lower confidence limit value of the separation efficiency are calculated according to ISO 2602. If the resulting lower confidence limit value is less than the required separation efficiency, consideration shall be given to improve the filter unit design.

5 Equipment

5.1 Welding fume source, capable of maintaining an emission rate of 10 mg/s ± 2 mg/s throughout the test period. The welding fume source shall be fitted with an extracted fume hood that retains all the fume emitted and shall be designed in such a way that it can be connected to the inlet duct of the test cabin, as described in Figure 1, or directly to welding fume separation equipment with a ducted outlet, as described in Figure 2. It shall be possible to determine the welding fume emission rate *in situ* without disturbing the welding set-up in any way. An example of a suitable welding source and parameters required to achieve the required welding fume emission rate are described in Annex B.

5.2 Test cabin, consisting of an enclosure for the welding fume separation equipment under test, connected to the welding fume source via an upstream measurement duct. The cabin is connected to a downstream measurement duct and an air mover (see Figure 1). The air flow rate through the air mover

is adjusted to between 95 % and 100 % of the air flow rate in the upstream duct, thus ensuring a small positive air pressure in the cabin.



Key

1 welding fume source (see Figure B.1)
2 welding fume separation equipment
3 test cabin
4 air mover
5 position for measuring the air flow rate in the upstream duct, $q_{V,1}$
6 positions for measuring the air flow rate in the downstream duct, $q_{V,2}$ and isokinetic sampling of welding fume in the downstream duct
7 damper (to control the air flow rate passing through the welding fume source in order to avoid shielding gas disturbance)
8 damper (to ensure that all welding fume is captured, even when filter units with a low air flow rate are under test)
9 damper (to regulate the total air flow rate passing through the separation equipment)
10 damper (to control the air flow rate in the downstream duct in order to achieve a slight overpressure in the cabin)
11 gap with a flap (to prevent damage on the cabin in case of high overpressure)
d_1 upstream duct diameter
d_2 downstream duct diameter

Figure 1 — Example of test cabin (schematic layout)

The positions for measuring the air flow rate and isokinetic sampling of welding fume in the downstream duct are not the same, but are shown thus in Figure 1 for convenience. The requirement is that they comply with the dimensions marked in Figure 1.

5.3 Test arrangement for welding fume separation equipment with a ducted outlet, consisting of a welding fume source connected to the equipment via an upstream measurement duct. The outlet