
**Health and safety in welding and allied
processes — Laboratory method for
sampling fume and gases generated by arc
welding —**

Part 1:

**Determination of emission rate and
sampling for analysis of particulate fume**

*Hygiène et sécurité en soudage et techniques connexes — Méthode de
laboratoire d'échantillonnage des fumées et des gaz émis par le soudage à
l'arc —*

ISO 15011-1:2002

*Partie 1: Détermination du taux d'émission et échantillonnage pour
l'analyse des poussières*



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 15011-1:2002

<https://standards.iteh.ai/catalog/standards/sist/a87e5ba2-e995-4365-859e-f9093c39337/iso-15011-1-2002>

© ISO 2002

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 15011 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15011-1 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 15011 consists of the following parts, under the general title *Health and safety in welding and allied processes — Laboratory method for sampling fume and gases generated by arc welding*:

- *Part 1: Determination of emission rate and sampling for analysis of particulate fume*
- *Part 2: Determination of emission rates of gases, except ozone*
- *Part 3: Determination of ozone concentration using fixed point measurements*

Annexes A to D of this part of ISO 15011 are for information only.

Contents

	page
Foreword.....	v
Introduction	1
1 Scope	1
2 Terms and definitions	1
3 Test equipment	1
3.1 Fume box	1
3.2 Filters	2
3.3 Pump	2
3.4 Measuring equipment	2
4 Test pieces	2
5 Consumable	2
6 Procedure	3
6.1 Principle.....	3
6.2 Test sequence.....	3
6.3 Precautions	3
6.4 Welding parameters	3
6.5 Duration of the test.....	3
7 Interpretation of results	4
7.1 Number of tests	4
7.2 Calculation of fume emission rate	4
7.3 Analysis	4
7.4 Recording of test data and presentation of results	4
Annex A (informative) Possible designs of fume boxes designed for manual metal arc welding, MIG-welding and MAG-welding	5
A.1 Design 1	5
A.2 Design 2	7
Annex B (informative) Test report.....	8
Annex C (informative) Recommended analytical analysis	9
Annex D (informative) Extraction method of total hexavalent chromium found in welding particulate matter	10

Foreword

This document (EN ISO 15011-1:2002) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DS, 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 October 2002, and conflicting national standards shall be withdrawn at the latest by October 2002.

This standard consists of the following parts:

- Part 1: Determination of emission rate and sampling for analysis of particulate fume;
- Part 2: Determination of emission rates of gases and vapours, except ozone;
- Part 3: Determination of ozone concentration using fixed point measurements.

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

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 15011-1:2002

<https://standards.iteh.ai/catalog/standards/sist/a87e5ba2-e995-4365-859e-f9093c39337/iso-15011-1-2002>

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

ISO 15011-1:2002

<https://standards.iteh.ai/catalog/standards/sist/a87e5ba2-e995-4365-859e-f9093c39337/iso-15011-1-2002>

Introduction

Welding and allied processes produce particulate fume and gaseous by-products which may be harmful to human health. A knowledge of the quantity of particulate fume and gases generated and the composition of the particulate fume may be useful for occupational hygienists in accessing workplace atmospheres. Emission rates cannot be directly related to fume concentrations existing in a welder's breathing zone, but processes with low emission rates are supposed to produce less fume concentration compared with high emission rates for the same welding condition.

The laboratory procedure described in Part 1 of this standard is used to determine emission rate of particulate fume generated by the arc welding and provides a method of sampling the fume for chemical analysis. The emission rate and composition of particulate fume depend on the welding process, welding parameters, workpiece surface, coatings etc.

With the aid of a fume box in an un-polluted atmosphere, the total particulate fume generated during welding is collected and sampled on a filter in order to determine the emission rate and/or chemical composition.

1 Scope

This European standard describes a method for the determination of the particulate fume emission rate from arc welding processes using a fume box technique. It defines a method of sampling particulate fume for chemical analysis and suggests possible analytical techniques in order to characterize fumes emitted by consumable during welding.

iTeh STANDARD PREVIEW

2 Terms and definitions (standards.iteh.ai)

For the purposes of this European Standard, the following terms and definitions apply.

<https://standards.iteh.ai/catalog/standards/sist/a87e5ba2-e995-4365-859e-f9093c39337/iso-15011-1-2002>

2.1

fume box

a closed or semi-closed ventilated chamber used for sampling and determination (emission rate and composition) of fume and gases in welding and allied processes

2.2

test piece

piece of metal on which the welding process is performed

2.3

arc time

arc time starts from arc initiation and stops immediately as the arc is extinguished

3 Test equipment

3.1 Fume box

The fume box should consist of a top section containing a filter, a welding chamber and a chamber base. The welding chamber shall be large enough to allow complete capture of the emitted fume. The fume box should be designed to reduce deposition of welding fume onto the internal box surface. Examples of possible arrangements are described in annex A, as an example. Other appropriate fume box designs may be used.

3.2 Filters

The filters shall be capable of withstanding the pressure drop and shall allow collection of fume loadings between 0,4 mg/cm² and 1,2 mg/cm². The filters shall have a minimum efficiency of 99,5 %.

NOTE Practically, to avoid clogging of the filter, such values require the use of filters with a diameter of approximately 250 mm.

For determination of emission rate, weight stability with respect to humidity is essential and glass fibre filters or quartz filters are recommended. If a fume sample is collected for chemical analysis the type of filter should be such that it is free from relevant contaminants and compatible with subsequent analysis procedures. A paper filter (cellulose) is recommended.

For the determination of hexavalent chromium, the fumes shall be removed immediately from the filter.

The filters are held by a stainless steel wire mesh; recommended dimensions for the mesh size are 0,5 mm to 2,0 mm.

The filter holding device shall allow the filter to be removed and there shall not be any leakage between the filter and its support.

3.3 Pump

The precise characteristics of the pump are not considered to be critical providing the flow is adequate to contain the fume within the box without interfering with the welding process and to clear the fume box of fume after completion of welding, within the time specified, see 6.5.

The pump shall have a suction characteristic able to give:

- at the beginning of the test a flow rate of 25 l/s to 30 l/s at 10000 Pa (0,1 bar) which corresponds to the resistance of the filter at 0 mg fume;
- at the end of the test, a flow rate of at least 5 l/s at 16000 Pa to 20000 Pa.

3.4 Measuring equipment

Voltage measurements across the arc and welding current shall be measured using electrical recorders with an accuracy class of 0,5.

The arc time shall be measured with a timer having increments of 0,1 s or smaller.

The mass of collected particulate matter shall be measured using a balance with a sensitivity of at least 1 mg.

4 Test pieces

All details concerning the test piece shall be noted in the test report (see annex B).

The choice of the test piece shall be appropriate to the welding process, the consumable and the welding conditions being used.

5 Consumable

All details concerning the consumable shall be noted in the test report (see annex B).

The choice of the consumable shall be appropriate to the welding process, the test piece and the welding conditions being used.

6 Procedure

6.1 Principle

A weld is made inside the fume box while the pump is running. The fume produced is collected on the filter.

6.2 Test sequence

The test sequence shall be as follows:

- a test piece shall be placed directly on the metallic table inside the fume box;
- a weighed filter shall be placed in the sampling device;
- the pump shall be switched on.

During welding:

- arc time shall be measured (see 2.3);
- suction shall be maintained at least for 30 s after arc extinction;
- the filter shall be immediately withdrawn and reweighed;
- for analysis, the collected particulate fumes should be removed from the filter immediately and stored in an airtight glass bottle.

6.3 Precautions

[ISO 15011-1:2002](https://standards.iteh.ai/catalog/standards/sist/a87e5ba2-e995-4365-859e-9d095c993575/iso-15011-1-2002)

<https://standards.iteh.ai/catalog/standards/sist/a87e5ba2-e995-4365-859e-9d095c993575/iso-15011-1-2002>

Before beginning a test, ensure that the inside surface of the fume box and the test piece have been cleaned, that both are at ambient temperature and that the chamber box is free of spatter.

Filters shall be handled with care and not soiled before or after the test with dust or grease from the fingers.

The test is only valid if:

- no fume escapes from the box;
- the temperature of the welding chamber does not become high enough to allow the deposition of the fume onto the internal box surface.

6.4 Welding parameters

All welding parameters shall be noted in the test report (see annex B).

The parameters shall be kept constant during each measurement and for each test.

6.5 Duration of the test

The test is continued until at least 0,1 g of fume is collected and shall be stopped before clogging of the filter.

Pre-tests allow determination of the welding time.