



## **ANSI/ASSE Z117.1-2009, "Safety Requirements for Confined Spaces" Standards Update**

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### **Introduction**

This paper summarizes and explains the latest edition of the ANSI/ASSE Z117.1 standard for safe work in confined spaces. We will examine the key requirements of the new standard, which was issued and became effective in August 2009. We will compare the new standard to the previous edition of the standard and to US Federal OSHA regulations for confined spaces. MSA participated in the development of the new standard and provides this information as a service to customers and safety professionals. It is our intent that the standard be widely recognized and adopted for the improvements it offers in the health and safety of workers in confined spaces.

MSA equipment purchasers and end-users will find references in this paper to new requirements in the standard for personal protective equipment. For further information on MSA products complying with these requirements, contact your MSA distributor or MSA Customer Service at 1-800-MSA-2222 and online at [www.msanet.com](http://www.msanet.com).

### **History and Background**

The Z117.1 standard was developed by a committee of the American National Standards Institute (ANSI), with the American Society of Safety Engineers (ASSE) as Secretariat. It is a national standard and applies to all industry sectors except those specifically excluded. The 2009 edition of the standard supercedes the previous editions of 1995 and 2003.

During revision of the 2003 version of the standard the Z117 committee reviewed accident data for confined space incidents. A subsequent review of 200 confined space fatality cases reported by US Federal OSHA occurring between 1993 and 2004 showed that the causes of fatalities had not appreciably changed. Nearly two-thirds of fatal accidents in confined spaces were attributed to atmospheric contamination. Another ten percent of fatalities were caused by engulfment. The remaining causes are related to many factors, including falls from height, electrocution, and being struck by a moving object.

The latest version of the Confined Space standard incorporates lessons learned since the last edition as well as advances in the technology of protective equipment.

### **Key Requirements of Z117.1-2009**

#### Scope of ANSI Z117.1-2009

The Confined Spaces standard provides safety standards to be followed while entering, exiting and working in confined spaces. This standard does not apply to the following activities:

- mining
- tunneling
- caisson work
- intentionally inert confined spaces

#### Identifying and Evaluating Confined Spaces

A qualified person is required to conduct a Confined Space Survey. The Survey develops an inventory of confined space locations or equipment so that workers can be made aware of them and the appropriate

procedures developed for safe entry. Hazards are identified by a qualified person prior to entry. **Confined spaces are always to be considered hazardous until determined to be otherwise.**

Confined spaces can become unsafe as a result of a number of causes:

- atmospheric contamination by toxic or flammable vapors, or oxygen deficiency/excess
- physical hazards such as high heat, moving machinery, electricity or falls from height
- possibility of liquids, gases or solids introduced into the space during occupancy
- isolation of occupants from rescue personnel
- presence of radiation sources

The standard lays out detailed criteria for evaluating hazards in a formal, documented Hazard Identification process. To control hazards, the standard establishes the following Hierarchy of Controls:

- Eliminate the hazard
- Engineering controls (for example: substitution, isolation, etc.)
- Administrative controls (such as: work practices, procedures, personnel assignments, etc)
- Personal Protective Equipment (PPE)

Before the confined space cover is removed, any known hazards must now be addressed through:

- elimination
- control of the hazard
- use of appropriate personal protective equipment

### Confined Space Classification

A qualified person must designate the class of confined space based on an evaluation of the hazards:

- Permit Required Confined Space - one found to contain actual or potential serious hazards. This confined space requires written authorization for entry.
- Non-Permit Required Confined Space - a space meeting the definition of a confined space but unlikely to have potential hazards, or has the hazards eliminated.

### Non-Permit Confined Spaces (NPCS)

The employer is responsible for defining the conditions and precautions necessary to allow entry into a NPCS. There must also be criteria in place to define a change in conditions. Changes in conditions require re-evaluation of the space and may result in re-classification to a Permit Required Confined Space. Employees are required to receive initial and follow-up training to maintain competence in entry procedures and precautions. NPCS must be periodically re-evaluated to assure the classification is correct.

Atmospheric testing is required prior to entry and periodically during occupation of the NPCS. If atmospheric levels are not within acceptable limits after implementing engineering controls, then the confined space is not a NPCS and entry must not proceed. An adverse change in atmosphere detected during occupation of the NPCS requires prompt evacuation of the space.

### Permit-Required Confined Spaces (PRCS)

In confined spaces which present a hazard to occupants, entry must be controlled by means of a permit system. The elements of the system include:

- review of hazards and communication of this information to all those involved
- date of entry, location, names of entrants and type of work performed
- identification of hazards to be controlled
- safety equipment required
- identification of test instruments, type of tests required and the criteria for evaluating the results of testing
- a rescue plan and equipment needed in the event of an emergency
- the duration of the permit, not to exceed the time needed to complete the work or one work shift, whichever is less. A system may be established to extend the permit and keep it current with the entry team members and their activities.

Permits must be revoked when conditions or work activities change or could introduce a hazard not included in the original permit. For example, if welding were to be added to the work activities after the original permit was issued. This would require an evaluation of precautions for hot work and amendment of the permit to control welding hazards before the work began.

### Atmospheric Testing

Atmospheric testing of confined spaces generally includes testing for the following:

- oxygen
- flammability/combustibility
- toxicity

Under provisions of the new confined space standard, entry team members should be permitted the opportunity to observe testing, atmospheric monitoring and the results of these efforts. Atmospheric testing must be conducted by a qualified person with specialized knowledge and skills. The standard goes into detail regarding different evaluation techniques to be employed by the qualified person.

Testing equipment, accessories and ventilation equipment used in hazardous areas must now be approved, listed, or certified for use in such areas by nationally recognized laboratories.

### Entry Team

All entry team members, attendants and entrants, must be trained and equipped prior to entry into a confined space. Attendants must be located immediately outside the entry/exit point of the confined space to observe the PCRS and be able to communicate with the occupants inside the space. Duties of the attendant include:

- providing assistance to entrants
- direct entrants to exit the confined space whenever irregularities occur, including:
  - whenever unanticipated hazards not allowed by the permit arise,
  - whenever entrants exhibit signs of exposure to contaminants
  - whenever surrounding operations or conditions create hazards for the entrants
- initiate evacuation or emergency procedures
- summon the rescue team
- monitor for adverse changes in conditions within the confined space
- remain at the entry point and maintain communication with entrants
- prevent unauthorized entry

Entrants to the confined space are responsible for carrying out the following duties:

- recognize hazards and use the equipment for controlling those hazards
- inspect for hazards not previously identified during initial entry
- respond to emergencies and possess the skills necessary for self-rescue or evacuation
- recognize the symptoms of exposure to hazardous conditions
- notify the attendant of any symptoms or other emergency conditions
- exit the confined space immediately if symptoms, warning signs or unacceptable conditions arise within the space

The Entry Supervisor or Leader is tasked with the following duties:

- know the requirements of the confined space program
- verify all required actions are taken prior to endorsing the permit
- verify rescue services are available prior to and through-out entry
- communicate status when supervisor change over occurs
- terminate entry, ensure removal of personnel and revoke the permit when required

### Isolation and Lockout/Tagout

All energy sources which are potentially hazardous to the entry team must be secured safely before personnel are permitted to enter the confined space. The goal is to control any situation where energy can be released

which could cause injury. Energy sources include:

- electrical
- thermal
- hydraulic
- radioactive
- mechanical
- chemical
- pneumatic
- gravitational

Isolation prevents the entry of hazardous gases and liquids from entering the confined space. A confined space must be isolated by one of several specified methods detailed in the standard. Pipelines and other conveyances must also be isolated to prevent engulfment or entry of hazardous vapors. Continuous monitoring must be conducted where an atmospheric hazard potential exists.

Machinery and processes must be locked or tagged or both in accordance with the current edition of ANSI/ASSE Z244.1, "Control of Hazardous Energy - Lockout /Tagout and Alternative Methods." Any removal of locks, tags or other protective measures must be performed according to this standard. Lockout/Tagout equipment and processes must be verified and confirmed as part of the entry permit review.

### Ventilation

Ventilation normally consists of a purge of several air changes prior to entry, followed by a continuous supply of fresh air during occupancy. Natural ventilation is permitted so long as it achieves the same results as mechanical ventilation. Air movers used in mechanical ventilation must meet the requirements of ANSI/NFPA 91, "Standard for Exhaust Systems," and ANSI/AIHA Z9.2, "Design and Operation of Exhaust Ventilation Systems."

When ventilation is not feasible for complete elimination of atmospheric hazards, other protective measures must be implemented under the direction of the qualified person before entry is authorized. The new standard also requires that the qualified person ensure the ventilation system offers the highest level of protection and that exhaust does not present a hazard in other areas.

### Cleaning/Decontamination

The preferred method of reducing exposure to hazardous materials is through cleaning and decontamination. Proper PPE and other precautions should be used to address any hazards. Disposable materials or equipment must be properly discarded and any runoff from decontamination managed per specific hazard protocol.

### Personal Protective Equipment (PPE)

A hazard evaluation should be performed by the qualified person to determine what PPE should be used. All PPE must meet the specifications of applicable standards.

Head protection must meet ANSI/ISEA Z89.1.

Respirators should be selected and used in conjunctions with a written respiratory protection program, as referenced in OSHA 29 CFR 1910.134. Respirators should be NIOSH approved. Self-Contained Breathing Apparatus (SCBA) should be certified to meet the NFPA 1981, "Standard on Open-Circuit Self-Contained Breathing Apparatus." The equipment should be selected and maintained in accordance with NFPA 1852, "Standard on Selection and Care and Maintenance of Open-Circuit Self-Contained Breathing Apparatus."

Fall protection systems should conform to ANSI/ASSE Z359, "Fall Protection Code." The provisions of the standard include equipment requirements for components of a fall arrest system, fall restraint, work positioning and rescue. New requirements published in 2009 address the design of fall protection systems. The Fall Protection Code also contains guidance in managing the fall protection program.

Eye and face protection includes protective eye wear for exposure to irritant dusts, vapors, abrasive particles and flying objects. Safety glasses, goggles and face shields should meet the requirements of ANSI/ISEA Z87.1.

Hearing protection must meet OSHA 29 CFR 1910.65 and consideration given to how hearing protection can affect communications among the confined space team.

Hand protection from mechanical, thermal chemical and electrical hazards should be provided.

Foot protection from physical hazards should be provided in accordance with the recommendations of the ASTM F13 committee.

Protective clothing should be available for exposure to hazardous materials and decontaminated or disposed of after use according to the manufacturers' instructions.

#### Auxiliary Equipment

Rescue equipment should be used in evacuating personnel from confined spaces as determined by the qualified person. Rescue components, including anchorage connectors, mechanical connecting devices and other components should meet ANSI/ASSE Z359.4, "Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components."

Appropriate retrieval equipment and methods must be used whenever a person enters a PRCS. Mechanical lifting devices should be designed and tested as required in ANSI/ASSE Z359.4 for personnel hoists and used in accordance with the manufacturers' instructions. Protective equipment must not interfere with ventilation or egress from the confined space.

Warnings or barricades must be used whenever the potential exists for persons or objects falling into a confined space.

Electrical equipment used in hazards locations must meet the requirements of the National Electrical Code, Article 500.

#### Warning Signs and Symbols

All permit required confined space openings must be marked with a sign, "Danger - Permit Required Confined Space." Refer to ANSI/NEMA Z535 standards for safety signs, symbols and colors.

#### Emergency Response, Evacuation and Rescue

The new Z117.1-2009 standard includes requirements for a written Emergency Response Plan to, "...address the response to identified or potential emergencies and to provide for timely evacuation, retrieval or rescue of entrants in a confined space." The plan must include:

- mandatory evacuation instructions when certain hazards are identified
- retrieval by trained crew members using methods separate from the methods used in entry
- rescue by trained emergency response personnel

Hazards should be identified in advance to determine the appropriate methods and equipment to be used in various emergency retrieval or rescue scenarios.

#### Horizontal Retrieval or Rescue

The confined space should be evaluated to determine whether a horizontal or vertical rescue procedure will be needed. This determines where to place anchors, the hazards to be encountered and the body size of entry personnel.

#### Vertical Retrieval or Rescue

Rescue methods for vertical rescue must include the use of fall protection for the entrant as well as suspended rescuers. A constant watch should be utilized whenever an entrant is being moved.

The rescue plan must determine the availability of appropriate equipment needed to rescue or retrieve entrants. Trained rescue personnel must be designated and identified as available where PCRS entries are conducted. This may mean advance planning for placement of the trained rescue personnel prior to entry and during entry operations. Effective means of communications must be available to summon help, including the use of radios, pagers, etc.

## Atmospheric Monitoring for Rescue Operations

Atmospheric monitoring must also be conducted to ensure the safety of rescue personnel.

## Respiratory Protection Equipment

All rescue personnel are now required to use NIOSH approved pressure-demand SCBA or NIOSH approved pressure-demand Combination Type C Airline/SCBA breathing equipment when potential atmospheric hazards are present.

## Rescue Equipment Inspection

All rescue equipment must be inspected by a qualified person, periodically and prior to use, to ensure that is operable.

Selected equipment should meet recognized national consensus standards such as the ANSI/ASSE Z359 Fall Protection Code and NFPA 1983 Standard on Life Safety Rope and Equipment for Emergency Services.

## Training

The Confined Space standard now requires supplemental training, "... to maintain competency when introducing changes in conditions, procedures or equipment." Training is required for everyone involved in planning, supervising, entering or participating in confined space entry and rescue. Training must adequately address functional duties and be completed prior to confined space entry. Training must include the following:

- an explanation of general hazards
- an explanation of the specific hazards to be encountered
- the hazard for which PPE was selected and its proper use, inspection, care, maintenance and limitations of PPE
- an explanation of the permit system
- how to respond to emergencies
- duties and responsibilities of each member of the confined space entry team
- description of how to recognize air contamination exposure

Personnel who operate atmospheric monitoring must receive additional training on the selection and use of the monitoring instruments based on a current hazard assessment. Similarly, specific training objectives are identified for each member of the confined rescue team.

## Training for Emergency Response Personnel

New requirements for rescue team members include the mandatory demonstration of proficiency for each type of confined space they may encounter. Their training is now required to be based on performance standards such as NFPA 1006, NFPA 1670 and NFPA 1981.

Emergency responders must be trained in the use of rescue equipment. Persons with Cardiopulmonary Resuscitation (CPR) or Automated External Defibrillator (AED) and/or first aid should possess current certification.

## Verification of Training

The effectiveness of personnel training must be conducted periodically by a qualified person. Training must be repeated as often as necessary to maintain an acceptable level of competence.

Written records of training must be maintained and periodically reviewed to ensure proper follow-up for refresher training.

## Medical Suitability

The physical and psychological suitability of persons to perform their duties in confined space work must be considered as needed prior to working in confined spaces. This includes an evaluation by a licensed health care professional.

## Contractors

When an employer contracts work that involves confined space entry, the employer must provide the contractor with information about the confined space, including:

- classification status of the confined space (e.g. permit or non-permit)
- hazards and operations within or near the space
- the employer's experience with the space
- any precautions the employer has implemented in or near the confined space where the contractor will be working

Employers are now required under the new version of the Confined Space standard to evaluate their contractors. Employers must ensure contractors have the appropriate qualifications to work safely in the confined space, including a contractor confined space safety program meeting the requirements of the new standard.

Contractors are now required to conduct a debriefing at the conclusion of entry operations. The debriefing is intended to, "... identify any additional hazards or problems encountered and corrective measures to be taken prior to future entry."

## **Key Changes in Z117.1-2009 from the Previous Z117.1-2003 Version of the Standard**

### Updated References to Latest Relevant Safety Standards

The new revision to the Confined Space Standard contains updates to references, clarifying language and several new requirements. Some of the most significant changes in the standard are contained in the references to new standards for equipment used in confined space entry. These include the suite of NFPA standards for protective clothing, NFPA/NIOSH standards for self-contained breathing apparatus (SCBA), and the new ANSI/ASSE Z359-2009 Fall Protection Code for fall arrest and rescue systems. The expanded and updated list of new standards incorporated into the Confined Space Standard direct safety professionals to higher and better levels of protection available with the latest technology in personal protective equipment.

### An Expanded Role for the Qualified Person

Additional new requirements in the Confined Space Standard enhance the role of the Qualified Person. The Qualified Person is typically a safety professional with advanced training, often a licensed professional engineer or someone with an equivalent level of training and experience. The revised Confined Spaces Standard places greater reliance on the Qualified Person to make expert judgments for many critical decisions in the employer's confined space program.

### Increased Training Requirements

Another important change to the Confined Space Standard concerns the increased emphasis on all aspects of worker training in safe entry and rescue/retrieval. This is especially evident in expanded language addressing the planning and execution of training for emergency rescue from confined spaces.

### Greater Demands on Contractor Safety and Coordination

Lessons learned from past accident investigation has resulted in a greater emphasis on the work of contractors. Employers are now directed to survey contractors to ensure that the contractor is prepared to work safely in confined spaces and has met a level of conformance to the standard equivalent to that of the employer. There are also new requirements to improve coordination between the employer safety organization and that of the contractor involved in confined space work.

## **The ANSI Standard Versus OSHA Rules for Confined Spaces**

Safety in confined spaces is addressed by US Federal OSHA in two standards, one for general industry and one (proposed) for construction. These requirements are given in the following OSHA rules:

- 29 CFR 1910.146 Confined Spaces in General Industry, Amended Final Rule (1998)
- 29 CFR 1926, Confined Spaces in Construction, Proposed Rule (2007)

The older General Industry rule is now 11 years old and has been augmented by several official OSHA Letters of Interpretation that address specific applications of the rule. The proposed new rulemaking for construction contains a very different approach to the classification of Permit Required Confined Spaces intended for construction and demolition activities. The status of the Confined Spaces for Construction rulemaking is problematic, as OSHA has not yet moved to promulgate the new standard. Public comment was concluded last year and the agency predicts action within the next year to finalize the rule. However, agency schedules are seldom met and may be subject to unanticipated delays before final passage of the proposed rule into law.

Both OSHA rules contain provisions that are roughly compatible with the requirements of the new ANSI/ASSE Z117.1-2009 Confined Space Standard. Employer organizations in the General Industry category are advised to adhere to the requirements of the OSHA confined space rule, which are considered to have the force-in-effect of law. Additionally, in those states with State OSHA plans, there may be further requirements above those required in US Federal OSHA. As a further note, OSHA regulators treat proposed rulemaking, e.g., the Confined Spaces in Construction regulation, as OSHA policy. Violations of proposed rules may therefore be considered violations of de facto policy although no actual Final Rulemaking has occurred. Employers are therefore cautioned to be aware of these proposed requirements in anticipation of enforcement actions resulting from failure to protect workers against known hazards in the workplace.

OSHA regulations are considered to be minimum requirements under the General Duty Clause of the Occupational Health and Safety Act. Additional protection afforded by nationally recognized voluntary standards, such as ANSI/ASSE Z117.1-2009, are considered to also bear upon the employer's responsibility to provide the highest and best level of protection to employees under the General Duty Clause. While failure to comply with voluntary standards is not considered a reason for citation in and of itself by OSHA inspectors, it may result in enforcement action under the General Duty clause.

The distinction and difference between OSHA regulations and voluntary ANSI standards are a complex issue. OSHA regulations like the Confined Spaces in General Industry rule are often

aged and may not reflect the latest developments in occupational safety. US voluntary consensus standards, on the other hand, are updated every five years and may provide a higher and better level of protection to at-risk workers than the corresponding OSHA regulations. Consideration must be given to potential legal actions arising out of occupational injury. In the current legal environment, liability can be assigned based on failure to follow the highest and best available protection regardless whether the knowledge is available from regulations or standards.

Employer organizations are advised to always follow the requirements of OSHA and, when a higher level of protection is evident, to incorporate the requirements of ANSI/ASSE Z117.1-2009 in their confined space safety program. If adopting the more stringent requirements of the standard is not feasible for your company, it is a good idea to document the rationale used in deciding not to comply.

### **Design of Confined Spaces**

The ANSI/ASSE Z117.1-2009 standard does not address the issue of safety in design of confined spaces. The authors of the standard believe, however, that design plays a critical role influencing the safe entry of confined spaces. The authors have therefore recommended that, "...designers, manufacturers and users make confined space design issues a priority when new or modified facilities...and equipment are contemplated."

Copies of ANSI/ASSE Z117.1-2009 are available from the American Society of Safety Engineers, Des Plaines, IL, online at [www.asse.org](http://www.asse.org)

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