

# SVENSK STANDARD

## SS-EN ISO 21904-3:2018

Fastställt/Approved: 2018-03-26  
Publicerad/Published: 2018-03-27  
Utgåva/Edition: 1  
Språk/Language: engelska/English  
ICS: 13.100; 25.160.01; 25.160.30

---

### **Hälsa och säkerhet vid svetsning och besläktade förfaranden – Krav, provning och märkning av utrustningar för filtrering av luft – Del 3: Bestämning av infångningsgrad för pistolintegrerade rökutsug (ISO 21904-3:2018)**

### **Health and safety in welding and allied processes – Requirements, testing and marking of equipment for air filtration – Part 3: Determination of the capture efficiency of on-torch welding fume extraction devices (ISO 21904-3:2018)**



# Standarder får världen att fungera

*SIS (Swedish Standards Institute) är en fristående ideell förening med medlemmar från både privat och offentlig sektor. Vi är en del av det europeiska och globala nätverk som utarbetar internationella standarder. Standarder är dokumenterad kunskap utvecklad av framstående aktörer inom industri, näringsliv och samhälle och befrämjar handel över gränser, bidrar till att processer och produkter blir säkrare samt effektiviserar din verksamhet.*

## Delta och påverka

Som medlem i SIS har du möjlighet att påverka framtida standarder inom ditt område på nationell, europeisk och global nivå. Du får samtidigt tillgång till tidig information om utvecklingen inom din bransch.

## Ta del av det färdiga arbetet

Vi erbjuder våra kunder allt som rör standarder och deras tillämpning. Hos oss kan du köpa alla publikationer du behöver – allt från enskilda standarder, tekniska rapporter och standardpaket till handböcker och onlinetjänster. Genom vår webbtjänst e-nav får du tillgång till ett lättnavigerat bibliotek där alla standarder som är aktuella för ditt företag finns tillgängliga. Standarder och handböcker är källor till kunskap. Vi säljer dem.

## Utveckla din kompetens och lyckas bättre i ditt arbete

Hos SIS kan du gå öppna eller företagsinterna utbildningar kring innehåll och tillämpning av standarder. Genom vår närhet till den internationella utvecklingen och ISO får du rätt kunskap i rätt tid, direkt från källan. Med vår kunskap om standarders möjligheter hjälper vi våra kunder att skapa verklig nytta och lönsamhet i sina verksamheter.

**Vill du veta mer om SIS eller hur standarder kan effektivisera din verksamhet är du välkommen in på [www.sis.se](http://www.sis.se) eller ta kontakt med oss på tel 08-555 523 00.**



# Standards make the world go round

*SIS (Swedish Standards Institute) is an independent non-profit organisation with members from both the private and public sectors. We are part of the European and global network that draws up international standards. Standards consist of documented knowledge developed by prominent actors within the industry, business world and society. They promote cross-border trade, they help to make processes and products safer and they streamline your organisation.*

## Take part and have influence

As a member of SIS you will have the possibility to participate in standardization activities on national, European and global level. The membership in SIS will give you the opportunity to influence future standards and gain access to early stage information about developments within your field.

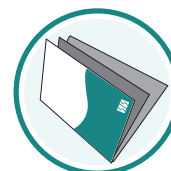
## Get to know the finished work

We offer our customers everything in connection with standards and their application. You can purchase all the publications you need from us - everything from individual standards, technical reports and standard packages through to manuals and online services. Our web service e-nav gives you access to an easy-to-navigate library where all standards that are relevant to your company are available. Standards and manuals are sources of knowledge. We sell them.

## Increase understanding and improve perception

With SIS you can undergo either shared or in-house training in the content and application of standards. Thanks to our proximity to international development and ISO you receive the right knowledge at the right time, direct from the source. With our knowledge about the potential of standards, we assist our customers in creating tangible benefit and profitability in their organisations.

**If you want to know more about SIS, or how standards can streamline your organisation, please visit [www.sis.se](http://www.sis.se) or contact us on phone +46 (0)8-555 523 00**



Europastandarden EN ISO 21904-3:2018 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 21904-3:2018.

The European Standard EN ISO 21904-3:2018 has the status of a Swedish Standard. This document contains the official version of EN ISO 21904-3:2018.

© Copyright/Upphovsrätten till denna produkt tillhör SIS, Swedish Standards Institute, Stockholm, Sverige. Användningen av denna produkt regleras av slutanvändarlicensen som återfinns i denna produkt, se standardens sista sidor.

© Copyright SIS, Swedish Standards Institute, Stockholm, Sweden. All rights reserved. The use of this product is governed by the end-user licence for this product. You will find the licence in the end of this document.

*Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.*

*Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.*

Denna standard är framtagen av kommittén för AGS 449 Miljö, hälsa och säkerhet, SIS/TK 134/AG 09.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på [www.sis.se](http://www.sis.se) - där hittar du mer information.



EUROPEAN STANDARD

EN ISO 21904-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2018

ICS 13.100; 25.160.01

English Version

Health and safety in welding and allied processes -  
Requirements, testing and marking of equipment for air  
filtration - Part 3: Determination of the capture efficiency  
of on-torch welding fume extraction devices (ISO 21904-  
3:2018)

Hygiène et sécurité en soudage et techniques connexes  
- Exigences, essais et marquage des équipements de  
filtration d'air - Partie 3: Détermination de l'efficacité  
de captage des torches aspirantes (ISO 21904-3:2018)

Arbeits- und Gesundheitsschutz beim Schweißen und  
bei verwandten Verfahren - Anforderungen, Prüfung  
und Kennzeichnung von Luftreinigungssystemen - Teil  
3: Bestimmung des Erfassungsgrades von  
brennerintegrierten Absaugeinrichtungen für  
Schweißrauch (ISO 21904-3:2018)

This European Standard was approved by CEN on 1 March 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

| <b>Contents</b>   |  | Page      |
|---|--|-----------|
| <b>European foreword</b> .....  |  | <b>iv</b> |
| <b>Introduction</b> .....   |  | <b>v</b>  |
| <b>1</b>  | <b>Scope</b> .....   | <b>1</b>  |
| <b>2</b>  | <b>Normative references</b> .....                                    | <b>1</b>  |
| <b>3</b>  | <b>Terms and definitions</b> .....                                   | <b>1</b>  |
| <b>4</b>  | <b>Principle</b> .....   | <b>2</b>  |
| <b>5</b>  | <b>Test equipment and materials</b> .....                            | <b>2</b>  |
| 5.1   | General requirement .....  | 2         |
| 5.2   | Test equipment .....   | 2         |
| <b>6</b>  | <b>Test procedure</b> .....  | <b>4</b>  |
| 6.1   | Preliminary tests .....  | 4         |
| 6.1.1   | Setting the shielding gas flow rate .....                            | 4         |
| 6.1.2   | Measuring the flow rates and determination of leakage .....          | 4         |
| 6.1.3   | Establishing the arcing time for total fume emission rate test ..... | 5         |
| 6.1.4   | Setting up the test equipment .....                                  | 5         |
| 6.2   | Capture efficiency tests .....                                       | 6         |
| 6.2.1   | General .....  | 6         |
| 6.2.2   | Test procedure .....   | 6         |
| 6.2.3   | Calculation of the results .....                                     | 7         |
| <b>7</b>  | <b>Test parameters for generating capture efficiency data</b> .....  | <b>8</b>  |
| <b>8</b>  | <b>Test report</b> .....   | <b>9</b>  |
| <b>Annex A (informative) Equipment notes</b> .....                                    |  | <b>10</b> |
| <b>Annex B (normative) Trial tests</b> .....  |  | <b>12</b> |
| <b>Annex C (informative) Examples of test chambers</b> .....                          |  | <b>14</b> |
| <b>Annex D (normative) Test procedures</b> .....                                      |  | <b>16</b> |
| <b>Annex E (informative) Data processing for test method 3</b> .....                  |  | <b>17</b> |
| <b>Annex F (normative) Test parameters form to be filled</b> .....                    |  | <b>19</b> |
| <b>Annex G (informative) Information about the necessity to measure leakage</b> ..... |  | <b>20</b> |
| <b>Bibliography</b> .....   |  | <b>21</b> |

## European foreword

This document (EN ISO 21904-3:2018) 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 2018, and conflicting national standards shall be withdrawn at the latest by September 2018.

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.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Endorsement notice

The text of ISO 21904-3:2018 has been approved by CEN as EN ISO 21904-3:2018 without any modification.

**SS-EN ISO 21904-3:2018 (E)****Introduction**

Welding generates fumes and gases which, if inhaled, can be harmful to human health. Therefore, control of the fume and gases needs to be exercised to minimize worker exposure.

The most effective method of welding fume control is local exhaust ventilation (LEV) which captures the fumes at source before they enter the general environment and the breathing zone of workers.

One form of LEV used in welding is on-torch extraction in which the extraction system is either an integral part of the welding torch or is attached to it close to the arc area. Anecdotal evidence within the fabrication industry suggested that it is impossible to capture fume efficiently while maintaining weld metal integrity but research (see Bibliography entry [6]) has shown this not to be the case, certainly as far as weld metal porosity is concerned.

It has been presumed in the drafting of this document that appropriately qualified and experienced people would execute its provisions and interpret the results obtained.



# Health and safety in welding and allied processes — Requirements, testing and marking of equipment for air filtration —

## Part 3: Determination of the capture efficiency of on-torch welding fume extraction devices

### 1 Scope

This document defines a laboratory method for measuring the welding fume capture efficiency of on-torch extraction systems. The procedure only prescribes a methodology, leaving selection of the test parameters to the user, so that the effect of different variables can be evaluated.

It is applicable to integrated on-torch systems and to systems where a discrete extraction system is attached to the welding torch close to the arc area. The methodology is suitable for use with all continuous wire welding processes, all material types and all welding parameters.

The method can be used to evaluate the effects of variables such as extraction flow rate, extract nozzle position, shielding gas flow rate, welding geometry, welding torch angle, fume emission rate, etc., on capture efficiency.

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

ISO/IEC Guide 98 (all parts), *Uncertainty of measurement*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

##### **test chamber**

semi-enclosed extracted chamber in which welding fume capture efficiency testing is performed

#### 3.2

##### **isokinetic sampler**

device for collecting aerosol samples at the same velocity as the air being sampled

## SS-EN ISO 21904-3:2018 (E)

### 3.3

#### **test chamber sampling duct**

duct between the test chamber and an extraction fan in which all the fume generated can be collected or sampled isokinetically

### 3.4

#### **emission rate**

mass of the particles emitted by the welding fume source per unit time

Note 1 to entry: The emission rate is expressed in mg/s.

## 4 Principle

Automatic welding is performed using the on-torch extraction torch under test, on a test piece, inside a continuously extracted test chamber. Testing is carried out using identical welding parameters with and without the on-torch extraction activated. The ratio of measurements in the test chamber sampling duct is used to calculate the capture efficiency of the on-torch extraction torch.

Three methods of measuring the fume can be used. Two methods employ gravimetric measurement. The first method measures the total fume generated while second method employs isokinetic sampling in the test chamber sampling duct. The third method employs a direct reading measuring technique in the test chamber sampling duct.

## 5 Test equipment and materials

### 5.1 General requirement

The test setup shall enable containment of the fume generated in the arc area within the test chamber while ensuring the air velocity in the welding area below the torch does not exceed 0,2 m/s without welding and with the on-torch extraction off. See also [B.1](#).

NOTE It is possible that not all of the fume generated by spatter production be contained within the test chamber.

### 5.2 Test equipment

**5.2.1 Test chamber**, constructed of materials that withstand close proximity to the heat and spatter generated by the welding or designed so that the materials used are sufficiently distant from the arc to avoid problems arising from heat and spatter generation. See [Figures C.1](#) and [C.2](#).

Compliance with the requirements of [5.1](#) shall be verified.

#### 5.2.2 Isokinetic samplers.

The sample flow rate shall be such that the velocity through the sample inlet is the same as the surrounding air velocity.

This ensures that:

- the particle size distribution is not affected by the sampling process; and
- the sample represents the particles present in the sampling duct. See also [B.2](#) and [B.3](#).

**5.2.3 Total fume and isokinetic filters**, manufactured from glass or quartz fibre, with particle retention properties down to approximately 1 µm to 2 µm.

The filters shall not tear or perforate during testing (see [A.2](#)) and shall not be so friable that fibres can be lost from the filters during handling.

Filters shall be treated according to the procedures defined in ISO 15767.

**5.2.4 Extraction fan**, capable of maintaining a constant flow rate ( $\pm 2\%$ ) in the test chamber sampling duct during testing when using during testing with isokinetic sampling or direct reading equipment.

The air flow generated by the fan shall be capable of retaining the entire fume generated within the test chamber (see [A.3](#)).

**5.2.5 On-torch extraction unit**, capable of maintaining a constant flow rate ( $\pm 2\%$ ) in the on-torch extraction line during testing.

**5.2.6 Equipment for measuring welding current, welding voltage, wire feed speed and arcing time**, capable of measuring the current, voltage, wire feed speed and arcing time within  $\pm 1\%$ .

Electronic integrating equipment with frequent sampling intervals and a logging capability is recommended.

In the absence of such equipment, current may be measured using a shunt or a Hall effect probe connected to a moving coil meter. Voltage may be measured using a moving coil meter. Wire feed speed may be determined by measuring the length of wire exiting the welding torch in a measured time.

**5.2.7 Equipment for direct-reading of fume concentration**, with a reading that is directly proportional to the fume concentration with a maximum linearity error of  $5\%$  over the expected concentration range.

NOTE Equipment suitable for direct-reading of fume concentration is described for example in CEN/TR 16013.

**5.2.8 Equipment for measuring the mass of fume collected.**

- **Balance** capable of measuring the mass of isokinetic sample filters and isokinetic sample filters plus fume with an accuracy of  $\pm 0,01$  mg or better.
- **Balance** capable of measuring the mass of total fume collection filters and total fume collection filters plus fume with an accuracy of  $\pm 1$  mg or better.

**5.2.9 Equipment for measuring shielding gas volume flow rate**, calibrated for the shielding gas in use, capable of measuring the volume flow rate to within  $\pm 5\%$  or better. See [A.4](#).

**5.2.10 Device for automatic welding**, permitting the capture efficiency test to be performed under automated conditions, capable of advancing the test piece under a stationary welding torch at an appropriate rate (welding speed).

It shall be possible to secure the test piece to the device, such that it cannot bow during welding.

**5.2.11 Device for measuring contact tip to workpiece distance (CTWD).**

- **Gauge**, made by machining a metal block to a thickness equivalent to the required CTWD to within  $\pm 5\%$  or better; or
- **Metal wedge** with distance markings at appropriate points.

**5.2.12 Device for measuring static pressure**, capable of measuring static air pressure in the on-torch extraction line with an uncertainty of measurement not exceeding  $\pm 1\%$  of the reading. See [A.6](#).

**5.2.13 Device for measuring the mass flow rate** to an accuracy of  $\pm 5\%$  or better (e.g. according to ISO 5167). See [A.7](#).