



OSHA and Welding Exhaust

The following has been taken directly from OSHA's General Industry Standards and Interpretations, Part 1910, Subpart Q – Welding, Cutting, and Brazing. We have omitted irrelevant portions and have made comments or underlined when necessary for clarification or to call your attention to a particular point.

“(4)

Work in confined spaces.

- (i) General. As used herein confined space is intended to mean a relatively small or restricted space such as a tank, boiler, pressure vessel, or small compartment of a ship.
- (ii) Ventilation. Ventilation is a prerequisite to work in confined spaces. ¹ For ventilation requirements see paragraph (f) of this section.

Health protection and ventilation.

(1) General

- (i) Contamination. The requirements in this paragraph have been established on the basis of the following three factors in arc and gas welding which govern the amount of contamination to which welders may be exposed:
 - (a) Dimensions of space in which welding is to be done (with special regard to height of ceiling).
 - (b) Number of welders
 - (c) Possible evolution of hazardous fumes, gases, or dust according to the metals involved.
- (ii) Ventilation. It is recognized that in individual instances other factors may be involved in which case ventilation or respiratory protective devices should be provided as needed to meet the equivalent requirements of this section. Such factors would include:
 - (a) Atmospheric conditions
 - (b) Heat generated
 - (c) Presence of volatile solvents

¹ This means Vanos, Jectairs, Ventairs, etc. Very good application for portable ventilation.

- (iii) Screens. When welding must be performed in a space entirely screened on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. It is desirable to have the screens so mounted that they are about 2 feet above the floor unless the work is performed at so low a level that the screen must be extended nearer to the floor to protect nearby workers from the glare of welding.
- (iv) Maximum allowable concentration. Local exhaust or general ventilating systems shall be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable concentration as specified in 1910.1000. ²

(40 F.R. 23072, May 28, 2975. (sic))

- (v) Precautionary labels. A number of potentially hazardous materials are employed in fluxes, coatings, coverings, and filler metal used in welding and cutting or are released to the atmosphere during welding and cutting. These include, but are not limited to, the materials itemized in paragraphs (f) (5) through (12) of this section. The suppliers of welding materials shall determine the hazard, if any, associated with the use of their materials in welding, cutting, etc.
 - (a) All filler metals and fusible granular materials shall carry the following notice, as a minimum, on tags, boxes, or other containers:

Caution

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. ³ See ANSI Z49. 1-1967 Safety in Welding and Cutting published by the American Welding Society.

- (b) Brazing (welding) filler materials containing cadmium in significant amounts shall carry the following notice on tags, boxes, or other containers:

² This list of allowable concentrations is published by OSHA and is constantly updated. We are not reprinting it here because of space limitations. This same information can be found in safety magazines and publications such as Industrial Ventilation issued yearly by the American Conference of Governmental Industrial Hygienists.

³ Note how this statement can serve as the impetus for purchase of Portavents, Welding Fume Arms and Portafilters.

WARNING
CONTAINS CADMIUM - POISONOUS FUMES MAY BE
FORMED ON HEATING

Do not breathe fumes. Use only with adequate ventilation such as fume collectors, exhaust ventilators,⁴ or air-supplied respirators. See ANSI Z49.1-1967.

If chest pain, cough, or fever develops after use, call physician immediately. Keep children away while using.

(c) Brazing and gas welding fluxes containing fluorine compounds shall have a cautionary wording to indicate that they contain fluorine compounds. One such cautionary wording recommended by the American Welding Society for brazing and gas welding fluxes reads as follows:

CAUTION
CONTAINS FLUORIDES

This flux when heated gives off fumes that may irritate eyes, nose and throat.

- (1) Avoid fumes – use only in well-ventilated spaces.
- (2) Avoid contact of flux with eyes or skin.
- (3) Do not take internally.

(2) Ventilation for general welding and cutting.

- (i) General. Mechanical ventilation shall be provided when welding or cutting is done on metals not covered in subparagraphs (5) through (12) of this paragraph. (For specific materials, see the ventilation requirements of subparagraphs (5) through (12) of this paragraph.)
 - (a) In a space of less than 10,000 cubic feet per welder.
 - (b) In a room having a ceiling height of less than 16 feet.
 - (c) In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation.
- (ii) Minimum rate. Such ventilation shall be at the minimum rate of 2,000 cubic feet per minute per welder, except where local exhaust hoods and booths as per subparagraph (3) of this paragraph, or airline respirators approved by the U.S. Bureau of Mines for such purposes are provided. ⁵ Natural ventilation is considered sufficient for welding or cutting operations where

the restrictions in subdivision (i) of this subdivision are not present.

(3) Local exhaust hoods and booths. Mechanical local exhaust ventilation may be by means of either of the following:

(i) Hoods. Freely movable hoods intended to be placed by the welder as near as practicable to the work being welded and provided with a rate of airflow sufficient to maintain a velocity in the direction of the hood of 100 linear feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding.⁶ The rates of ventilation required to accomplish this control velocity using a 3-inch wide flanged suction opening are shown in the following table.

Welding Zone	Minimum air flow ¹ Cubic feet/minutes	Duct Diameter, inches ²
4 to 6 inches from arc or torch	150	3
6 to 8 inches from arc or torch	275	3 ½
8 to 10 inches from arc or torch	425	4 ½
10 to 12 inches from arc or torch	600 (See Note 7)	5 ½

¹ When brazing with cadmium bearing materials or when cutting on such materials increased rates of ventilation may be required.

² Nearest half-inch duct diameter based on 4,000 feet per minute velocity in pipe.⁸

⁵ Note: Local exhaust can drastically reduce the amount of ventilation air that must be heated or cooled.

⁶ This is a key point. Well-designed flanged hoods minimize the amount of airflow necessary to accomplish this.

⁷ This can vary with the type of welding, drafts, use or non-use of proper hoods, etc. Results of our own testing are shown in the performance charts of our welding fume arm systems.

- (ii) Fixed enclosure. A fixed enclosure with a top and not less than two sides which surround the welding or cutting operations and with a rate of airflow sufficient to maintain a velocity away from the welder of not less than 100 linear feet per minute.
- (4) Ventilation in confined spaces.
- (i) Air replacement. All welding and cutting operations carried on in confined spaces shall be adequately ventilated⁹ to prevent the accumulation of toxic materials or possible oxygen deficiency. This applies not only to the welder but also to helpers and other personnel in the immediate vicinity. All air replacing that withdrawn shall be clean and respirable.
- (5) Fluorine compounds.
- (i) General. In confined spaces, welding or cutting involving fluxes, coverings, or other materials which contain fluorine compounds shall be done in accordance with subparagraph (4)¹⁰ of this paragraph. A fluorine compound is one that contains fluorine, as an element in chemical combination, not as a free gas.
 - (ii) Maximum allowable concentration. The need for local exhaust ventilation or airline respirators for welding or cutting in other than confined spaces will depend upon the individual circumstances. However, experience has shown such protection to be desirable for fixed-location production welding and for all production welding on stainless steels.¹¹ Where air samples taken at the welding location indicate that the fluorides liberated are below the maximum allowable concentration, such protection is not necessary.

⁸ This leads to very high duct pressure losses. We do not know why this high velocity was chosen. Industrial Ventilation (14th Edition) suggests a duct velocity of 3000 fpm and the National Institute for Occupational Safety and Health in Recommended Industrial Ventilation Guideline (January 1976) suggest a duct velocity of 2000 fpm. We feel 2000 fpm is adequate.

⁹ Excellent portable ventilation application.

¹⁰ Refer back. Dilution ventilation at the very least Vanos, Jectairs, etc.

¹¹ Portafilter, Portavent, Welding Fume Arms.

(6) Zinc.

- (i) Confined spaces. In confined spaces welding or cutting involving zinc-bearing base or filler materials or metals coated with zinc-bearing materials shall be done in accordance with subparagraph (4) of this paragraph.¹⁰
- (ii) Indoors. Indoors, welding or cutting involving zinc-bearing base or filler metal coated with zinc-bearing materials shall be done in accordance with subparagraph (3)¹² of this paragraph.

(7) Lead.

- (i) Confined spaces. In confined spaces, welding involving lead base metals (erroneously called lead-burning) shall be done in accordance with subparagraph (4)¹⁰ of this paragraph.
- (ii) Indoors. Indoors, welding involving lead-base metals shall be done in accordance with subparagraph (3)¹² of this paragraph.
- (iii) Local Ventilation. In confined spaces or indoors, welding or cutting involving metals containing lead, other than as an impurity, or involving metals coated with lead-bearing materials, including paint shall be done using local exhaust ventilators¹¹ or airline respirators. Outdoors such operations shall be done using respiratory protective equipment approved by the U.S. bureau of Mines for such purposes. In all cases, workers in the immediate vicinity of the cutting operation shall be protected as necessary by local exhaust ventilation¹¹ or airline respirators.

(8) Beryllium. Welding or cutting indoors, outdoors, or in confined spaces involving beryllium-containing base or filler metals shall be done using local exhaust ventilation and airline respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by 1910.1000. In all cases, workers in the immediate vicinity of the welding or cutting operations shall be protected as necessary by local exhaust ventilation¹¹ or airline respirators.

¹² Refer back. Local exhaust. Note 11.

(9) Cadmium.

- (i) General. Welding or cutting indoors or in confined spaces involving cadmium-coated base metals shall be done using local exhaust ventilation¹¹ or airline respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within acceptable concentrations defined by 1910.1000. Outdoors such operations shall be done using respiratory protective equipment such as fume respirators approved by the U.S. Bureau of Mines for such purposes.
- (ii) Confined space. Welding (brazing) involving cadmium-bearing filler metals shall be done using ventilation as prescribed in paragraph (3) or (4)^{10, 11} of this paragraph if the work is to be done in a confined space.

(10) Mercury. Welding or cutting indoors or in a confined space involving metals coated with mercury-bearing materials including paint, shall be done using local exhaust ventilation¹¹ or airline respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by 1910.1000. Outdoors, such operations shall be done using respiratory protective equipment approved by the U.S. Bureau of Mines for such purposes.

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