SLOVENSKI STANDARD
SIST EN ISO 15011-1:2003

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Zdravje in varnost pri varjenju in sorodnih postopkih - Laboratorijska metoda za vzorčenje dima in plinov, nastalih pri obločnem varjenju - 1. del: Določevanje emisij in vzorčenje za analizo prahu (ISO 15011-1:2002)

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 (ISO 15011-1:2002)

Arbeits- und Gesundheitsschutz beim Schweißen und bei verwandten Verfahren - Laborverfahren zum Sammeln von Rauch und Gasen, die beim Lichtbogenschweißen erzeugt werden - Teil 1: Bestimmung der Emissionsrate und Probenahme zur Analyse von partikelförmigem Rauch (ISO 15011-1:2002)

Hygiene et sécurité en soudage et techniques connexes - Méthode de laboratoire d'échantillonnage des fumées et des gaz émis par le soudage a l'arc - Partie 1: Détermination du taux d'émission et échantillonnage pour l'analyse des poussieres (ISO 15011-1:2002)

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This European Standard was approved by CEN on 20 April 2001.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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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.

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.

2 Terms and definitions

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

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

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.

7 Interpretation of results

7.1 Number of tests

To evaluate the emission rate three tests are made and the mean value is calculated. If the individual results differ by more than ± 10 % of the mean, two more tests shall be made and the mean value of the five results calculated.

7.2 Calculation of fume emission rate

The fume emission rate, *E*, (expressed in milligrams of particulate fume per second of welding time) is calculated as follows:

$$E = \frac{M_2 - M_1}{t}$$

where

M_1 is the mass of the filter before welding in milligrams (mg);

M_2 is the mass of the filter after welding in milligrams (mg);

t is the arc time in seconds (s) .

7.3 Analysis

Elements to be analysed are dependent on the welding process and the consumable.

The recommended techniques are given in annex C.

Total hexavalent chromium is analysed after extraction according to the method given in annex D.

The analysis shall provide sufficient information to enable compliance with national health and safety regulations to be established.

7.4 Recording of test data and presentation of results

It is necessary to record complete information about the welding operation, since the choice of welding parameters can greatly influence the amount of fume produced. An example of a test report is given in annex B.