

ANSI/ASSP Z9.4-2011

Abrasive-Blasting Operations-Ventilation and Safe Practices for Fixed Location Enclosures

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ANSI/AIHA® Z9.4–2011

American National Standard — Abrasive-Blasting Operations — Ventilation and Safe Practices for Fixed Location Enclosures

Secretariat

American Industrial Hygiene Association

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FOREWORD (This foreword is not part of ANSI/AIHA® Z9.4–2011)

This standard was processed and approved for submittal to ANSI by the Z9 Accredited Standards Committee on Health and Safety Standards for Ventilation Systems. Committee approval of the Standard does not necessarily imply that all committee members voted for its approval. At the time it approved this Standard, the Z9 Committee had the following members:

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American National Standard for Exhaust Systems — Abrasive-Blasting Operations – Ventilation and Safe Practices for Fixed Location Enclosures

1. Scope and Purpose

- 1.1 General.** This standard applies to all operations in fixed location abrasive-blast enclosures in which an abrasive forcibly comes in contact with a surface by pneumatic or hydraulic pressure or by centrifugal force. It does not apply to steam blasting, steam cleaning, or hydraulic cleaning methods in which work is done without the aid of abrasives. It also does not apply to abrasive blasting conducted outdoors (e.g., bridges, water towers) even though temporary enclosures may be built at such locations.

The final criterion for the designed equipment's performance and operation will preclude any accident, health hazards, or violation of governmental regulations. The exhaust ventilation must:

- keep the escape of dust from the enclosure to a minimum;
- maintain a reasonable visibility in blast-cleaning rooms and cabinets, and
- provide for rapid clearance of the dust-laden air within the enclosure after the cessation of blasting to permit the enclosure to be opened.

- 1.2 Selection of Abrasive and Equipment.** Prohibit the use of silica sand as an abrasive-blasting agent.

1. Scope and Purpose

- 1.1 General.** The rules and principles established in this standard are intended to protect employees engaged or working in the vicinity of abrasive blasting in fixed location enclosures from: 1) significant risk of health impairment; and 2) physical injury due to explosions, high velocity jets of abrasive-blasting particles, or moving equipment involved in abrasive blasting.

- 1.2 Selection of Abrasive and Equipment.** Each type of abrasive and equipment has its particular advantages in producing the quality of work desired, and the selection depends on the specific requirements of the user. From a health standpoint silica sand is currently the most hazardous abrasive commonly used. Therefore, with the single exception of prohibiting the use of silica sand as an abrasive-blasting agent, no rule or

suggestion is given in this standard for the selection of a particular abrasive or equipment.

If properly designed equipment is operated and maintained in accordance with the manufacturer's recommendations, all types of abrasives and equipment can be used safely; however, the health hazards of silica sand to abrasive-blasting operators is sufficiently severe to prohibit its use, since feasible alternative abrasives are available. Abrasives that create minimum hazards should be used whenever feasible.

The presence of silica sand or crystalline silica as a contaminant on or a component of the object being subjected to abrasive blasting (e.g., mold sand adhering to a casting, stone with crystalline silica content) is not prohibited by this standard. Reasonable efforts should be made to minimize the amount of silica sand contamination on the work, however.

2 Referenced Standards and Publications

2.1 General. The following regulations, standards, and guidelines contain provisions that, through reference in this text, constitute provisions of this American National Standard.

2.2 ANSI/AIHA® Z9.2–2006, *Fundamentals Governing the Design and Operation of Local Exhaust systems*⁽¹⁾

ANSI/AIHA® Z9.7–2007 *Recirculation of Air from Industrial Process Exhaust Systems*

ANSI Z87.1–2003, *Occupational and Educational Personal Eye and Face Protection Devices* ⁽²⁾

ANSI/NFPA 91–2004, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*⁽⁴⁾

2 Referenced Standards and Publications

2.1 General. At the time of publication, the editions indicated were current. All standards and guidelines are subject to revision, and users of this American National Standard are encouraged to consult the most recent editions of the standards and guidelines listed below and apply them when feasible.

NFPA 654–2006, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*.⁽⁴⁾

NFPA 654 is the primary standard that applies to combustible abrasive blast systems. However, parts of NFPA 91, 68, and 69 are also referenced.

ANSI/NFPA 61–2008, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*.⁽⁴⁾

ANSI/NFPA 68–2007, *Standard on Explosion Protection by Deflagration Venting*.⁽⁴⁾

ANSI/NFPA 69–2008, *Standard on Explosion Prevention Systems*.⁽⁴⁾

ANSI/NFPA 70–2011, *National Electric Code*.⁽⁴⁾

2.3 Occupational Safety and Health Administration Standards and Guidance

Code of Federal Regulations, Title 29, Part 1910, Section 1000, “Permissible Exposure Limits.”

Code of Federal Regulations, Title 29, Part 1910, Section 94, Paragraph (a), “Abrasive Blasting Ventilation.”

Code of Federal Regulations, Title 29, Part 1910, Section 244, Paragraph (b), “Abrasive blast cleaning nozzles.”

Compliance Directive OSHA CPL 03-00-008, Combustible Dust National Emphasis Program, 3/11/2008.

OSHA Status Report Combustible Dust National Emphasis Program 10/2009 and annually.

2.4 Other Publications

AIHA® Z88.2–1992, *Respiratory Protection*.

Publication is in revision

ASHRAE, *HVAC Applications, Industrial Air Conditioning* (2007).⁽⁵⁾

Published every four years.

Compressed Gas Association
Compressed Air for Human Respiration
(G-7-2003).⁽³⁾

To be used with GA G-7.1-2004.

Compressed Gas Association
Commodity Specification for Air (CGA
G-7.1-2004).⁽³⁾

ASTM F2413-05 *Standard Specification*
for Performance Requirements for Foot
Protection⁽⁶⁾

Industrial Ventilation – A Manual of
Recommended Practice for Design, 27th
edition. Cincinnati, OH: ACGIH®, 2010.⁽⁷⁾

Published every three years.

Industrial Ventilation – A Manual of
Recommended Practice for Operation
and Maintenance Design, 1st Edition.
Cincinnati, OH: ACGIH®, 2007.⁽⁷⁾

Threshold Limit Values for Chemical
Substances and Physical Agents and
Biological Exposure Indices. Cincinnati,
OH: ACGIH®.⁽⁷⁾

Published approximately every three years.

Workplace Environmental Exposure
Level Guides. Fairfax, VA: AIHA®.⁽¹⁾

Criteria for a Recommended Standard ...
Occupational Exposure to Crystalline
Silica (HEW Publication No. [NIOSH] 75-
120).⁽⁸⁾

Published annually.

NIOSH Alert Request for Assistance in
Preventing Silicosis and Deaths from
Sandblasting (DHHS [NIOSH] Publication
No. 92-102).⁽⁸⁾

Published annually.

ASME Boiler and Pressure Vessel Code,
Sec VIII – Section 11 ⁽⁹⁾

Sections for reference: U-2 (a), UG21, UG-22,
UG-23, UG-98, UG-99, and associated tables.
This list is intended as a guideline to establish
points of reference in design requirements, not
as a comprehensive list. Due to its scope, a com-
plete list of subsections would be prohibitive.

ISO 7708: 1995 *Air quality, Particle Size*
Related Sampling Fraction Definitions for
Health⁽¹⁰⁾

3 Definitions

Abrasive: A collection of discrete, solid particles that when impinged on a surface cleans, removes surface coatings, or improves the quality of – or otherwise prepares to modify – the characteristics of that surface, either by impact or friction.

Abrasive blasting: The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

Abrasive-blasting respirator: An airline respiratory protective device operating either in the continuous flow or positive pressure mode, that protects the abrasive blaster by reducing exposure via the inhalation route to toxic substances whether they are the abrasive-blasting agent or materials removed by the abrasive-blasting process. This type of respirator is also constructed so that it covers the head, neck, and shoulders to protect the wearer from rebounding abrasives.

Aerosol: Particles, whether solid (e.g., dusts, fumes) or liquid (e.g., mists, sprays), dispersed in air which are sufficiently small in diameter (0.01–100 µm) to remain suspended for a significant period of time.

Airline respirator: A device consisting of a facepiece, helmet, or hood to which clean air is supplied to the wearer through a small-diameter hose from a source not on the wearer's body.

Automatic equipment: automatic fire and explosion suppression equipment.

Blasting barrel: An enclosed container for workpieces that rotates on an axis or has an internal moving tread to tumble

3 Definitions

Examples of abrasives include but are not limited to the following: aluminum oxide, crushed glass, dry ice, glass bead, plastic, silicon carbide and sodium bicarbonate.

When blasting with carbon dioxide (CO₂ or “dry ice”), the gas formed is an asphyxiant that does not support life and can displace oxygen in the air to be an immediate health hazard. Observe extreme care when blasting with CO₂ in confined areas, pits, and rooms with poor ventilation.

the parts, in order to expose various surfaces of the parts to the action of an abrasive blast.

Blasting cabinet: A blasting enclosure that is similar to a blasting room but is too small to admit an operator, in which the blasting nozzles are operated automatically or by an operator who stands outside and operates them through openings in the enclosure.

Blasting room: A complete enclosure in which blasting operations are performed. The enclosure is large enough to accommodate workpieces of substantial size and, depending on the design, one or more blasting operators stationed inside to operate blasting nozzles to direct the flow of abrasive.

Breathing air: Air that equals or exceeds Grade D specifications for gaseous air in accordance with ANSI/CGA G-7.1–2004⁽¹⁾, and that does not present a health hazard to anyone breathing the air. OSHA's regulatory requirements for breathing air are contained in 29 CFR 1910.134(d) and 29 CFR 1910.94(a)(6).

Combustible abrasive: An abrasive material that will char, smolder, ignite, burn, explode – or any combination thereof – when the environment is conducive to such reactions. Examples are plastic media, walnut or pecan shells.

Dust: Any finely divided solid material that is 420 microns or smaller in diameter, (i.e. passes a U.S. No. 40 Standard Sieve).

Dust collector: A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

Dust explosion: A dust combustion process that results in an appreciable pressure rise.

Combustible dust: NFPA 654 – A combustible solid material composed of distinct particles or pieces regardless of shape or chemical composition, which due to its small particle size present a flash-fire or explosion hazard as a result of its ability to propagate combustion when dispersed in air or the process specific oxidizing medium.

Dust explosion hazard: A condition in which a concentration of a dust is or could be suspended in air and is in excess of an established dust minimum explosible concentration (MEC) for that particular dust. Assume organic dusts, suspended in air for which there is no established dust MEC, to be a hazard in any concentration.

Enclosure: A room, cabinet, barrel, or other structure that fully surrounds (i.e., on all sides, top, and bottom) the abrasive-blasting operation and is intended to contain the airborne blast agent and the removed material generated.

Fixed location: Permanently placed or sited. This standard is not intended to cover abrasive blasting in enclosures temporarily erected around outdoor structures such as bridges and water towers.

Health hazard: A condition in which an employee's exposure to a chemical substance, biological agent, or physical agent is in excess of those permitted levels established by the regulatory agencies having jurisdiction, or in excess of guidelines established by consensus standards organizations, or any other generally recognized hazard that affects employee health (e.g., poor sanitation). In abrasive blasting, the primary health hazards are the blast agent and the material removed by the abrasive blasting.

Inhalable particles: Solid or liquid airborne particles that when inhaled, may be hazardous when deposited anywhere in the respiratory tract.

Make-up air: Outside air drawn into a ventilation system to replace exhausted air.

Minimum explosible concentration (MEC): The least quantity of dust suspended in air sufficient to produce an explosion when subjected to the established ignition temperature for that particular dust. This concentration is usually expressed as ounces of dust per cubic foot of air (or grams per cubic meter of air).

ISO 7708: 1995 defines the probability of deposition of inhalable particle mass fraction as an expression of collection efficiency versus particle size (median aerodynamic diameter).

Minimum explosible concentration is defined by the test procedure in ASTM E 1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*. MEC is equivalent to the term *lower flammable limit* for flammable gases.