
Section 17

Hand and Power Tools, Pressure Vessels, Compressors, Chainsaws, and Welding

17.1 Scope

This section sets forth the requirements for the operation and maintenance of hand tools, power tools, pressure vessels, compressors, chainsaws, and welding equipment. These requirements apply to both shop-based and mobile equipment. Reclamation employees that use or work around these equipment types must follow the requirements of this section.

17.2 General Requirements

All welding and cutting operations shall comply with OSHA Standard 29 CFR 1910.252, *Welding, Cutting and Brazing*, by following the current edition of American National Standards Institute (ANSI) Z49.1, *Safety in Welding, Cutting, and Allied Processes*. All tools or equipment must be evaluated for noise levels and follow Reclamation Safety and Health Standard (RSHS) Section 31, *Hearing Loss Prevention Program*.

17.3 Responsibilities

17.3.1 Facility Manager - Welding

- 17.3.1.1** Shall ensure their facility has a written hot work operations plan, per RSHS Section 10 *Fire Prevention and Protection*.
- 17.3.1.2** Shall designate, in writing, the authorizing individual for hot work permitting, as well as for authorizing cutting and welding operations for areas not specifically designed for hot work.
- 17.3.1.3** Shall ensure that permanently designed hot work areas in their facility are identified.

17.3.2 Facility Manager—Pressure Vessels

- 17.3.2.1** Shall maintain a log or recordkeeping process for pressure vessel inspections and permits per Facilities Instructions, Standards, and Techniques (FIST) Manual 2-9, *Inspection of Unfired Pressure Vessels*.
- 17.3.2.2** Shall schedule all pressure vessel inspections at least every 5 years per FIST Manual 2-9.
- 17.3.2.3** Shall ensure a current permit is hanging on the pressure vessel or prominently displayed close to the pressure vessel.

17.3.3 First-Line Supervisors—General

- 17.3.3.1** Shall ensure that each employee can safely perform the work tasks and operate the tools, equipment, and machines used in their jobs.
- 17.3.3.2** Shall provide employees with personal protective equipment (PPE) and equipment for tasks as determined by the job hazard analysis (JHA).

17.3.4 First-Line Supervisors—Welding

- 17.3.4.1** Shall ensure all hot work is conducted per the hot work permit, including establishing controls for designated areas for cutting and welding based upon the fire potentials of the plant or facility where hot work will happen, including ensuring flammable substances are not in the spark zone of any welding activities.
- 17.3.4.2** Shall ensure hot work equipment is appropriate for the type of hot work performed.
- 17.3.4.3** Shall advise contractors of hazardous conditions in hot work areas.

17.3.5 First-Line Supervisors—Compressed Gas

- 17.3.5.1** Shall ensure the handling, storage, and utilization of all compressed gases in cylinders, and portable tanks are in accordance with Compressed Gas Association Pamphlet P-1-1965, which is incorporated by reference as specified in OSHA 29 CFR 1910.6.
- 17.3.5.2** Shall ensure that compressed gas cylinders are visually inspected prior to use in accordance with the most recent Compressed Gas Association Pamphlet C-6.
- 17.3.5.3** Shall ensure compressed gases are transported according to 49 CFR Parts 171-179 and 14 CFR Part 103.
- 17.3.5.4** Shall ensure employees complete the training requirements listed in paragraph 17.4.3, *Compressed Gas Training* of this RSHS.
- 17.3.5.5** Shall remove unsafe compressed gas cylinders from service until repaired.

17.3.6 First-Line Supervisors—Hand Tools

- 17.3.6.1** Shall ensure the safe condition of tools and equipment.
- 17.3.6.2** Shall ensure employees are trained on all tools, equipment, and machines used in their job, in accordance with paragraph 17.4, *Training Requirements* of this RSHS before employees operate or maintain said equipment.
- 17.3.6.3** Shall ensure all tools are stored properly at the end of each work shift.

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- 17.3.6.4** Shall ensure damaged or defective tools are tagged and removed from service until repaired. If the tool cannot be repaired, a competent employee must destroy the tool so it cannot return to service.

17.3.7 First-Line Supervisors—Power Tools

- 17.3.7.1** Shall keep the manufacturers owner’s manual for all machinery and equipment under their control, or shall provide a procedure to document deficiencies/hazards for machinery or equipment where a manufacturers owner’s manual cannot be obtained.
- 17.3.7.2** Shall ensure employees are trained in accordance with paragraph 17.4.1, *Training Requirements* of this RSHS, before employees operate and maintain equipment.
- 17.3.7.3** Shall ensure all tools are stored properly at the end of each work shift.
- 17.3.7.4** Shall ensure safe condition of tools, by ensuring damaged or defective tools are tagged and removed from service until repaired. If the tool cannot be repaired, a competent employee shall destroy the tool so it cannot return to service.

17.3.8 Employees—General

- 17.3.8.1** Shall follow all requirements of this section.
- 17.3.8.2** Shall wear PPE identified in the JHA.

17.4 Training Requirements

17.4.1 Initial—Hand and Power Tools

Before initial use, employees shall be trained by the supervisor or an assigned on-the-job trainer on all machinery or equipment they are required to use. Only trained personnel or those in supervised on-the-job training shall operate shop machinery or equipment unless they pass a proficiency check by their first-line supervisor. Proficiency and training on one kind of hand or power tool does not imply an employee is proficient and trained on all hand or power tools. Each tool or type of tool requires separate consideration.

17.4.2 Initial – Chainsaws

Training shall meet the requirements established in consensus standard ANSI-OPEI B175.1 (2021 Edition) *Outdoor Power Equipment – Internal Combustion Engine-Powered Hand-Held Chain Saws – Safety and Environmental Requirements*. Training shall:

- be provided at no cost to employees,
- be provided prior to the employee performing chainsaw-related work,
- be provided whenever the employee is assigned a new task, tools, or equipment,
- cover the safe performance of assigned work,

- cover safe use, operation, and maintenance of tools, including an emphasis on understanding and following the manufacturer's operating and maintenance instructions, warnings, and precautions,
- cover recognition of safety and health hazards associated with the employee's specific work tasks, including the use of measures and work practices to prevent and control those hazards,
- include first aid training for all employees required to use chainsaws in the performance of their duties,
- be documented in the form of a written certification that contains the name of the employee trained, the dates of training, the signature of the person who conducted the training, and the signature of the supervisor, and.
- refresher or recertification training whenever an employee demonstrates unsafe performance

17.4.3 Initial—Compressed Gas Training

Employees that use, handle, store, transport, or ship compressed gases shall be trained on the following minimum elements:

- RSHS Section 33, *Hazard Communication Program*, paragraph 33.4.1, *Initial Training*, on the hazards of compressed gases used at the facility and the associated compressed gas equipment,
- handling and use procedures,
- storage procedures,
- required PPE,
- gas-specific safety procedures,
- shipping procedures as applicable,
- transport procedures as applicable, and
- compressed gas emergency procedures.

17.4.4 Training—Welding

Welders must be trained to the level of work they are performing (e.g., American Welding Society, ANSI). The facility manager shall determine if it is appropriate for an apprentice to work under a certified welder or to become certified to meet a certain standard.

17.4.5 Refresher—General

When work duties or conditions change in the facility, first-line supervisors shall provide employees refresher training.

17.4.6 Lack of Proficiency—General

Retraining is necessary when an employee demonstrates a lack of knowledge of the training elements identified in paragraph 17.4 of this RSHS.

17.4.7 Recordkeeping—General

All training records shall be kept in the Department of the Interior's approved repository and managed in accordance with the Information Management Handbook as referenced in Reclamation Manual Directive and Standard, *Information Management* (RCD 05-01).

A summary of employee's training relating to this section shall be easily and quickly accessible at the employee's assigned duty station and a copy provided to the job lead/facility manager when the employee reports to another duty station for temporary or detail work.

17.5 Hazard Identification, Assessment, and Safety Measures

17.5.1 Hazard Identification and Assessment—Compressed Gas

The first-line supervisor, with the assistance of a safety professional if needed, shall identify the types of compressed gases, work areas, and storage areas. First-line supervisors shall ensure that a JHA is developed in accordance with paragraph 17.6.1, *Job Hazard Analysis (JHA)* of this RSHS. First-line supervisors shall ensure employees are trained per paragraph 17.4 of this RSHS.

17.5.2 Safety Measures—Compressed Gas

17.5.2.1 Prohibited Work Activities

The first-line supervisor shall ensure employees working with compressed gases never perform the following forbidden practices:

- attempt to repair a cylinder, pressure relief device, or valve,
- store acetylene cylinders on their side,
- store cylinders containing oxygen, acetylene, or fuel gases in confined spaces,
- bleed a cylinder to below 25 psi,
- set the acetylene regulator above 15 psi,
- roll or drag cylinders,
- tamper or disable safety devices on cylinders or cylinder accessories,
- mix gases in a cylinder or try to refill a cylinder; always contact the supplier for this,
- use the recessed top of the cylinder as a storage area for tools or materials,
- open valves until regulators are drained of gas and pressure-adjusting devices are released,
- point outlets towards employees or sources of ignition when opening cylinders,
- use the valve or valve cap to lift the cylinder,
- use oxygen and compressed air interchangeably, and/or
- permit smoking or open flame sources where cylinders are stored.

17.6 Pre-job Briefing and Planning Requirements

17.6.1 Job Hazard Analysis (JHA)

The first-line supervisor and the employees doing the work shall conduct a Risk Assessment and JHA planning and review, and shall ensure the written JHA includes appropriate

handling, use, inspection, storage, and transport procedures for job tasks. First-line supervisors shall ensure a post-job JHA review is conducted per RSHS Section 4, *Work Safety Planning*.

First-line supervisors shall verify an employee has the competency to utilize the tools and equipment to do their job, at a level sufficient to meet the hazards identified in the JHA.

17.6.2 Hot Work Permit

Shall comply with RSHS Section 10, *Fire Prevention and Protection*. Any hot work conducted outside of a designated hot work area requires to have a hot work permit.

17.6.3 Pressure Vessels

FIST Manual 2-9, *Inspection of Unfired Pressure Vessels*, provides inspection and testing guidelines for pressure vessels including pre-job planning and considerations. First-line supervisors shall consult FIST 2-9 prior to any job involving a pressure vessel.

17.7 Hazardous Atmosphere

When a hazardous atmosphere develops or exists, all work will immediately cease until the atmosphere has returned to acceptable conditions, as referenced in RSHS Section 14, *Confined Spaces and Permit-Required Confined Spaces*.

17.8 Personal Protective Equipment (PPE)

The first-line supervisor shall ensure employees have the appropriate PPE identified in the JHA for their job tasks and have been trained on proper PPE use per RSHS Section 8, *Personal Protective Equipment*.

17.8.1 Additional Welding or Hot Work Operations PPE

Additional PPE is required for welding operations per RSHS Section 8, *Personal Protective Equipment*.

17.8.2 PPE Requirements When Operating Chainsaws

When operating chainsaws, employees must use the following PPE:

- long sleeved shirt and long pants,
- cut-resistant or leather, laced 8 inches (204mm) high, boots that provide ankle support and nonskid soles (hard toes are optional),
- hard hat or cutting helmet meeting ANSI Z89.1,
- ANSI Z87.1 clear safety glasses, at a minimum or equivalent, mesh “bug-eye” type or mesh face shield type,
- hearing protection required for gasoline powered chainsaw use,

- gloves or chain saw mitts made of leather when sharpening chainsaw blades (alternative style of gloves may be used for inclement weather conditions, based on the JHA),
- chaps or cut-resistant pants for chain saw use shall meet the requirements of the most current version of ASTM F-1897, overlapping boots at least 2 inches, and
- additional PPE as identified by local conditions or identified in a local JHA.

17.9 Other Safety Equipment

17.9.1 Fire Extinguishers

Fire extinguishers rated 2A:40B:C units or larger must be immediately available in areas of hot work.

17.10 Safe Practices

17.10.1 Welding/Hot Work

Each employee performing welding/hot work shall have a copy of, and follow, the hot work permit. The hot work permit and hot work operations shall follow the requirements of RSHS Section 10, *Fire Prevention and Protection*. Employees shall:

- ensure the hot work permit remains in place until the work is complete, and
- obtain training per paragraph 17.4.4 of this RSHS.

17.10.2 Compressed Gas Handling

The first-line supervisor shall ensure employees are aware of and use the following work practices when handling compressed gases:

- wear the appropriate PPE identified in the JHA when handling or working around compressed gases,
- examine cylinders as soon as received for damage or leakage,
- use carts, dollies, or other material handling equipment designed to secure cylinders to move cylinders,
- ensure protective valve caps are securely fastened on cylinders when idle or being transported,
- ensure cylinders are equipped with valves, hoses, connectors, and regulators and all are in good condition prior to use,
- check the cylinder's label before putting the cylinder into service to ensure the correct gas is being used,
- perform a leak check immediately after compressed gas cylinder(s) are connected to equipment or systems,
- place a warning tag on damaged or leaking cylinders and move to a safe area until the supplier removes the cylinder,
- use regulators, pressure relief devices, valves, hoses, and other auxiliary equipment specifically designed for the container and compressed gas/cryogenic liquid to be used,

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- leave gauges attached on torchsets that are kept available (ready for use), to prevent damage to the gauge seals due to excessive removal and reattachment of gauges,
 - close cylinder valves when cylinders are in storage, in transit, or not in use,
 - ensure the valve wrench or wheel is in the operating position when cylinder is in use,
 - handle cylinders properly to not weaken or damage the cylinders or valves,
 - roll cylinders on the bottom rim during short displacements,
 - never subject cylinders containing compressed gases to temperatures above 125 degrees Fahrenheit,
 - when transporting or moving compressed gas cylinders with a crane, hoist or derrick, ensure the cylinders are placed in a cradle, net, or skip, and
 - Never transport compressed gas cylinders by slings, chains, or magnets.

Employees shall:

- attend initial training as described in paragraph 17.4.3, *Compressed Gas Training* of this RSHS,
- attend refresher training as described in paragraph 17.4.5, *Refresher Training* of this RSHS,
- conduct visual gas cylinder inspections prior to use and shall immediately report any leaking, damaged, or malfunctioning cylinders to their first-line supervisor,
- never use any leaking, damaged, or malfunctioning cylinders, and
- review the JHA before handling, using, storing, or transporting compressed gases, and shall follow all identified precautions and risk minimization protocols.

17.10.3 Compressed Gas Storage

The first-line supervisor shall ensure employees are aware of and use the following work practices when storing compressed gases:

- separate cylinders in storage from flammable or combustible materials by at least 20 feet, or by a fire-resistive partition with at least a 1-hour fire-resistive rating of at least 5 feet in height,
- store cylinders in dry, well-ventilated areas away from exits and stairways,
- store cylinders off the ground,
- keep out of direct sunlight and keep temperatures below 125 Fahrenheit when storing cylinders outside,
- ensure cylinders containing a flammable or oxidizing gas are not stored near an ignition source,
- ensure a properly rated and sized fire extinguisher is available where compressed gases are stored and one is close by when using flammable compressed gases,
- store cylinders upright and secure cylinders properly (e.g., bracket, chain) while in storage or during transit,
- ensure cylinder valve caps are securely in place when the regulator is disconnected from the cylinder (e.g., storage, transport),
- store empty and full cylinders in separate areas,
- ensure empty cylinders are labeled/marked with a tag indicating "empty" or "MT,"
- ensure cylinders are stored in areas away from contact with extreme temperatures (e.g., heating elements, cryogenic liquids) and/or corrosive materials, and
- do not use oxygen or other compressed gases as a substitute for compressed air.

17.10.4 Safe Use of Compressed Gases

The first-line supervisor shall ensure employees are aware of and use the following work practices when using compressed gases:

- always keep removable caps and valve outlet caps/plugs on containers except when connecting to dispensing equipment,
- ensure that employees that use or store oxyfuel-gas containers for welding, cutting, and other similar activities are trained per this RSHS,
- ensure the valve wrench or wheel is in the operating position when the cylinder is in use,
- always open cylinder valves slowly and never to the fully open position,
- keep fuel gas and liquid cylinders upright and away from heat, sparks, fire, or electrical circuits,
- ensure gases (e.g., flammables and oxidizers) are segregated by type and arranged by compatibility,
- keep oxygen cylinders and fittings free of oil or grease,
- do not use oxygen cylinders with oily hand or gloves,
- do not direct oxygen at oily surfaces, greasy cloths, or into a container, storage tank, or vessel,
- ensure the cylinder valve is fully shut off when gas is not in use, and
- ensure that cylinders are firmly secured using a mounted bracket and chains.

17.10.5 Transporting Compressed Gases

The first-line supervisor shall ensure employees transporting compressed gases have the appropriate training for transporting compressed gases on public roads or highways, according to U.S. Department of Transportation (DOT) regulations 49 CFR Parts 171-179 for hazardous materials. The first-line supervisor shall ensure employees that transport compressed gases on public roads or highways have properly placarded the vehicle per DOT regulations.

17.10.6 Material and Warning Signage for Compressed Gases

Warning signs (e.g., DANGER, NO SMOKING, NO OPEN FLAME, NO IGNITION SOURCES) are required in areas where fuel gases are used or stored. Stored cylinders must be signed in compliance with Table 1 of ANSI Z53.1-1967 or Table 1 of ANSI Z535.1-2006(R2011), per the requirements set forth in 1910.145(d)(2) through (d)(6).

17.10.7 Hand Tools

Employees shall:

- replace or dispose hand tools with mushroomed heads,
- keep cutting edges sharp so tools move smoothly without binding or skipping,
- replace broken or fractured handles on hand tools, or dispose them,
- store tools when not in use,
- store tools in a dry, secure location,
- replace or dispose worn or bent wrenches,
- use the appropriate handles on hand tools,

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- service jacks on a regular basis,
 - lubricate jacks at frequent intervals, and
 - never use jacks beyond their rated capacity.

17.10.8 Powder-actuated Tools

Use of portable powder-actuated tools must comply with the following:

- powder-actuated tools must be left unloaded until ready for use,
- powder-actuated tools shall be inspected for obstructions or defects prior to use, and
- powder-actuated tools shall be stored individually and in a locked container when not in use.

17.10.9 Portable Powered Tools

Use of portable powered tools must comply with the following:

- powered tools must have the appropriate machine guarding,
- manufacturer machine guarding shall not be tampered with, adjusted beyond original specifications, or in any way altered to bypass any portion of the guarding or safety features,
- abrasive wheel machines (e.g., hand grinders, cut-offs) must have safety guards which cover the spindle, nut, and flange projections and the guards must be mounted to maintain proper alignment with the wheel. Maximum revolutions per minute (rpm) rating of each abrasive wheel must exceed the rpm rating of the motor it is installed on,
- abrasive wheel machines must have a built-in on/off control switch,
- employees must ring test new abrasive wheels before mounting,
- bench and pedestal grinders must be permanently mounted,
- dust collectors and powered exhausts must be provided on mounted grinders that produce large amounts of dust or fine particles, and
- grinders that use coolant must have mounted splash guards.

17.10.10 Extension cords and transferred potential

Electrical conductors near Reclamation power facilities can pose a severe electric shock hazard due to electrical transferred potential during a power system ground fault. This typically occurs when a person standing outside of a powerplant, pumping plant or switchyard ground grid touches an electrical conductor connected to the ground grid during a power system ground fault. This shock hazard exists when working with a corded tool outside the plant or switchyard fence with an extension cord plugged into an electrical outlet located within the powerplant, pumping plant or switchyard. Double insulated tools alone do not provide protection against electrical transferred potential due to the high voltages that could be present. Using battery powered tools or pneumatic tools (with non-conducting hoses) eliminates the electrical transferred potential shock hazard. See IEEE Std 80-2013 section 17.9 for additional details.

17.11 Use and Maintenance

17.11.1 Hand Tools, Power Tools, and Chainsaws

When using hand tools, power tools, and chainsaws employees shall:

- use, inspect, and maintain the tool in accordance with the manufacturer's instructions and recommendations,
- only use the tool for its intended purpose/use,
- have a copy of the manufacturer's instructions and recommendations with the tools, as applicable,
- inspect tools periodically during a task or work shift to ensure safe operating conditions,
- ensure tools are in good repair and required safety devices or guards are installed and properly adjusted, and
- have guards on power tools equipped per manufacturer's requirements and guards are fully functional.

17.11.2 Hand Tools

Employees shall:

- inspect all hand tools before use, and
- Immediately turn in any damaged or defective tools to their first-line supervisor.

17.12 Definitions

Hot work	Welding, cutting, brazing, riveting, arc-gouging, grinding, and all other processes which may produce a flame or spark as a byproduct or secondary effect of its use.
Compressed gas	Any non-flammable material or mixture having a pressure exceeding 41 pounds per square inch absolute (2.8 bar) at 70° F (21° C) or any flammable or poisonous material in gaseous form at 70° F (21° C) and has a pressure of 14.7 pounds per square inch absolute (1 bar) or greater.
Machine guarding	A safety feature on or around machinery. It consists of a shield, cover, or other device to prevent contact with body parts, catching loose clothing items, or flying chips/sparks.
Pressure vessel	A tank or cylinder vessel designed to operate at pressures above 15 psig (e.g., external air receivers and internal air receivers in oil separators, compressed air systems, governor tanks, boilers).
Hazardous Atmosphere	An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness.
Hot work permit	A written process document specific to each hot work job outlining important information, duties, and safety precautions to reduce the potential of ignition in hot work areas.

Powder-actuated tool	Fastening tool actuated by explosives or any similar means, and propel a stud, pin, fastener, or other object for the purpose of affixing it by penetration to any other object.
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17.13 References

- Occupational Safety and Health Administration. 29 CFR 1910.101, *Compressed gases*. [1910.101 - Compressed gases \(general requirements\). | Occupational Safety and Health Administration \(osha.gov\)](https://www.osha.gov/1910.101-Compressed-gases-(general-requirements)-Occupational-Safety-and-Health-Administration-(osha.gov))
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- U.S. Department of the Interior, Bureau of Reclamation, Power Resources Office. *Facilities Instructions, Standards and Techniques (FIST) Manual 2-9, Inspection of Unfired Pressure Vessels*. https://www.usbr.gov/power/data/fist/fist2_9/fist2-9a.pdf