General Shop Safety

Environmental Health and Safety

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Tool Safety

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Common Hand and Power Tools

Hand Tools	Power Tools
Hammers	Electric/air/powder
Saws	Drill motors
Chisels	Nailers/staplers
Shovels	Impact wrenches
Pry bars	Impact/roto hammers
Pliers	Jackhammers
Screwdrivers	Soil tampers/compactors
Wrenches	Grinders
Measuring tools	Bandsaws/block saws/table saws
	Powder actuated tools
	Concrete mix/vibrators

Switches

- Positive “on-off” control
  - *Routers, planers, shears, scroll saws, laminate trimmers, jig saws, nibblers*
- Momentary contact “on-off” control
  - *Power drills, grinders, tappers, disc and belt sanders, reciprocating saws*
- Constant pressure switch
  - *Circular saw, chain saw, and percussion tools*

Power-Operated Hand Tools

- Never carry or lift a tool by its electrical cord
- To protect a worker from electrical shock, tools must:
  - *Have a 3-wire cord plugged into a grounded receptacle*

    or

  - *Be double-insulated*

Plug with a grounding pin

Double- insulated markings

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Pneumatic Power Tools

- Secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected
- Tools operating at more than 100 p.s.i must have a safety device on the muzzle to prevent the tool from ejecting fasteners unless the muzzle is in contact with work surface

Improper and unsecure

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Spray Equipment

- Airless spray guns
  - Operating at ≥1,000 p.s.i. must have automatic or visible manual safety device that prevents pulling trigger until manually released
- Abrasive blast cleaning nozzles
  - Must be equipped with operating valve which must be held open manually

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Fuel-Powered Tools

- Fuel powered tools must be stopped while being refueled, serviced, or maintained

- Fuel must be transported, handled, and stored in accordance with Subpart F- Fire Protection and Prevention

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Power-Actuated Tools

- All users must be properly trained
- Use with the correct shield, guard, or attachment recommended by the manufacturer
  - Test tool daily before loading to ensure the safety devices are working properly
- Never use a tool that is not working properly
- Don’t use in explosive or flammable atmosphere
- Do not load until just prior to intended firing time
- Wear suitable ear, eye, and face protection
- Keep hands clear of the barrel end
- Never point the tool at anyone
- Loaded tools shall not be left unattended

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Use of Abrasive Wheels

- Must be closely inspected and ring-tested before mounting to ensure that they are free from cracks and defects
- Ensure the spindle speed does not exceed the maximum speed marked on the wheel
- Grinding wheels must fit freely on the spindle
- Tighten the spindle nut only enough to hold the wheel in place

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Maximum RPM 8,700

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Abrasive Wheel Machinery

- Distance between the wheel periphery and the adjustable tongue shall not exceed ¼ inch

Tongue guard too high

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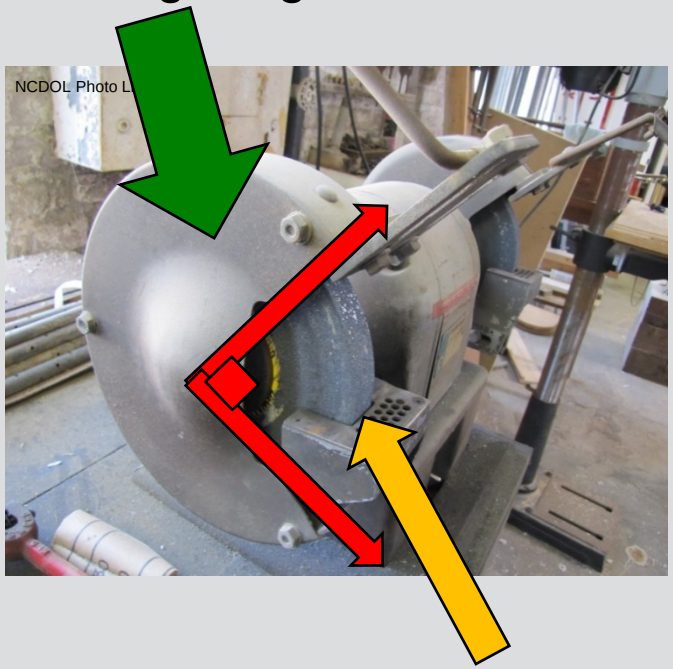
Abrasive Wheels and Tools - Guards

- Must be provided with safety guards that cover the spindle end, nut, and flange
- Floor and bench-mounted grinders
  - Angular exposure of the grinding wheel should not exceed 90 degrees or ¼ of the periphery
- Work rests must be adjusted closely to the wheel with a maximum opening of ⅛”

270 degree guard



Opening between wheel and rest 1/8”

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Portable Grinders

- Vertical portable grinders must have safety guard on tool with a maximum exposure angle of 180°
- Install the proper type guard located so as to be between the operator and the wheel during use
- Guard adjusted to deflect broken pieces of wheel away from operator

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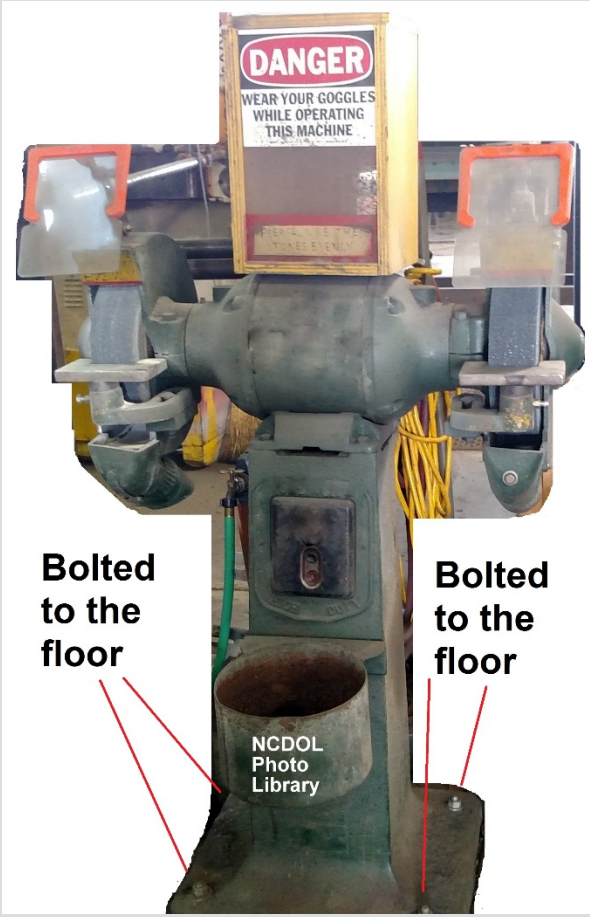
Anchoring Fixed Machinery

- Machines designed for fixed location must be anchored to prevent walking or moving



Woodworking Tools

- Fixed power driven woodworking tools must be provided with a disconnect switch
- Switch can either be locked or tagged in the **off** position

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Woodworking Tools – Portable Circular Saw

- Must be equipped with guards above and below the base plate or shoe
- Upper and lower guard must cover the saw to the depth of the teeth
- Lower guard must automatically return to the covering position over the blade teeth when tool is withdrawn from the work
- Mechanical or electrical power control provided for operator to cut off power
- Control is located on machine where operator does not have to leave his position at the point of operation

Woodworking Tools - Jointer

- Hand-fed jointer with horizontal cutting head must have an automatic guard
  - Must cover the **working** side of the fence or gage
  - Automatically adjust and cover the unused portion of the head

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Woodworking Tools- Bandsaw and Band Resaw

- All portions of saw blade must be enclosed or guarded **except** working portion between guide rollers and the table
- Bandsaw wheels must be fully encased

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Woodworking Tools – Radial Saws

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- Must have guard to prevent the operator from coming in contact with the rotating blade
- Lower portion of blade must be guarded on both sides
  - Guarded to the full diameter of the blade
  - Will adjust itself to the thickness of the stock

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Woodworking Tools – Hand-fed Ripsaw

- Provided with a hood guard
  - Must automatically adjust itself to thickness of material being cut
- Remain in contact with material
- Hood must completely enclose portion of saw blade above the table
- Mounting must be strong enough to resist any reasonable side thrust

Spreader

Machine Guarding

OSHA 29 CFR 1910.212 General Requirements for All Machines

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Introduction to Machine Guarding

- Protects body parts and unwanted objects from coming into contact with moving or dangerous machinery parts
- Required by OSHA for any machine part, function or process that has the potential of causing an injury
- Methods for guarding are machine- and use-specific

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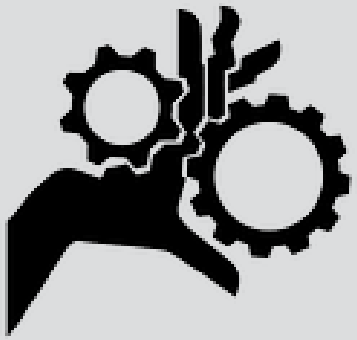
OSHA Annual Statistics

- Workers who operate and maintain machinery suffer approximately 18,000 amputations, lacerations, crushing injuries, and abrasions
  - Amputation is one of the most severe and crippling types of injuries in the occupational workplace, and often results in permanent disability.
- Over 800 deaths per year due to machine use

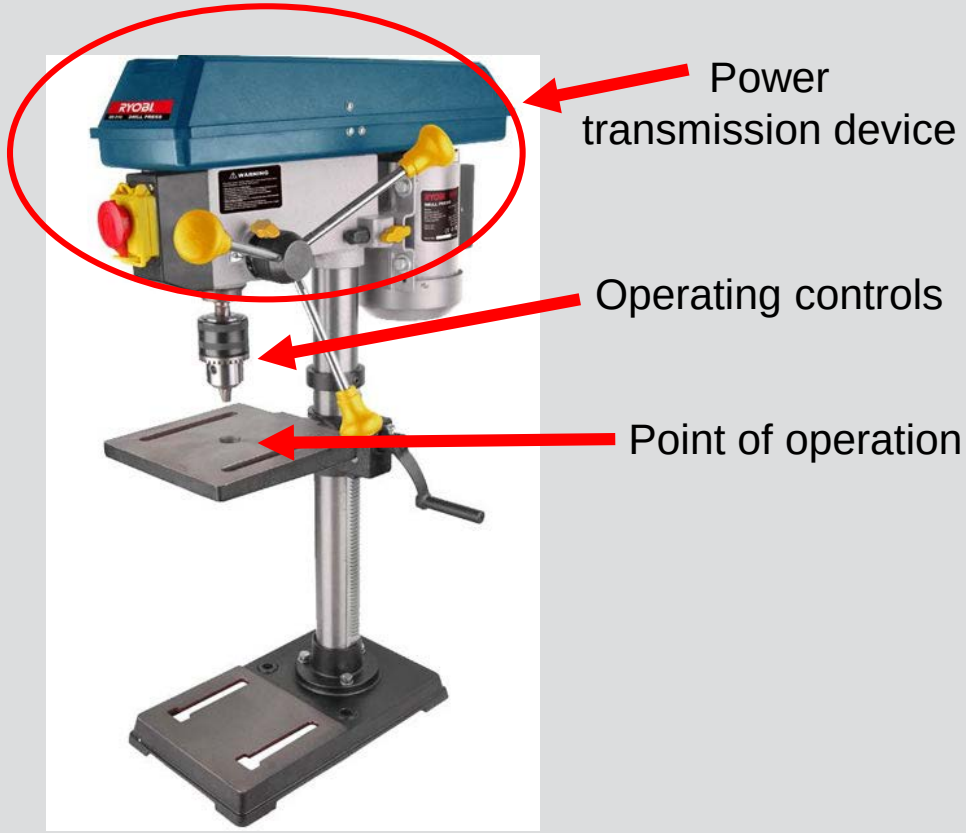
Injuries from Improper Guarding



- Cuts, punctures, or abrasions
  - Drill presses, table saws, various woodworking machines, metal forming/cutting equipment
- Pinched, crushed or severed body parts
  - Compactors, mowers, printing machines, wood and metal cutting machines
- Eye injuries or blindness
  - Grinders, table saws, power saws, drill presses

Machine Components

- Point of Operation – guarded
  - Where work is performed on material
- Power Transmission Devices
  - Mechanical component that transmits energy to the point of operation
- Operating Controls
  - All parts of the machine that move during operation



Hazardous Activities

- Situations that may present a potential hazard to the operator
- Examples
  - Normal production operations
  - Setup/preparation
  - Inspection
  - Clearing jams
  - Adjustments
  - Cleaning/Lubricating
  - Maintenance

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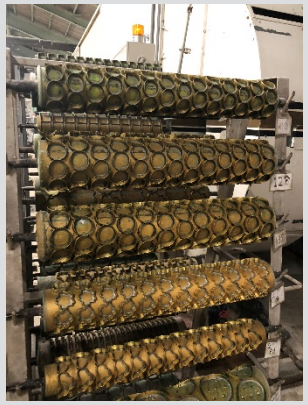
Hazardous Motions

- Rotation - circular motion
  - Can “grab” operator and force body part into dangerous position
- Reciprocating – back and forth or up and down
  - Can strike or pin an employee between moving and fixed objects
- Transverse
- In-running nip (pinch) points

Rotation

Reciprocating

Transverse



Pinch (nip) point

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Hazardous Actions - Cutting

- May be rotating, reciprocating, or transverse motion
- Hazard exists at point of operation where bodily injury can occur or flying materials can strike eye or face
- Bandsaw, circular saw, boring and drilling machines, lathes, etc.

Hazardous Actions - Punching

- Results when power is applied to a slide
- Hazard exists at point of operation where stock is manipulated by user
- Presses, etc.

Hazardous Actions - Shearing

- When power is applied to slide or knife used to trim or shear materials
- Shearing – hazard exists where user inserts, holds or withdraws material by hand
- Metal shear, etc.

Hazardous Action - Bending

- Occurs when power is applied to a slide to draw, turn, or stamp materials into shape
- Hazard at point of operation where stock is inserted, held and withdrawn
- Power presses, tube bender, press brake

Machine Guards (Safeguards)

- Six requirements set by OSHA must be met or exceeded
  - Prevent contact
    - Prevent body parts from making contact with dangerous moving parts
  - Be secured to machine, floor, wall, etc.
    - Workers should not be able to move or tamper with guard
  - Protect from falling objects
    - Ensure that nothing can fall into moving parts
  - May NOT create a new hazard
    - Guard should not have shear point, jagged edge or unfinished surface
  - May NOT create interference
    - Should not impede worker from performing the job quickly and comfortably
  - Allow for safe lubrication
    - If possible should be able to lubricate or service machine with guard in place

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OSHA Maximum Permissible Opening

OSHA GUARD-OPENING REQUIREMENTS

The maximum permissible opening for guards as required by OSHA 29 CFR 1910.217 for mechanical power presses is as follows:

Distance of Opening from Point-of-Operation Hazard (Inches)	Maximum Width of Opening (Inches)
½ to 1 ½	1/4
1 ½ to 2 ½	3/8
2 ½ to 3 ½	1/2
3 ½ to 5 ½	5/8
5 ½ to 6 ½	3/4
6 ½ to 7 ½	7/8
7 ½ to 12 ½	1 1/4
12 ½ to 15 ½	1 1/2
15 ½ to 17 ½	1 7/8
17 ½ to 31 ½	2 1/8
Over 31 ½	6

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Machine Guard Construction

- Guards should be purchased form equipment manufacturer for the specific machine
  - Conform to the design and function of specific equipment
  - May strengthen machine or serve additional functional purpose

User Built Guards

- Just because a guard is not produced does NOT mean one doesn’t have to be used
- If machine pre-dates the use or production of guards or guard is not produced by manufacturer
  - User guards can be developed as long as they are fabricated to meet specifications of proper guarding for specific machine

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Machine Guarding Aides

- Safety trip controls
- Gates
- Photoelectric barrier
- Awareness barriers
- Special hand tools

Safety Trip Control

- Quick means for deactivating machine in emergency
- Examples
  - Pressure activated bar
  - Emergency stop buttons
  - Emergency pull cord

Gates

- Moveable barrier that protects operator at point of operation
- Gate must be interlocked so that machine will not begin a cycle without gate in place
- Gate must be closed for machine to function

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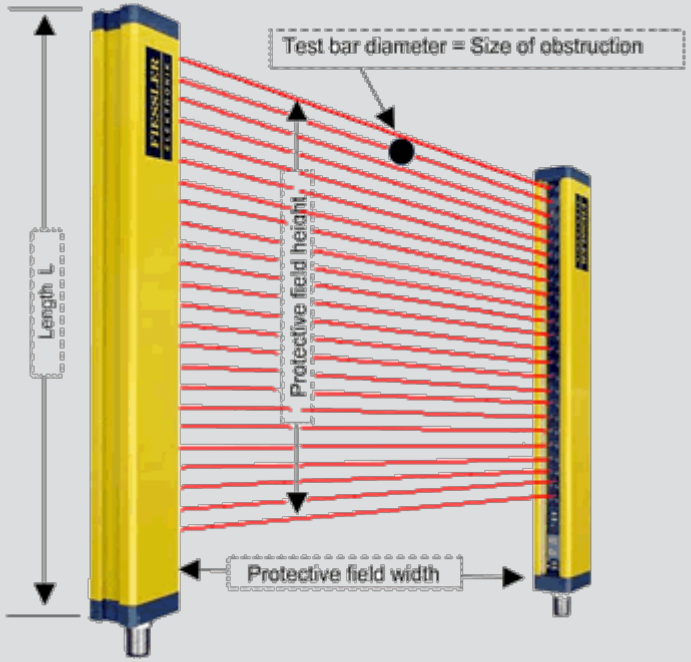
Photoelectric Barrier

- Optical presence-sensing device
- Light sources are known as “light curtains”
- If light curtain is broken – machine instantly stops



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Awareness Barrier

- Reminds person that they are approaching danger area
- Does NOT physically prevent person from entering
- Must be used in conjunction with actual guard – never alone
- Employee must take action to enter danger area
  - Step or reach over, under or through the barrier

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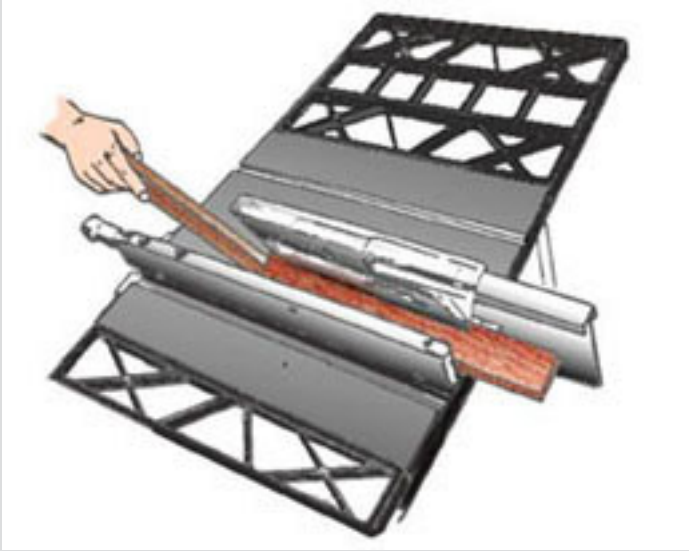
Special Hand Tools

- Tools used to place and remove material without operator having to place hands in danger zone
- Does not replace actual guard



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Feeding

- Automatic
  - Material is fed from rollers or another automatic method
- Semi-Automatic
- Material is fed by chutes, moveable dies, dial feed, plunger or sliding bolster

Ejection

- Automatic
  - Material is ejected by air or mechanical means
  - May create debris hazard and/or noise hazard
- Semi-automatic
  - Material is ejected by mechanical means initiated by operator

Lockout/Tagout

- If guarding must be removed for maintenance proper LOTO procedures must be followed
- See NCCU LOTO awareness training and program

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Ladder Safety

OSHA 1926.1053

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When Should a Ladder be Used?

- When there is a break in elevation 19” or more and no ramp, runway, embankment or personnel hoist
- Ask these questions to decide if a ladder is the best choice
  - Do I need to hold heavy items while on the ladder?
  - Is the elevated area so high that the required ladder might be unstable?
  - How long will I be on the ladder working?
  - Would I have to stand on the ladder sideways to work?

If you answer yes to any of these questions, consider another option!

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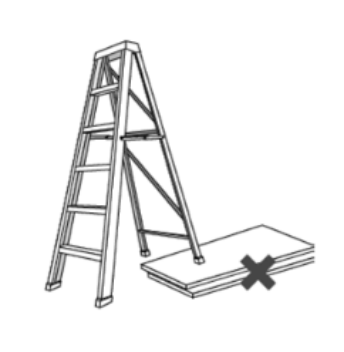
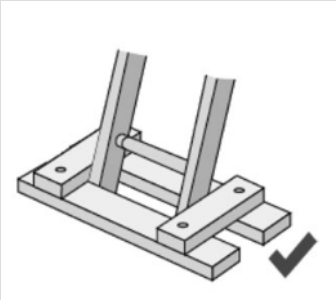
Best Practices



- Maintain ladders free of oil, grease and other slip hazards
- Use ladders only for designated purpose
- Do not load ladders beyond rated capacity
- Use ladders on stable, level surfaces
- Secure ladders when traffic or activity may displace ladder
- Do not place ladder on other objects to obtain additional height
- Do not move, shift or extend ladder while in use
- Always secure the base of the ladder



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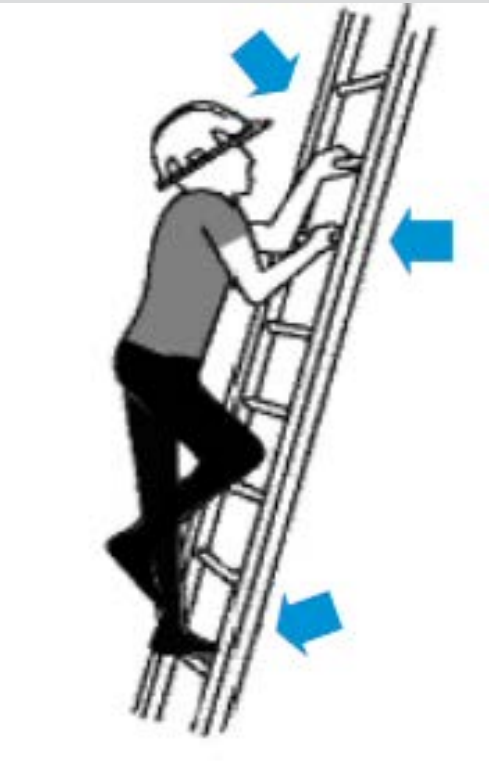
3-point Contact

- Always maintain 3-point contact when climbing
  - 2 hands + foot
  - 2 feet + hand
- Keep body near middle of step and face the ladder



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Types of ladders

- Step
- Portable
- Fixed
- Do NOT use single-rail ladder

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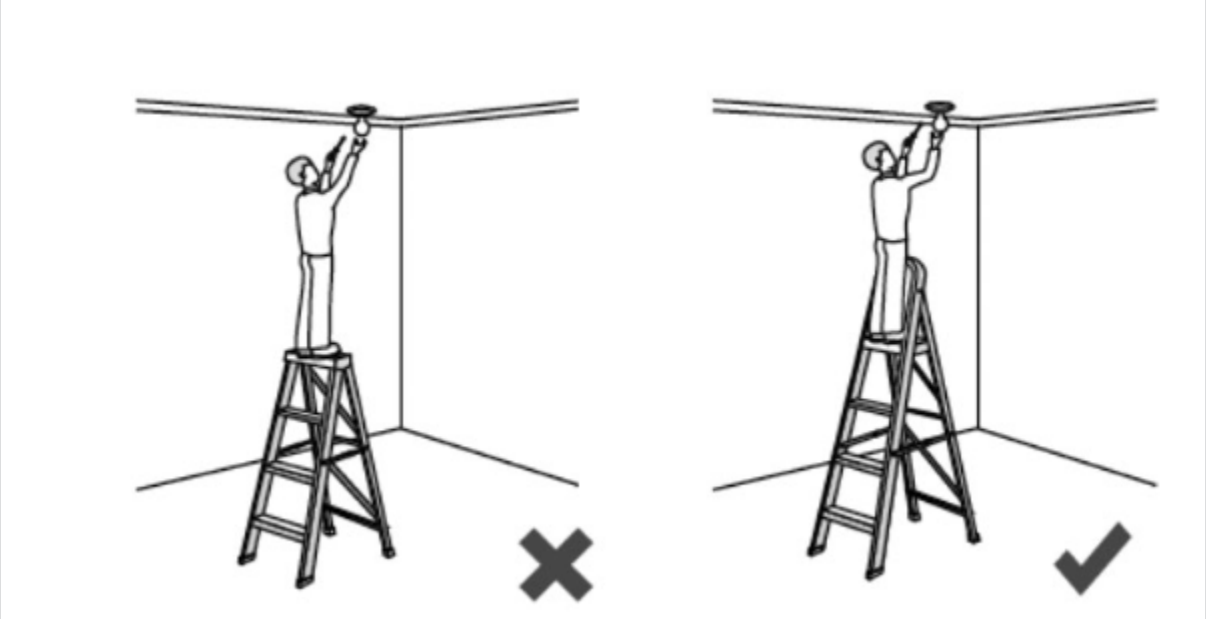
Use the Right Ladder for the Job

- Do not stand on top rung
- Do not overextend reach



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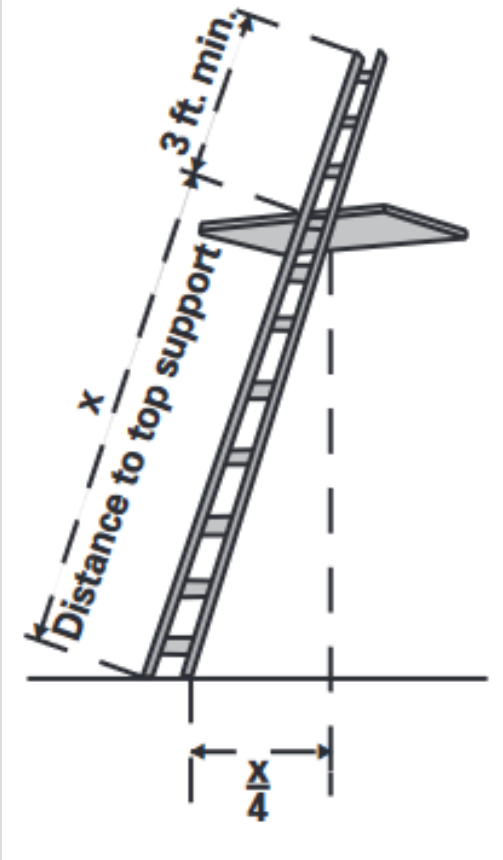
Extension or Straight Ladder

- Must extend at least 3 feet above the point of support
- Do not stand on the three top rungs of a straight, single or extension ladder
- Place base ¼ of working length of the ladder from the wall or other vertical surface



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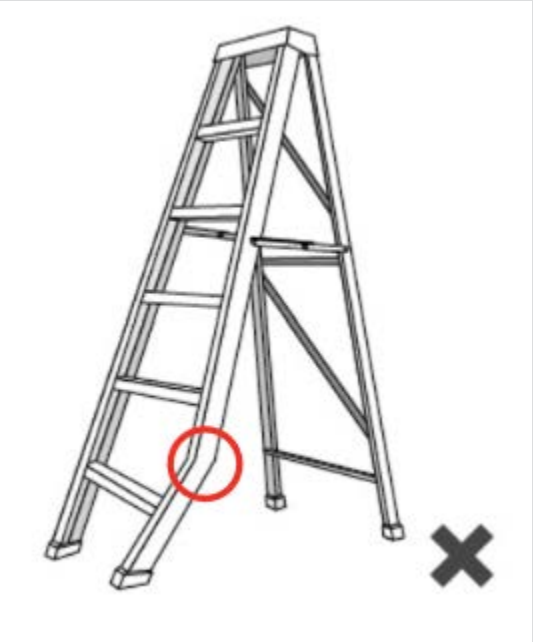
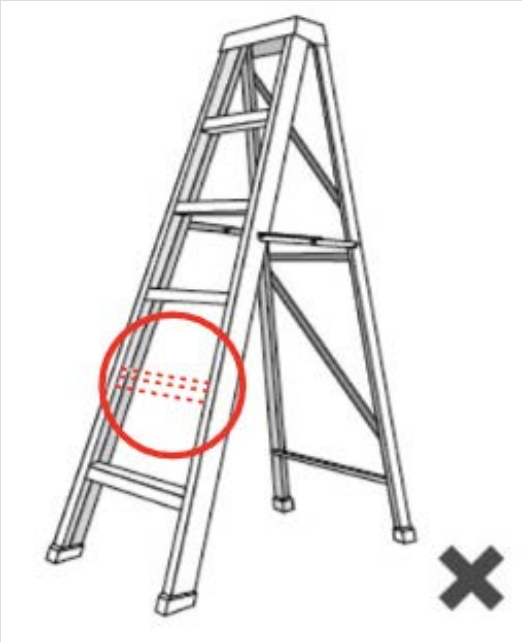
Maintain Ladders Properly

- Before use, check to ensure there are no defects
- **•Ladders must be inspected before initial use in each work shift, per OSHA 1910.23(b)(9) – any ladders found with deficiencies must be tagged and taken out of service immediately**
- Do not use ladder if bent, missing steps or locking device





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Combustible Dust Hazard Training

NFPA 652, 654, and 664

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Introduction

- Dust is generated as a by-product of processes is not necessarily a hazard; however
- Combustible dust that is allowed to accumulate can lead to explosion and cause injury, loss of life, and property damage

Combustible Dust

- Combustible materials (and some non-combustible materials) can burn rapidly when found in a finely divided form (dust) in air in right concentration can become explosive
- National Fire Protection Association (NFPA 654)
  - “any finely divided solid material that is 420 microns or smaller in diameter and presents a fire or explosion hazard when dispersed and ignited in air”
- OSHA National Emphasis Program (NEP)
  - “A combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless or particle size or shape.”

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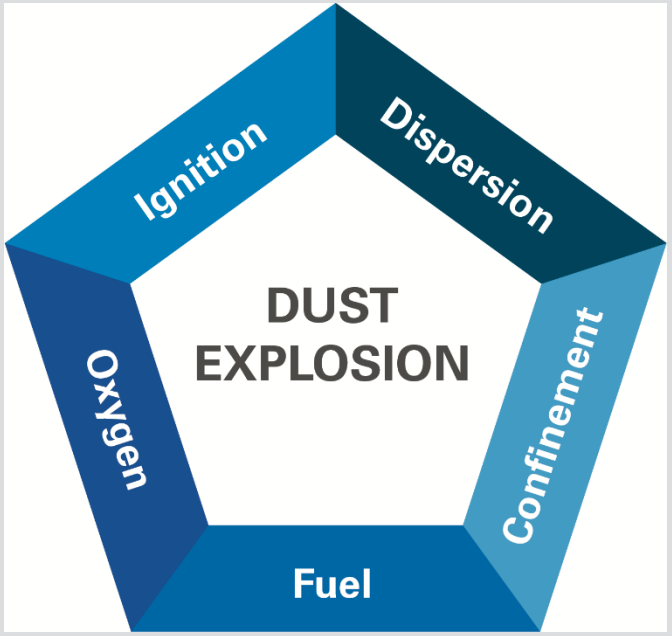
NEP Definitions

- Minimum Explosive Concentration (MEC)
  - Minimum concentration of dust suspended in air that will support a deflagration (combustion which propagates through a gas or across the surface of an explosive at subsonic speeds, driven by the transfer of heat
  - Typically 2-3 times orders of magnitude higher than “health” based exposure levels
  - Normally present inside process equipment (conveyors, silos, etc.)
  - Accumulation of dust in an area, when disturbed, may result in temporary concentrations greater than MEC

Dust Explosion Pentagon



- Fuel – combustible dust
- Heat/ignition – flame
- Oxygen in air
- Dispersion of dust
- Confinement of dust cloud

When all elements are present in a enclosed space, resulting pressure can cause an explosion

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Materials That Form Combustible Dust

- Metals (i.e. aluminum)
- Wood
- Coal
- Plastics
- Paper
- Soap
- Certain textiles

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Possible Ignition Sources

- Open flames and sparks
- Hot surfaces
- Heat from mechanical impact
- Electrical discharges
- Static electricity
- Smoldering or burning dust
- Smoking materials

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Ignition Control

- No hot work should be performed in areas where combustible dust hazard exists even after cleaning
- Follow all safe welding, cutting, and brazing precautions
- Ensure employees do not smoke near these work areas

Dust Concentration

- Dust layer greater than 1/32 of an inch accumulated on surface area of at least 5% of a room's floor or above ceiling area constitutes a significant explosion hazard

Control Recommendations (NFPA 654)

- Minimize escape of dust from process equipment or ventilation systems
- Use dust collection systems and filters
- Use surfaces that reduce accumulation and help with cleaning
- Conduct regular inspections and cleaning for dust
  - Clean in a manner that does not generate dust clouds
- Develop and implement written plan for hazardous dust inspection, housekeeping, and control

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Control Measures
American Industrial Hygiene Association (AIHA)

- Keep ignition sources out of hazardous areas
- Keep areas and equipment clean
- Establish regular cleaning program for horizontal surfaces such as ducts, pipes, ledges, etc. that are not part of normal cleaning
- Train employees and emphasize the importance of good housekeeping and other operational procedures

Housekeeping

- Use supplemental dust cleaning equipment (HEPA filtered vacuums) to clean area
- Never blow dust around – use wet cleaning methods
- Remove dust as soon as possible to prevent accumulation
- Maintain cleanliness in woodworking areas and on tools and equipment where wood dust may accumulate
- Keep overhead ventilation ducts and equipment free of dust

Hot Work and Welding

NCFC Chapter 35 and OSHA 1910.252

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Definition

- Hot Work includes:
- Cutting
- Welding
- Soldering
- Brazing
- Grinding
- Any activity similar to the above

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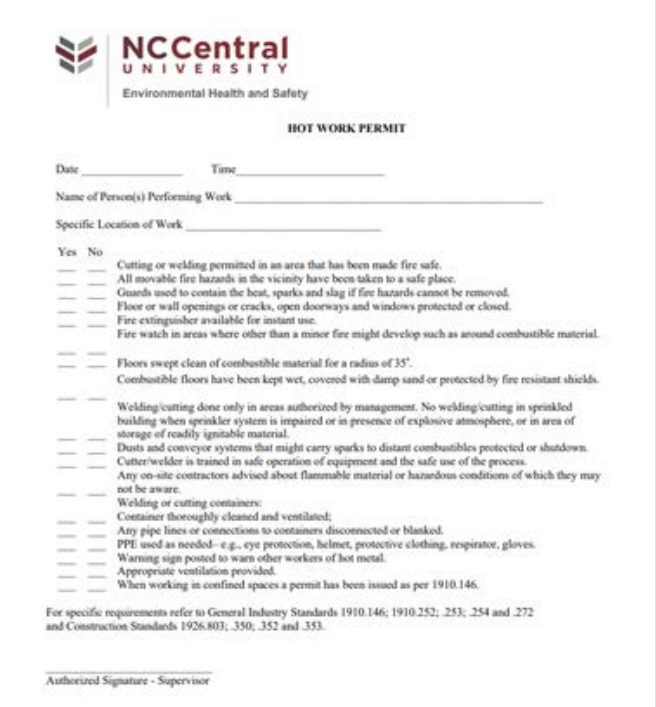
Permit Required

- Any hot work on campus requires the issuance of a Hot Work Permit prior to the work beginning

- All requirements set forth in the permit must be followed



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HOT WORK PERMIT

Date _____ Time _____

Name of Person(s) Performing Work _____

Specific Location of Work _____

Yes	No	
___	___	Cutting or welding permitted in an area that has been made fire safe.
___	___	All movable fire hazards in the vicinity have been taken to a safe place.
___	___	Guards used to contain the heat, sparks and slag if fire hazards cannot be removed.
___	___	Floor or wall openings or cracks, open doorways and windows protected or closed.
___	___	Fire extinguisher available for instant use.
		Fire watch in areas where other than a minor fire might develop such as around combustible material.
___	___	
___	___	Floors swept clean of combustible material for a radius of 35'.
		Combustible floors have been kept wet, covered with damp sand or protected by fire resistant shields.
___	___	
		Welding/cutting done only in areas authorized by management. No welding/cutting in sprinkled building when sprinkler system is impaired or in presence of explosive atmosphere, or in area of storage of readily ignitable material.
___	___	Dusts and conveyor systems that might carry sparks to distant combustibles protected or shutdown.
___	___	Cutter/welder is trained in safe operation of equipment and the safe use of the process.
		Any on-site contractors advised about flammable material or hazardous conditions of which they may not be aware.
___	___	
		Welding or cutting containers:
___	___	Container thoroughly cleaned and ventilated;
___	___	Any pipe lines or connections to containers disconnected or blanked.
___	___	PPE used as needed– e.g., eye protection, helmet, protective clothing, respirator, gloves.
___	___	Warning sign posted to warn other workers of hot metal.
___	___	Appropriate ventilation provided.
___	___	When working in confined spaces a permit has been issued as per 1910.146.

For specific requirements refer to General Industry Standards 1910.146; 1910.252; .253; .254 and .272 and Construction Standards 1926.803; .350; .352 and .353.

_____
Authorized Signature - Supervisor

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Fire Watch Required

- During any approved hot work operations, a Fire Watch must be maintained in accordance with NCFC 3504.2
- The Fire Watch personnel must have no other responsibilities beyond the watch
- A portable fire extinguisher, in good condition, must be available throughout

Prohibited Areas

- Hot work may not be performed in the following areas:
  - Any area not authorized
  - Near storage of combustible materials
  - In any area that may develop an accumulation of combustible dusts
  - In any area where a combustible atmosphere is present or could develop

Personal Protective Equipment (PPE)

- All persons exposed to hazards created by hot work shall be issued appropriate PPE
- PPE shall be worn at all times during hot work operations

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Painting Safety

OSHA 1910.106, NFPA 30, and NFPA 33

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General Safety

- Paint and other flammable or combustible liquids must be stored appropriately – in a flammable storage cabinet, when required
  - Be aware of the classification/characteristics of the liquid(s) you are using – check the SDS before use or storage
- Practice good housekeeping – do not leave brushes, rags, etc. lying about
  - Clean up paint spills immediately
- Ensure adequate ventilation is present when painting

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Personal Safety

- Wear proper PPE when painting – for example, wear a respirator and eye protection when spray painting
- Be aware of the type of paint to be used – some paints are toxic and present potential health hazards
- Do not paint when other hazards are present
  - Painting should not be done in the same area as "hot work," for example

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Fire Safety

- Store paint and other liquids in the appropriate container/cabinet
  - Only take out for use the amount necessary to complete your intended purpose
- Open flames are not permitted in the area of paint storage or painting operations
  - Be aware of other possible sources of ignition such as improper electrical fixtures or appliances
- Spray painting must be done in areas with adequate ventilation

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Workers’ Rights

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Rights

- Working conditions that do not pose risk of serious harm
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days

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Questions

Department of Environmental Health and Safety

(919) 530-7125

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EHS Website

To complete this training, you must take this quiz and pass with a score of ≥ 80%

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