AWS F3.2:2018
An American National Standard

Ventilation Guide for Weld Fume

American Welding Society®



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Ventilation Guide for Weld Fume

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Prepared by the
American Welding Society (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 introduces the reader to various types of ventilation systems, including general supply and exhaust and local exhaust, for control of weld fumes. It contains or refers to information on air contaminants found in welding fumes, principles of system design and selection, and drawings that illustrate ventilation techniques.

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Foreword

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

In 1981, the American Welding Society entered into an informal arrangement to distribute an insurance company publication, *Welding Fume Control with Mechanical Ventilation.* In October 1986, the copyright was purchased and an updated version was prepared for publication as ANSI/AWS F3.1:1989, *Guide for Welding Fume Control*. It contained information to help plan new or evaluate existing systems for control of welding fume in the workplace. Because more than a revision was determined to be necessary, ANSI/AWS F3.1:1989 was withdrawn in 1997 and replaced with an updated and expanded ventilation guide, AWS F3.2: 2001. This revision is the second edition of F3.2. The health information listed for welding contaminants in the first edition have been removed and an expanded description of occupational exposure limits was added. New clauses on Maintenance (Clause 9) and Confined Spaces (Clause 10) were added. The last edition of this document used dual dimensions, the International System of Units (SI) followed by U.S. Customary Units in brackets and was designated F3.2M/F3.2. This edition uses U.S. Customary Units with approximate SI equivalents in parentheses, and is designated F3.2. This change was made because ventilation calculations in the U.S. are primarily in U.S. Customary Units.

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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Ventilation Guide for Weld Fume

1. Introduction, Scope, and General Provisions

1.1 Introduction. A ventilation system consists of either a naturally, or mechanically, supplied and exhausted flow of air which can be used to control fumes and gases generated during welding or cutting operations. Mechanical ventilation systems are typically more consistent in their ability to control contaminants and are generally utilized when it is necessary to:

(1) Control contaminants to meet occupational exposure limits (PEL, TLV, etc.);

(2) Advance environmental stewardship by collecting emissions at the source, for disposal and recycle; and

(3) Improve housekeeping by reducing settled particulates.

1.2 Scope. This guide describes recommended principles of ventilation to be used in facilities where welding and allied processes are performed. The primary objective of this document is to enhance the health and safety of all those found in a welding environment. Other objectives include the provision of information relevant to energy conservation and environmental compliance. This guide does not provide information on respiratory protection or specific precautions related to working in a confined space. Also, this guide does not address issues associated with combustible dust hazards applicable to ventilation systems. Information dealing with this issue can be found in NFPA 654, *Standard for Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids*, and NFPA 484, *Standard for Combustible Metals*.

Basic information related to a range of ventilation systems and techniques that can be used in a welding and cutting environment is provided here. Comparisons are drawn between techniques and highlight both the effectiveness and relative cost of each approach. It is intended that this information will assist in the identification and selection of an appropriate ventilation solution for a specific welding and/or cutting operation.

1.3 Units of Measure. This standard makes sole use of U.S. Customary Units. Approximate mathematical equivalents in the International System of Units (SI) are provided for comparison in parentheses or in appropriate columns in tables and figures.

1.4 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.

Sources of safety and health information include:

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) Safety Data Sheets (SDS) supplied by materials manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable regulatory agencies, such as:

(1) Occupational Safety and Health Administration

(2) Environmental Protection Agency

2. Normative References

The standards listed below contain provisions, which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

(1) AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*[1]

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

3. Terms and Definitions

AWS A3.0, *Standard Welding Terms and Definitions*, provides the basis for terms and definitions used herein.

4. Occupational Exposure Limits

The need to prevent unacceptable airborne contaminant exposures in the workplace environment is most often the impetus behind the deployment of ventilation systems. Ultimately, it is likely that the effectiveness of those ventilation systems will be judged more by the extent to which airborne contaminant exposures are maintained or controlled to levels below specific occupational exposure limits than by their ability to meet targeted system performance characteristics.

Regulations related to contaminant and other exposures in the workplace tend to be performance based and compliance is determined by taking measurements of employee exposure levels and comparing them to occupational exposure limits. Therefore, it is crucial that those involved in decisions related to the selection or application of ventilation systems understand the fundamental concepts related to occupational exposure limits.

4.1 Permissible Exposure Limits. Permissible Exposure Limits (PELs) are regulatory values in the U.S. and are published by the Occupational Safety and Health Administration (OSHA). PELs are enforceable to protect workers against the potential health effects of overexposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a substance in the air, expressed in terms of an averaged 8-hour exposure period or 8-Hour Time-Weighted Average (TWA). OSHA also designates compounds requiring engineering and other controls to prevent skin exposures. PELs can be found in 29 CFR 1910.1000, Tables Z-1, Z-2, and Z-3, and references within. Some states have their own occupational safety and health programs, so state exposure limits may differ, but they must be at least as stringent as the federal OSHA limits.

OSHA has established other types of exposure limits. The Short Term Exposure Limit (STEL) is expressed in terms of a concentration averaged over a 15-minute interval. A Ceiling Limit (C) indicates a level of exposure which may not be exceeded at any time, regardless of duration. Action Levels, designated for certain substances, are the levels where certain required activities such as exposure monitoring and medical surveillance are required. It is important to understand that specific contaminants may have one or more of these limits associated with them.

4.2 Threshold Limit Values. The ACGIH (American Conference of Governmental Industrial Hygienists) is an independent, not-for-profit, nongovernmental corporation. The ACGIH members review published studies and scientific literature to make recommendations and establish Threshold Limit Values (TLVs[2]) and Biological Exposure Indices (BEIs[2]). The ACGIH states that the TLVs formulate a conclusion, based on available information, as to the level of exposure that nearly all workers can experience repeatedly without adverse health effects. The ACGIH establishes TLVs and BEIs for the practice of industrial hygiene and they are not intended to indicate a fine line between safe and unsafe exposures. They represent the opinion of the scientific community that has reviewed the data described in the documentation, that exposure at or below the level of the TLV does not create an unreasonable risk of disease or injury. TLVs and BEIs are not standards.

The ACGIH also establishes recommended short-term and ceiling exposure thresholds. Their definitions closely resemble those established by OSHA.

[1] AWS standards and ANSI Z49.1 are published by the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.
[2] TLVs and BEIs are registered trademarks of ACGIH.