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# SS-EN ISO 21904-2:2020

**Hälsa och säkerhet vid svetsning och besläktade förfaranden – Utrustning för infångning och avskiljning av svetsrök – Del 2: Krav på provning och märkning av avskiljningsgraden (ISO 21904-2:2020)**

**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 21904-2:2020)**

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ICS: 13.100; 25.160.01; 25.160.30

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Europastandarden EN ISO 21904-2:2020 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 21904-2:2020.

Denna standard ersätter SS-EN ISO 15012-2:2008, utgåva 1 och SS-EN ISO 15012-1:2013, utgåva 2

The European Standard EN ISO 21904-2:2020 has the status of a Swedish Standard. This document contains the official version of EN ISO 21904-2:2020.

This standard supersedes the SS-EN ISO 15012-2:2008, edition 1 and SS-EN ISO 15012-1:2013, edition 2

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN ISO 21904-2

March 2020

ICS 25.160.01; 13.100

Supersedes EN ISO 15012-1:2013

English Version

# 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 21904-2:2020)

Hygiène et sécurité en soudage et techniques connexes - Équipements de captage et de filtration des fumées - Partie 2: Exigences relatives aux essais et marquage de l'efficacité de séparation (ISO 21904-2:2020)

Arbeits- und Gesundheitsschutz beim Schweißen und bei verwandten Verfahren - Einrichtungen zum Erfassen und Abscheiden von Schweißrauch - Teil 2: Anforderungen an Prüfung des Abscheidegrades (ISO 21904-2:2020)

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**



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# Contents

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# European foreword

This document (EN ISO 21904-2:2020) has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" in collaboration with Technical Committee CEN/TC 121 “Welding and allied processes” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2020, and conflicting national standards shall be withdrawn at the latest by September 2020.

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

This document supersedes EN ISO 15012-1:2013.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**Endorsement notice**

The text of ISO 21904-2:2020 has been approved by CEN as EN ISO 21904-2:2020 without any modification.

# 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 document has therefore been developed to specify a test method for determining the efficiency of welding fume separation equipment and the requirements of the test method.

# 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 document 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 document applies to equipment that is manufactured after its publication.

NOTE General ventilation systems are excluded from the Scope of ISO 21904-1.

## 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 2602:1980, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

ISO 15011-1:2009, *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*

ISO 21904-1:2020, *Health and safety in welding and allied processes — Equipment for capture and separation of welding fume — Part 1: General requirements*

## 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:

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

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

**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

**3.3**
**welding fume source**
source generating welding fume by welding process that charges separation equipment to perform separation efficiency tests

**3.4**
**emission rate**
mass of the particles emitted by the welding fume source per time

Note 1 to entry: The emission rate is expressed in milligrams per second.

## 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 concentrations are measured in the incoming and exhausted air of the separation unit. 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 separately. Therefore, the welding fume generated by the source is sampled on preweighed filters over a period of time.

The air volume flow rate of the welding fume separation equipment and the testing time shall be measured during the separation efficiency test. Emission rate, testing time and air volume flow rate are used subsequently to calculate the concentration of welding fume in the incoming air. Welding parameters should be the same when emission rate and separation efficiency test are performed.

Before separation efficiency measurements are made, all welding fume separation equipment are 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 welding fume passing through the separation equipment is measured subsequently for a period of 30 min and the measured concentration is used, together with the welding fume concentration calculated from the welding 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.

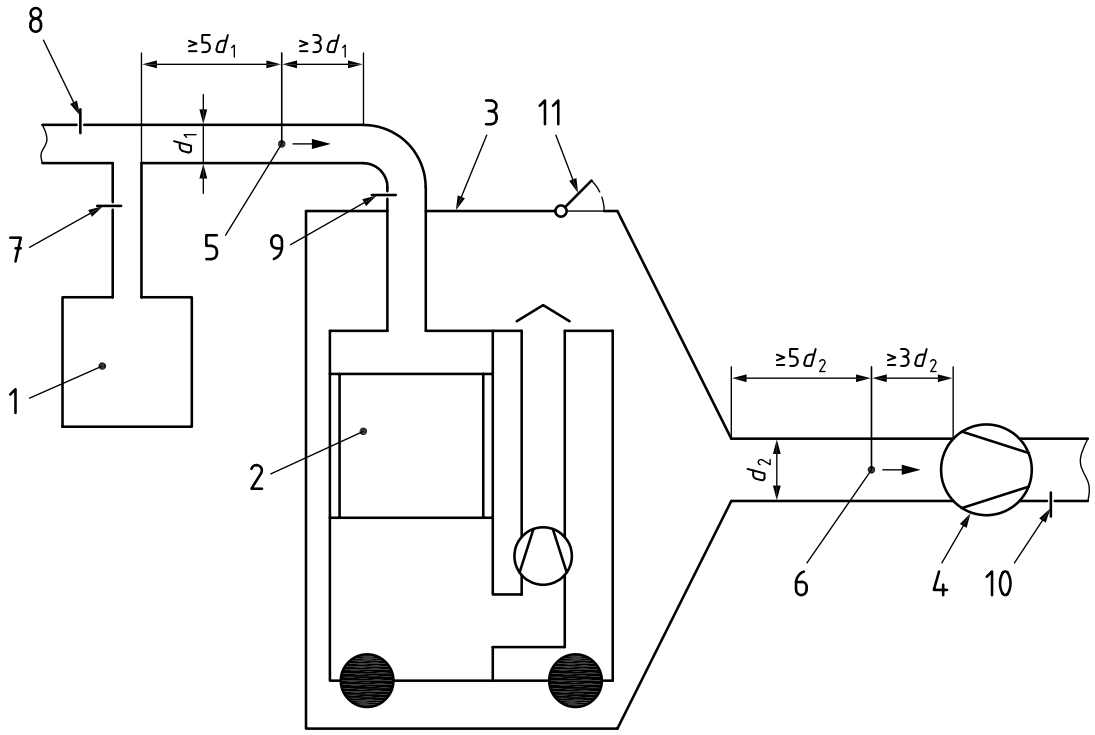
## 5 Apparatus

**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 extraction hood that retains all the welding 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 fume 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 volume flow rate through the air mover is adjusted to between 95 % and 100 % of the air volume 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 volume flow rate in the upstream duct, $q_{V,1}$
6 positions for measuring the air volume 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 volume 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 volume flow rate are under test)
9 damper (to regulate the total air volume flow rate passing through the separation equipment)
10 damper (to control the air volume 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 volume flow rate and isokinetic sampling of welding fume in the downstream duct are not the same, but are shown in Figure 1 for convenience. They shall comply with the dimensions marked in Figure 1.