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

Part 1:

**Testing of the separation efficiency for
welding fume**

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*Hygiène et sécurité en soudage et techniques connexes — Exigences,
essais et marquage des équipements de filtration d'air —*

ISO 15012-1:2004
Partie 1: Essai de l'efficacité de la séparation des fumées de soudage

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Foreword

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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 15012-1 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 9, *Health and safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read “...this European Standard...” to mean “...this International Standard...”.

ISO 15012 consists of the following parts under the general title *Health and safety in welding and allied processes — Requirements testing and marking of equipment for air filtration*:

- *Part 1: Testing of the separation efficiency for welding fume*
- *Part 2: Testing of the capture zone of welding fume extraction devices*

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Foreword

This document (EN ISO 15012-1:2004) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

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of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at the latest by June 2005.

This document includes a Bibliography.

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

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1 Scope

This document deals with the significant hazards caused by the emission of welding fume particles from welding fume separation equipment operated according to its intended use and under the conditions foreseen by the manufacturer.

This document specifies safety requirements concerning the separation of welding fumes and describes a method for determining the particle separation efficiency of welding fume separation equipment.

This document does not deal with:

- the hazards caused by gases emitted by welding, cutting and allied processes or by the welding fume separation equipment itself;
- the hazards caused by the noise and vibrations of the welding fume separation equipment or
- other fundamental aspects of safety technology, such as electrical, mechanical and pneumatical safety, maintenance, etc.

This document applies to equipment that is manufactured after the issue of this document.

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.

EN 842, *Safety of machinery - Visual danger signals - General requirements, design and testing.*

EN 1070:1998, *Safety of machinery - Terminology*, <https://standards.iteh.ai/catalog/standards/sist/d9933bfb-0aca-49df-a7d6-9118220aac3c/iso-15012-1-2004>

EN 1093-6, *Safety of machinery - Evaluation of the emission of airborne hazardous substances - Part 6: Separation efficiency by mass, unducted outlet.*

EN 1093-7, *Safety of machinery - Evaluation of the emission of airborne hazardous substances - Part 7: Separation efficiency by mass, ducted outlet.*

EN ISO 12100-2:2003, *Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles (ISO 12100-2:2003)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1070:1998 and the following apply.

3.1

welding fume separation equipment

air filtration equipment, the purpose of which is to separate particles generated by welding and allied processes from workplace air

3.2

filter cleaning system

system designed to clean the filter of welding fume separation equipment in order to restore the air flow rate through the filter when it is reduced by an accumulation of welding fume particles

3.3

on-line filter cleaning system

filter cleaning system that operates while welding fume separation equipment is working

- 3.4 off-line filter cleaning system**
filter cleaning system that is operated after the fan of the filtration equipment is switched off
- 3.5 separation efficiency by mass**
ratio of the mass of particles retained by welding fume separation equipment to the mass of particles entering the equipment during a given period (see also EN 1093-6 and EN 1093-7)
- 3.6 emission rate**
mass of the particles emitted by the welding fume source per unit of time, in mg/s (see Annexes C and D).
- 3.7 preseparator**
capture devices with built-in closed-meshed sieves or spark arrestors

4 List of significant hazards

This clause contains the significant hazards dealt with in this document.

Table 1 — List of hazards, risk assessment, measures for reduction

Hazard	Hazardous situation	Measure	Clause	Verification
Welding fume emission	welding fume emission with separated air	separation of welding fumes	6.2	testing of the separation efficiency

5 Safety requirements and/or measures

5.1 Preseparator

The welding fume separation equipment or the exhaust system shall be designed to protect the separation unit and shall prevent damage to the filter caused by the impact of large, hot and/or abrasive particles.

5.2 Emission of particles from welding fume separation equipment

5.2.1 Welding fume separation efficiency

Welding fume separation equipment shall have a separation efficiency of at least 95 % and shall be assigned to a welding fume separation class using the classification system given in Table 2. The welding fume classes differ in the requirements for the separation efficiency based on the state of the art.

Table 2 — Welding fume classes

Welding fume class	Separation efficiency (%)	Recommended for the separation of particles generated by welding of:
W 1	≥ 95	unalloyed and low-alloy steel, i.e. steel with a very low nickel and chromium content
W 2	≥ 98	as above and alloyed steel, i.e. steel with a nickel and chromium content ≤ 30 %
W 3	≥ 99	as above and high-alloy steel

NOTE The welding fume classes are only intended to provide guidance on the suitability of a given unit when considered in combination with:

- the welding location (e.g., a confined space or open workshop);
- the fume emission rate;
- the toxic elements present in the fume;
- current legal requirements; and
- the capture efficiency.

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5.2.2 Marking of welding fume separation equipment

The manufacturer shall mark the welding fume separation equipment to indicate the welding fume class to which it has been assigned using labels conforming to the specifications given in Annex A. The marking shall be permanent and remain legible throughout the expected lifetime of the equipment.

5.3 Emission of particles during change of separation elements

Welding fume separation equipment shall be designed to minimise the emission of the collected welding fume particles during the changing of the separation elements.

5.4 System for waste management

5.4.1 Particles collected by the welding fume separation equipment shall be removed from the separation elements and disposed of in a manner that minimises their emission.

5.4.2 If the collected welding fume particles are disposed of in containers or bags, these shall be able to withstand the stresses of transportation, even when filled to their maximum capacity, and they shall be tightly sealed in a manner that will ensure that there is no possibility of emission of the collected particles.

5.5 Filter cleaning system

5.5.1 For welding fume separation equipment with a filter cleaning system, the filter cleaning system shall maintain the performance of the equipment so that it continues to meet the separation efficiency requirement for the welding fume class into which it is placed (see 5.2).

5.5.2 Cleaning of the separation elements shall not result in emission of welding fume particles.

5.6 Control units/indicators

5.6.1 General

Welding fume separation equipment shall be fitted with control units or indicators that warn of or prevent abnormal operation conditions, as described in 5.6.2 to 5.6.5.

Acoustic warning signals shall work within an audio-frequency between 500 Hz and 3000 Hz and have a pulse time between 0,5 s and 5 s. The A-weighted sound pressure level shall be between 15 dB and 30 dB higher than the 1 m-surface sound pressure level of the welding fume separation equipment (see EN 457).

Visual warning signals shall work with a pulse time between 0,5 s and 5 s, emitting yellow or yellow-orange light. The warning signals shall comply with the requirements of EN 842.

5.6.2 Direction of rotation of the fan

Mobile welding fume separation equipment operated with three-phase electrical motors shall be marked to indicate the correct direction of rotation of the fan.

5.6.3 Prevention of reversed air flow

If the consequence of a "wrong" direction of rotation is a reversed air flow, mobile welding fume separation equipment shall be fitted with equipment (e.g. a check valve or a damper) that prevents the reversal of air flow and an emission of collected welding fume particles.

5.6.4 Electrostatic separation systems

Separation equipment with an electrostatic separation system shall be fitted with a device that indicates if abnormal electrical properties occur.

5.6.5 Mechanical separation systems

Separation equipment with a mechanical separation system - even a system that services several work stations - shall be fitted with a device that indicates if a high pressure drop, exceeding the manufacturer's recommendation, occurs.

5.7 Exhaust and cooling air

Mobile welding fume separation equipment shall be positioned so that the exhaust and the cooling air of the motor do not blow in the direction of any persons working in the vicinity of the equipment. They also shall not unduly disturb dust settled on the floor and/or on walls. The velocities of the exhaust and of the cooling air shall not exceed 1 m/s at a distance of 1,5 m around the welding fume separator, between a lower measurement plane at a height of 50 mm above the floor level and an upper measurement plane at a height of 2 m above the floor level (see Figure 4).

6 Verification of safety requirements and/or measures

6.1 Testing of the preseparator

Check compliance with the requirements of 5.1 by inspection.

6.2 Testing of the separation efficiency

6.2.1 Principle

The method is based on the methods described in EN 1093-6 and EN 1093-7. The welding fume separation equipment under test is operated under defined conditions, according to its intended use, and the mass flow rates of welding fume in the upstream and downstream air are measured and used to determine the separation efficiency of the equipment.

6.2.2 Welding fume source

For testing of welding fume separation equipment intended for single work stations, use a welding fume source with an emission rate of 10 mg/s (suitable welding fume sources are described in Annex C or D).

For testing of welding fume separation equipment used to filter air from a number of work stations, use a welding fume source with an emission rate equal to 10 mg/s multiplied by the number of work stations that are operated at the same time (see Annex D).

6.2.3 Test rig or test arrangement

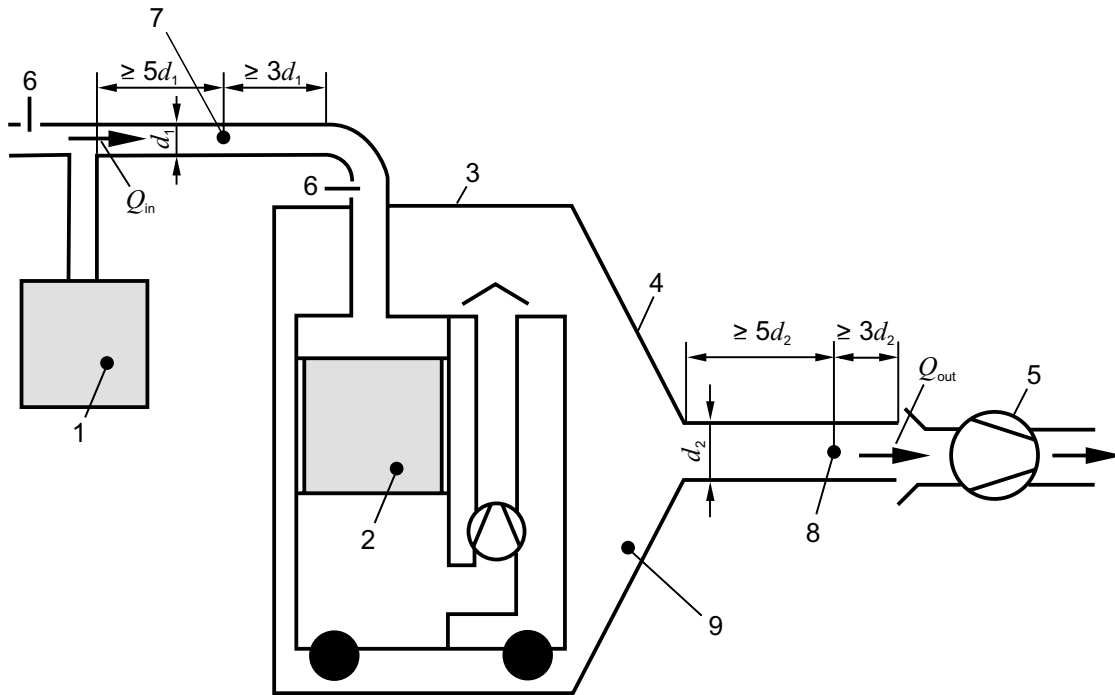
6.2.3.1 Selection of test rig or test arrangement

For welding fume separation equipment with unducted outlet, carry out the test of separation efficiency using a test rig as described in Figure 1.

For welding fume separation equipment with a ducted outlet, carry out the test of separation efficiency using a test rig as described in Figure 1 or using a test arrangement as described in Figure 2. However, if the filter is working with internal overpressure, leak test the welding fume separation equipment before testing it or test it using a test rig as described in Figure 1.

6.2.3.2 Test rig for determination for welding fume separation equipment with an unducted outlet

The test rig consists of a closed test cabin as 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, followed up by an optional air mover to keep a small overpressure within the cabin to prevent the measurements from being influenced by leakages (see Figure 1). The outlet air flow rate in the downstream measurement duct shall be at least 95 % and shall not exceed 100 % of the inlet air flow rate. If compressed air is used as the motive power this air flow rate shall be taken into consideration when determining the outlet air flow rate.



Key

- 1 Welding fume source
- 2 Welding fume separation equipment
- 3 Cabin
- 4 Funnel
- 5 Air mover
- 6 Damper
- 7 Upstream measurement plane (concentration and air flow rate measurement)
- 8 Downstream measurement plane
- 9 Measurement point (air pressure)

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Figure 1 - Test rig for determination of the separation efficiency of welding fume separation equipment with an unducted outlet (schematic layout)

To maximise the transport of emitted particles from the welding fume separation equipment to the downstream measuring point, position the equipment in the cabin in such a way that the exhaust air is emitted along the longitudinal axis of the downstream measurement duct.

Ensure that the aerodynamic conditions in the cabin and the duct do not lead to significant deposition of emitted particles between the welding fume separation equipment and the downstream measurement point.