



WORKER SAFETY GUIDELINES

SAFETY PROCEDURES FOR THE USE OF COMPRESSED AIR

The use of compressed air presents numerous hazards, especially when it is used incorrectly to clean off skin and clothing. The following practices are recommended to prevent injuries.

1. Hose and hose connections used for conducting compressed air to utilization equipment shall be designed for the pressure and service to which they are subjected.
2. Workers should never use compressed air for cleaning themselves or their clothing; nor should compressed air be aimed or sprayed at others. Only employees who have been properly trained and suitably protected should be involved in compressed air operations. Others should not be in the immediate work area.
3. Compressed air will blow particles about. Look for other alternative ways of accomplishing the cleaning. Perhaps exhaust ventilation (with filters) would do the job, or an industrial vacuum system could capture waste materials as they are generated or during cleanup.
4. Compressed air for cleaning purposes may not exceed 30 pounds per square inch (psi), and then only with effective chip guarding and personal protective equipment. Hoses with approved safety nozzles that meet OSHA standards (30 psi) should be used.
5. The condition of air hoses must be checked regularly and before each use. Training sessions should include showing examples of worn or defective connectors or hoses.
6. Flexible air lines should be fastened down to prevent whipping in the case of a broken line. A dislodged or broken hose line, lashing about, can cause serious injury.
7. Before disconnecting a hose from an air line, workers should shut off the source and bleed the remaining air from the line.
8. After use, air hoses should be returned to a safe storage space.
9. Where compressed air is to be used, designate specific cleaning procedures and specify the appropriate personal protective equipment for each operation. In some cases that may be as simple as safety goggles or eyeglasses with side shields; greater exposures may require full face shields or hood-type respirators. Gloves are often recommended.
10. Pneumatic tools used on or around energized lines have non-conducting hoses and an accumulator on the compressor to collect moisture.



11. Retainers are required on impact tools to prevent the accidental release of fasteners or paints and other fluids.
12. All hoses exceeding one-half inch inside diameter must have a safety device at the source of the supply or branch line to reduce pressure in case of hose failure.

HOT WORK PERMIT AND APPROVALS

The process for obtaining a permit to perform “hot work” on campus (e.g. grinding, cutting, welding, soldering, etc.) is initiated through the Facilities Management Department; please refer to the following link for more information:

<http://www.colorado.edu/facilitiesmanagement/pdc/safety/documents/HotWorkPermit2008-v1.pdf>

PRECAUTIONS FOR HOT WORK

BUILDING SYSTEMS

1. Fire sprinklers kept operational
2. Building ventilation protected from smoke and fumes
3. Fire alarm system kept operational; detectors removed only if necessary in the vicinity if they would likely be activated by the work; Facilities Management Fire Alarm Group requires at least 72 hours notice to perform these functions.
4. Cutting and welding equipment in good operating condition

PERSONNEL / OCCUPANT PROTECTION

1. Workers protected from smoke, fumes, toxic materials by use of exhaust ventilation or other approved safety measures
2. Vision screens / barriers in place
3. Confined space entry permit / procedures in place
4. Energized equipment locked / tagged out of service
5. Workers properly trained in use of equipment

WITHIN 35 FEET OF WORK

1. Floors swept clean of combustibles
2. Combustible floors swept down & covered with damp sand, metal or other spark / heat shields
3. Combustible and flammable materials removed
4. Fixed combustibles and flammables covered with covers, guards, and/or shields
5. Wall and floor openings covered with non-combustible covers
6. Covers suspended beneath work to collect sparks



WORK ON WALLS OR CEILINGS

1. Construction must be non-combustible and without combustible covering.
2. Combustibles moved away from opposite side of wall and second fire watch provided

WORK ON ENCLOSED EQUIPMENT (tanks, ducts, plenums, etc.)

1. Confined space entry permit / procedures
2. Compressed gases out of confined space
3. Equipment empty, cleaned of residues, pressure released, purged of vapors, gases shut off

FIRE WATCH (at work site)

1. Fire watcher shall be present during and for 30 minutes after operation. Fire watcher shall search for any smoldering or flaming ignition and extinguish any such sources.
2. Fire watcher shall be supplied with hose and fire extinguishers of proper size and type and be properly trained in use of same.
3. Fire watcher shall be trained in emergency procedures and activating fire alarm.
4. The permit applicant or their representative shall protect all combustibles from hot work ignition sources. This includes sealing of floor and wall penetrations.
5. Fire watcher shall stop hot work if any of the safety precautions cannot be met.

ADDITIONAL BUILDING FIRE WATCH CODE REQUIREMENTS

INTENT OF FIRE ALARM SYSTEM

The intent of National Fire Protection Association (NFPA) 72 for a protected premise connected to a central monitoring station, requires the fire alarm system to: notify occupants to evacuate when there is a fire in the building, notify the central monitoring station (Facilities Management Service Desk) to initiate emergency personnel response, and activate fire protection systems, e.g., release door holders and shut down fans.

WHEN BUILDING FIRE WATCH IS REQUIRED

1. When, in the opinion of the Authority Having Jurisdiction (FM FPG), it is essential for public safety, one or more qualified persons are to be on fire watch duty (Uniform Fire Code, sec.25.117).
2. In the event of temporary failure of the alarm system or an excessive number of accidental alarm activations, the Jurisdiction's authorized representative may require the building owner or occupant to provide stand-by personnel until the system is restored (UFC, sec.14.110).
3. When work necessitates disabling any fire detection, suppression or alarm system component which would conflict with the intent of NFPA 72.
4. Whenever welding or torch cutting is performed in locations where other than a minor fire might develop, or any of the conditions required by NFPA 51B exist, as indicated on the Hot Work Permit.



HOW BUILDING FIRE WATCH IS ACCOMPLISHED

1. Fire watch personnel are to keep diligent watch for fires and are not to perform any other simultaneous duties.
2. Fire watchers are to be familiar with facilities and procedures for sounding an alarm in the event of a fire. The fire watch is to have planned a response method meeting the intent of NFPA 72 (see A. above).
3. Fire watchers are to have fire extinguishing equipment readily available and be trained in its use, including practice on test fires.
4. Fire watchers are to look for signs of fires in all exposed areas, and try to extinguish fires if it can be done safely and within the capacity of the equipment available, and after sounding the building fire alarm to summon emergency response personnel.
5. Fire watch is to be maintained for at least one half hour after completion of hot work operations.

LADDERS AND SCAFFOLDING

I. Ladder Safety

Each year thousands of people are injured while using ladders. At the CU-Boulder campus there are approximately 20 ladder accidents a year. Before using a ladder, you should inspect it thoroughly. Check for loose or damaged hinges, steps, braces, and that ladders are clean and dry. On extension ladders, check that the safety feet are in place and that ropes are not frayed or worn. Metal ladders should be checked for dents and/or bends. Only non-conductive ladders should be used around electrical equipment. Wood ladders should not be stored outdoors where they will be subject to deterioration by weather. Ladders should not be painted, as paint may hide defects. Report any damage or unsafe equipment immediately and clearly label it as "out of service."

Select the right ladder for the job. Make sure the ladder is long enough and strong enough for your purpose. Extension ladders should extend 3 feet above the top support. Never position a ladder on a window or window sash or against a door. Ladders used in public areas or exit ways should be provided with proper signs and barricades. Never stand on the top two steps of a step ladder or the top four rungs of an extension ladder. Spreaders for a stepladder should lock securely in the open position.

Place ladders on solid, level surfaces. If the ground is soft, frozen, or moist, use planks under the feet of the ladder. A good rule of thumb for ladder placement is the 4-to-1 rule. That is, for every four feet of ladder height, the ladder should be one foot away from the wall. Ladders should be tied off at the top, bottom, or both to prevent accidental movement while in use.

Face the ladder and use both hands when climbing or descending. If you need tools, use a rope and a bucket or a tool belt to haul them up. Keep your body centered on the ladder and



the ladder centered on the job. Cages or a safety harness and/or tie offs are required when working above 20 feet.

II. Scaffolding Safety

Scaffolds are used when above-ground jobs require more workers and/or equipment than a ladder can safely handle. Scaffolds should be designed maintained and used in compliance with safety standards and specifications. Use only manufacturer's parts when replacing damaged or worn components.

A scaffold should be made of strong metal, stress grade lumber, or approved fiberglass. When in use, the scaffold should be secured to the building or wall (mobile scaffolds and ladder stands shall have wheel "locks" to prevent movement). When working on or around a scaffold, a hard hat and safety shoes with nonskid soles should be worn. A safety harness and/or tie offs may be required.

The first line of protection in scaffold safety is to inspect a scaffold carefully before each use to look for:

- Footings that are sound, rigid, and capable of holding the intended weight (boxes, barrels, etc., do not qualify)

- Guard rails that are 2" X 4" wide and 3 to 3 1/2 feet high

- Guard rail supports every 10 feet on all open sides

- Toeboards that are 4" high on all sides

- Screens between the guard rails and toeboards if people will pass underneath

- Ladders or other safe methods to get on and off the scaffold

- Poles, legs, or other uprights that are plumb and secured

- Planks that extend 6 to 18 inches over the end supports on wooden scaffolds

- Cross braces on metal scaffolds

- Pedestrian traffic should be routed away from overhead work

LOCKOUT / TAGOUT

Lockout should be implemented to isolate machines or equipment from energy sources. When lockout is not possible, tagout should be used. This ensures that machines and



equipment are isolated from all potentially hazardous energy, and locked out or tagged out before employees perform any servicing or maintenance activities where the unexpected energization, start-up, or release of stored energy could cause injury. All affected employees and other employees whose work operations are or may be in the areas should be instructed in the purpose and use of the lockout or tagout procedures.

A. Sequence of Lockout/Tagout Procedures

1. Notify all affected employees that a lockout/tagout system is going to be utilized.
2. If the equipment is operating, shut it down using normal stopping procedures.
3. Operate switches, valves, or other energizing devices to isolate the equipment from its energy sources. Stored energy (such as in springs, elevated machine members, rotating flywheels, hydraulic systems, air/gas/steam/water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking or bleeding down.
4. Lockout /tagout the energy-isolating devices with assigned individual locks or tags.
5. After ensuring that no personnel are exposed, and as a check on having disconnected all of its energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate. CAUTION: Return operating controls to "neutral" or "off" position after the test.

B. Restoring Machines/Equipment to Normal Production Operations

1. After the servicing and/or maintenance is completed and equipment is ready for normal production operations, check the area around the machines or equipment to ensure that no one is exposed. Notify affected employees that the system is being reactivated.
2. After all tools have been removed from the machine or equipment, guards have been reinstalled, and employees are in the clear, remove all lockout and tagout devices.
3. Operate the energy-isolating device to restore energy to the machine or equipment.

WELDING AND CUTTING

A. General Precautions



Always receive proper training before working with welding tools, machines and equipment. Only qualified persons may perform welding operations. A Hot Work Permit should be completed before welding or cutting is performed. Pre-placement physical examinations, including chest x-rays, are recommended for all personnel engaged in welding.

Follow the proper procedures for work in confined spaces. Confined spaces broadly describes the many pits, vaults, vessels, tanks, underground tunnels, pipelines, and even open-topped spaces more than four feet in depth, that may pose an occupational safety or health hazard.

Remove all hazardous, combustible and flammable materials from areas where welding is to be performed. If this cannot be accomplished and the material nearby could be affected by the welding, then the welding area should be enclosed in fireproof blankets or other protective shields.

Consult Material Safety Data Sheets (MSDS) for the gases and welding rods you are using and the materials to be welded or cut.

Use approved exhaust systems.

Purge and check for residues before welding any tank. Tanks should be open, ventilated, and checked for hazardous atmospheres.

Always follow safe housekeeping principles. Keep tripping and shock hazards, such as tools and water off the floor.

Make sure you do not drag hoses or cables over hot metal scrap when cutting, and keep them away from molten sparks when cutting or burning.

Hot metal should be barricaded and/or marked "HOT" with chalk or soapstone, or with a proper sign indicating a hot surface. Always remove these signs when the material has cooled down to the touch.



B. Protective Equipment

Flame resistant gauntlet gloves. Do not use excessively worn or wet gloves.

Leather apron or other flame resistant material. These aprons are designed to withstand radiated heat and sparks produced when welding.

Safety shoes wherever heavy objects are handled. Do not use low-cut shoes with unprotected tops because of the spark hazard.

Head protection, such as hard hats, for protection against sharp or heavy falling objects and skull caps of flame-resistant or leather fabric under helmets (to prevent head burn)

Leather capes, shoulder covers or other suitable material for overhead work (not asbestos)

Ear protection (wool or rubber plugs or wire screen protectors) for overhead work

Hair restraints for employees with long hair, around moving parts of machinery. Keep sleeves and pants cuffs rolled down and collars buttoned up.

Wear ANSI approved eye protection. Operators, welders and their helpers should wear goggles, helmets, and shields that give the maximum eye protection.

Use a fire resistant vision screen when a welding or cutting operation can be observed by a person nearby.

C. Electric Arc Welding

A Hot work Permit should be completed before electric arc welding is performed.

Inspect all equipment before welding. Look for frayed cables, poor electrode connections, proper grounding and shielding.

Never look at the arc or flash unless equipped with a shield having the correct shade of glass or lens. When welding in public areas, provide adequate barriers to prevent ultraviolet radiation exposure to passers-by.

Shields and welding goggles must be free of cracks and holes to prevent penetration of intense light.

Never strike an arc on compressed gas cylinders.

Ground all work equipment before turning on welder.



Keep floor free of electrodes once you begin to weld. They could cause a slip or fall.

Place welding stubs in a metal container.

Always wear a helmet when overhead welding and when other overhead hazards exist.

For arc welders, there is a greater danger of shock or electrocution, so basic electrical safety practices should be followed. Additionally, use the correct cable size and be sure insulation is in good condition; turn off power before touching electrical parts; ground what you are welding with a separate electrical connection; do not wear metal jewelry that could become a conductor; and do not weld in the rain or in wet conditions.

D. Oxyacetylene Welding

A Hot Work Permit should be completed before oxyacetylene welding is performed. Use only certified welding components.

Inspect all equipment before welding. Check gas cylinders, flashback arrestors, backflow/pressure protectors, regulators, hoses, torches and shielding.

Check for leaks in the hoses, regulators and connections whenever you change tanks or suspect a leak. Check equipment with soapy water, never a flame. If you detect or suspect a leak in the equipment, stop and effect repairs promptly.

Do not use oil on the torch, blow pipe, valves, regulators or any other portion of the equipment as oxygen and oil can start a fire.

Do not use pliers on apparatus. Use the proper wrench. Keep wrench on acetylene cylinder valve while in use so it can be shut off quickly if necessary.

In the event of a fire emergency, tanks should be shut off and removed from the area. If this is not possible, responding emergency personnel must be notified of the hazard before entry.

Do not exceed 15 psi for acetylene or an explosion may occur.

Make sure connections are tight when you change tips or other apparatus. Do not over tighten.

Do not use oxygen or any other compressed gas to blow dirt off your clothes.

Do not permit equipment to run over the hoses; protect them from sharp objects, kinks, and heat sources.



Use flint spark lighter; never matches or cigarette lighters. Follow the proper sequence for torch ignition.

Use special care when cutting, so hot pieces do not fall onto you or equipment hoses.

Lighted torches should never be laid down, hung up or left unattended.

Never "crack" a cylinder in the vicinity of an open flame or fire source.

Keep cylinders upright and secured. Keep valve caps on cylinder when not in use.