AWS F1.1M:2018
An American National Standard

Methods for Sampling Fumes and Gases Generated by Welding and Allied Processes

American Welding Society®

Approved American National Standard
ANSI

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Approved by
American National Standards Institute
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Methods for Sampling Fumes and Gases Generated by Welding and Allied Processes

6th Edition

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Prepared by the
AWS Project Committee on Fumes and Gases

Under the Direction of the
AWS Committee on Safety and Health

Approved by the
AWS Board of Directors

Abstract

This document aids the reader in the proper technique for sampling welding fumes and gases in the workplace. Emphasis is placed on positioning the sampling device and calibration of the equipment.

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

In 1976, the American Welding Society published the first edition of AWS F1.1, *Method for Sampling Airborne Particulates Generated by Welding and Allied Processes*, in recognition of the need to standardize the procedure for sampling contaminants in the welder's breathing zone. The Project Committee on Fumes and Gases, using expertise in welding as well as industrial hygiene, developed the technique through field testing. Minor modifications and editorial changes were made in the 1985, 1992, 1999, and 2006 editions.

In 1987, the first edition of AWS F1.5, *Methods for Sampling and Analyzing Gases from Welding and Allied Processes*, was published to complement AWS F1.1. Minor modifications and editorial changes were made in the 1996 and 2003 editions.

In 2009, a decision was made to combine these two standards into a single document so that information needed to accurately assess welder exposure in the workplace would be found in one document. This document describes commonly accepted industrial hygiene sampling techniques but no longer includes the actual analytical methods as recommended by the National Institute of Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA). The analytical methods are readily available and are not generally needed by industrial hygienist collecting exposure assessment samples in the workplace. Instead, these analytical methods are referenced only.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, Safety and Health Committee, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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1. Scope and General Provisions

1.1 Scope. This standard describes procedures for sampling fumes and gases generated by welding and allied processes. Because it is limited to health hazard evaluation, the standard is primarily concerned with sampling at the worker's breathing zone (see 4.1). It also describes procedures for general area sampling of fumes and gases. The sampling methods described in this standard apply to the sampling of solid particulate matter as well as the gases liberated during welding and allied processes. Gases generated during welding may include, but are not limited to, the following:

(1) Ozone (O_3)

(2) Carbon Monoxide (CO)

(3) Nitric Oxide (NO) + Nitrogen Dioxide (NO_2) = Oxides of Nitrogen (NO_x)

(4) Gaseous Fluorides

This publication is intended for use by personnel who are responsible for sample collection and evaluation of the environment of personnel involved with welding and allied processes. It provides the most widely recognized, safe methods for the sampling to be used in the evaluation of airborne concentrations of fumes and gases commonly formed during welding. Where appropriate, analytical methods have been referenced.

While not generally present around most welding operations, it is possible to encounter toxic phosgene gas where degreasing or cleaning activities involving chlorinated hydrocarbons are carried out in close proximity to welding. Antispatter compounds may also contain chlorinated hydrocarbons. When vapors from these materials enter the atmosphere around the arc, a reaction between ultraviolet radiation from the welding arc and these vapors can produce phosgene. Since phosgene levels as low as 2 ppm can cause serious health impairment or even death, it is important to prevent vapors from any chlorinated hydrocarbon from entering the welding area. Consult the Safety Data Sheet (SDS) for any cleaning products used in close proximity to welding processes. Sampling for phosgene is outside the scope of the procedures described in this standard.

This standard makes sole use of the International System of Units (SI).

1.2 Safety. Safety and health issues and concerns are beyond the scope of this standard; some safety and health information is provided, but such issues are not fully addressed herein.

Safety and health information is available from the following sources:

American Welding Society:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) AWS Safety and Health Fact Sheets

(3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

(1) SDSs supplied by materials manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies