INTERNATIONAL STANDARD

ISO 21904-4

First edition
2020-02

Health and safety in welding and allied processes — Equipment for capture and separation of welding fume —

Part 4: Determination of the minimum air volume flow rate of capture devices

Hygiène et sécurité en soudage et techniques connexes — Équipements de captage et de filtration des fumées —

Partie 4: Détermination du débit volumique minimal d'air des dispositifs de captage

Reference number
ISO 21904-4:2020(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Captor hoods, nozzles and slot nozzles **1**
4.1 Principle 1
4.2 Apparatus 2
4.3 Test method 2
4.3.1 Test setup 2
4.3.2 Determination of the position of the entry and the measurement plane 2
4.3.3 Procedure 3
4.4 Test report 4
5 On-torch extraction devices **5**
5.1 Principle 5
5.2 Apparatus 6
5.3 Test method 6
5.3.1 Test setup 6
5.3.2 Procedure 6
5.4 Test report 7
Annex A (informative) **Additional information for on-torch extraction** **8**
Bibliography **10**

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 9, *Health and safety*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

A list of all parts in the ISO 21904 series can be found on the ISO website.

This first edition cancels and replaces ISO 15012-2.

Introduction

Welding and allied processes generate fume and gases, which, if inhaled, can be harmful to human health. Control is often required to maintain exposure at acceptable levels and this can be achieved by capturing the fume and gases using local exhaust ventilation.

For a particular capture device, the air velocity to capture welding fume can only be achieved by applying a minimum air volume flow rate. Consequently, capture devices need to be used with exhaust systems that provide, at least, the minimum air volume flow rate.

Health and safety in welding and allied processes — Equipment for capture and separation of welding fume —

Part 4: Determination of the minimum air volume flow rate of capture devices

1 Scope

This document specifies two methods for establishing the minimum air volume flow rate. One method is dedicated for use with captor hoods, nozzles and slot nozzles with a ratio of slot length to hose diameter of 8:1 or less. The other method is dedicated for use with on-gun extraction devices.

These methods are not applicable to down draught tables.

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 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

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 12100 and ISO 21904-1 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/

4 Captor hoods, nozzles and slot nozzles

4.1 Principle

Tests are performed to determine the minimum air volume flow rate to provide a suction field of given dimensions and air velocity at a measured distance perpendicular to the entry plane of the hood. The required velocity in the suction field as specified in ISO 21904-1:2020, 5.2, and the required dimensions are at least 1,5 *D* long and at least 1 *D* wide at a distance of 1,5 *D*, where *D* is the internal diameter of the extraction duct. It can be achieved by the measurement described in 4.3 or by numerical simulation (Computational Fluid Dynamics, CFD).

4.2 Apparatus

4.2.1 Anemometer, non-directional, suitable for measuring air velocities in the range 0,2 m/s to 0,5 m/s with a maximum uncertainty of ±0,06 m/s and having a calibration that is traceable to national standards if available.

4.2.2 Measure, suitable for measuring distances with an uncertainty of ±1 mm.

4.2.3 Equipment for measuring flow rates in ducts, pressure differential devices such as a venturi nozzle or an orifice plate with an uncertainty of ±5 % are suitable. This is the most appropriate equipment for measuring flow rates in ducts.

4.2.4 Equipment for generating an adjustable volume flow rate, e.g. a fan with a frequency converter or an in-line valve.

4.3 Test method

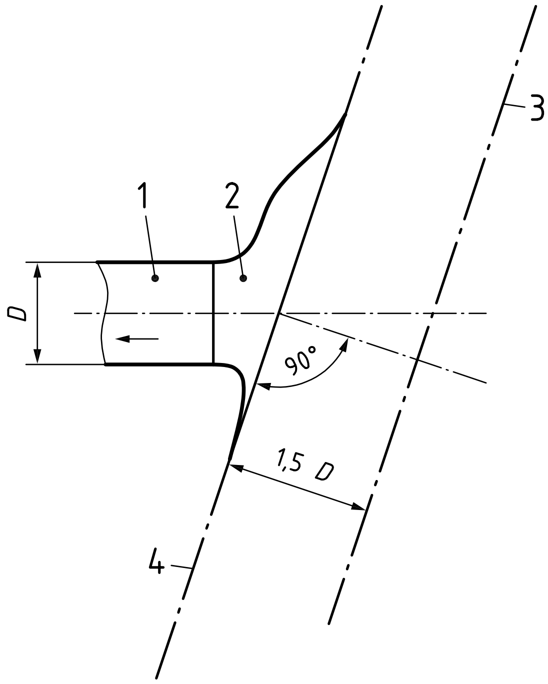
4.3.1 Test setup

Position the hood or nozzle so that it is free standing and sited away from any obstructions. Ensure that any disturbing air draughts in the immediate test area average less than 0,1 m/s in a 5-minute test period.

The anemometer shall be moveable in the measurement plane.

4.3.2 Determination of the position of the entry and the measurement plane

Determine the position of the entry plane according to Figure 1.



Key

1 duct

2 hood

3 measurement plane

4 entry plane

D internal diameter of the extraction duct

Figure 1 — Test setup

The measurement plane shall be parallel to and 1,5 *D* distant from the entry plane.

4.3.3 Procedure

Set up the capture device under the test conditions specified in 4.1 and set and record an air volume flow rate. Ensure that the air volume flow rate remains constant throughout the test period.

Place the anemometer on the x-axis in the measurement plane and move it until the required velocity specified in ISO 21904-1 furthest along the x-axis is obtained. If the required velocity cannot be measured, repeat the process using a higher air volume flow rate. If the required velocity can be measured, record the position and then move the anemometer as shown in Figure 2 to establish a similar position on the opposite side of the x-axis and record it. Calculate the distance between the two positions recorded.

Repeat the procedure for the y-axis.

Each air velocity measurement shall be the average over a minimum period of 5 min. The logging interval shall be a maximum of 5 s.

