Collaborative Bachelor's Degree Program of Fire Protection and Safety Engineering Technology between Southwest Jiaotong University and Oklahoma State University, U.S.A.

FPST 2023 Industrial and Occupational Safety

Hand and Power Tools

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BUREAU OF LABOR STATISTICS

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Types of Hand and Power Tools

- Classified into two categories:
  - Hand (Manual) Tools
  - Power Tools
    - Electric Tools
    - Pneumatic Tools
    - Hydraulic Tools
    - Powder Actuated Tools

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Hand Tools

- No external power required
- Broad range of tools from extremely simple to more complex, such as:
  - Hammers
  - Saws
  - Spades
  - Bullfloats
  - Screw driver
  - Pliers, etc.


Hammer


Spade


Hack Saw


Bullfloat

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Power Tools

- Operated with external power
- Determined by their power source (electric, pneumatic, powder actuated, etc.)
- Some examples are:
  - Jackhammers
  - Power Saws
  - Grinders
  - Power Drills, etc.

Powder Actuated Fastener


Grinder


Jackhammer

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WHAT TYPES OF HAZARDS WOULD YOU EXPECT TO FIND WHEN WORKING WITH TOOLS?

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General Hazards

- Dust, fumes and sparks generated by hand and power tools
- Falling, flying, abrasive, and splashing objects
- Lack of Personal Protective Equipment (PPE)
  - e.g. lack of eye protection may result in foreign body in the eye
- Untrained and/or unauthorized person working with the tools

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General Hazards

- Keep all tools in good condition with proper storage and regular maintenance
- Use the right tool for the job
- Examine each tool for damage before use
- Do not use damaged tools
- Operate tools according to the manufacturers' instructions and recommendations
- Provide and use appropriate PPE

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Proper Tool?

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Hand Tools

Hazards:

- Misuse of tools or using tools for wrong tasks
- Using damaged tools (poor maintenance)
- Poor housekeeping and improper storage (tripping hazard)

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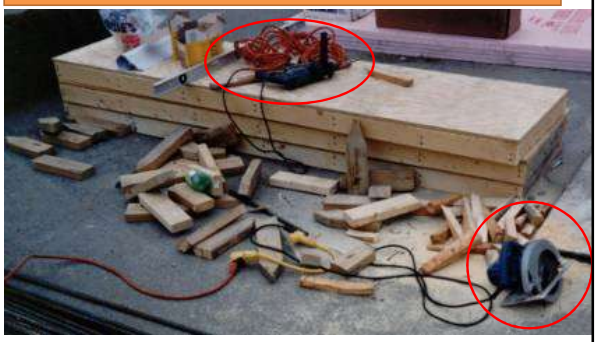
Poor Housekeeping



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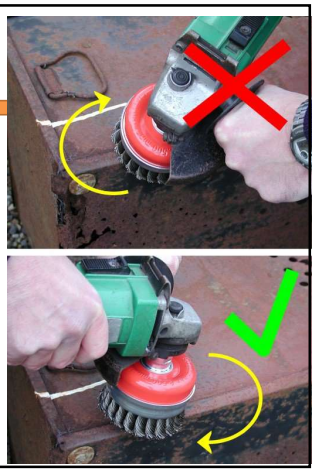
Proper Use



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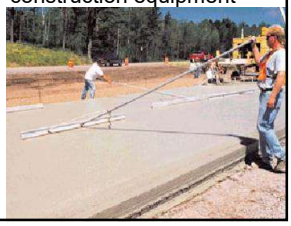
Hand Tools

- Injury/Illness Prevention:
- Inspect and remove unsafe hand tools
- Keep workspace as clean as possible and don't leave tools laying around unattended
- When using saw blades and knives, direct the tools away from other workers working in close proximity
- When using equipment with long handles (e.g. bullfloat), keep it clear from the path of traffic or construction equipment



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Hand Tools

- Injury/Illness Prevention:
- Stay away from flammable substance while working with hand tools that may produce sparks
- Keep wooden handles of tools free of splinters and cracks
- Keep impact tools free of mushroomed heads
- Wear appropriate personal protective equipment

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Power Tool Hazards and Injury/Illness Prevention

- General Safety Precautions
- Machine Guarding
- Electric Tools
- Power Saws
- Portable Abrasive Wheel Tools
- Pneumatic Tools

- Video - Angle Grinder Accident

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General Safety Precautions for Power Tools

- Disconnect tools when not in use
- Never carry a tool by the cord or hose
- Keep cords and hoses away from heat, oil, and sharp edges
- Avoid accidental starting
  - Do not hold fingers on the switch button while carrying a plugged-in tool

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General Safety Precautions for Power Tools

- Secure work with clamps or a vise, freeing both hands to operate the tool
- Keep all people not involved with the work at a safe distance
- Be sure to keep good footing and maintain good balance when operating power tools
- Wear proper apparel for the task

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Machine Guarding

- Guard exposed moving parts of power tools
- Machine guards must protect the operator and others from:
  - Point of operation
  - In-running nip points
  - Rotating parts
  - Flying chips and sparks

- Guards must be properly affixed to the machine
- Never remove safety guards when a tool is still in use

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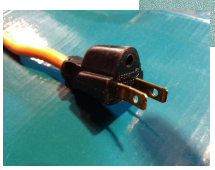
Electric Tools

Hazards:

Electrical shock and fire hazards due to:

- Damage or internal defects
- Improper or no grounding
- Defective insulation and wiring
- Damage to insulation
  - Due to overworking, overheating.



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Electric Power Tools

To protect a worker from shock, these tools must:

- have a 3-wire cord plugged into a grounded receptacle
- be double insulated, or
- be powered by a low-voltage isolation transformer

Plug with a grounding pin

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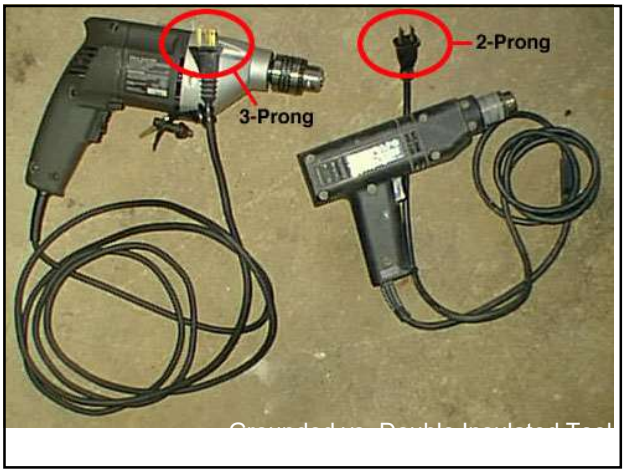

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Electric Tools

- Injury / Illness Prevention:
  - Connect tools only to outlets with GFCI
    - ground-fault circuit interrupter
    - Type of circuit breaker which shuts off electric power when it senses an imbalance between the outgoing and incoming current
  - Inspect tools and extension cords before each use
  - Use durable and weather proof extension cords
  - Use cords with three prong plugs

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Electric Tools

Do not use wires with worn out insulation

- Injury / Illness Prevention:
  - Operate electric tools within the limits of their design
  - Do not use electrical tools in damp and /or wet areas
  - Remove all damaged portable electric tools from use
  - Ensure that electrical cords do not present tripping hazards
  - Use gloves and appropriate safety footwear when using electric tools

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Power Saws

Hazards:

- Lack of proper guarding
- Sawing objects not adequately supported
- Dust inhalation due to lack of personal protective equipment
- Operator distraction

Saw not stored properly after use

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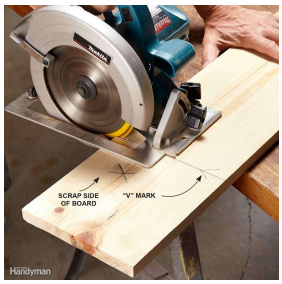

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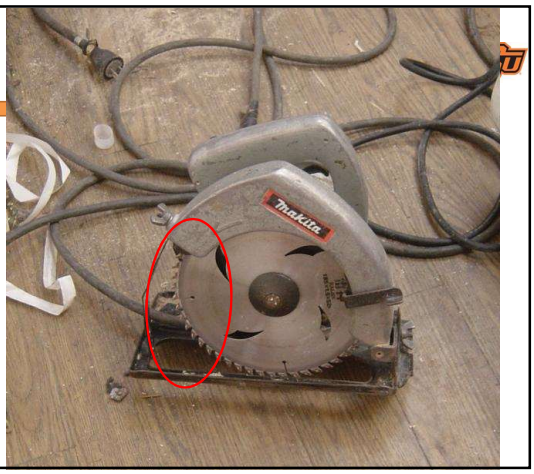

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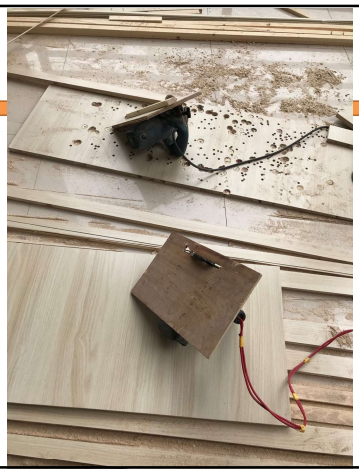

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Portable Abrasive Wheel Tools

- Hazards:
  - Flying fragments
  - Defective or cracked wheels
  - Wheel breakage during start-up
- Injury/Illness Prevention:
  - Proper machine guarding
    - Cover the spindle end, nut, and flange projections
    - Maintain proper alignment with the wheel
    - Do not exceed the strength of the fastenings

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Portable Abrasive Wheel Tools

Injury/Illness Prevention:

- Ensure wheel fits freely on the spindle
  - Spindle speed should not exceed the maximum operating speed
- Never stand in the plane of rotation as the wheel accelerates to full operating speed
- Before mounting the wheel, inspect for damage and perform "ring-testing" (tap with a light instrument)
  - Video - Grinder Wheel ring test

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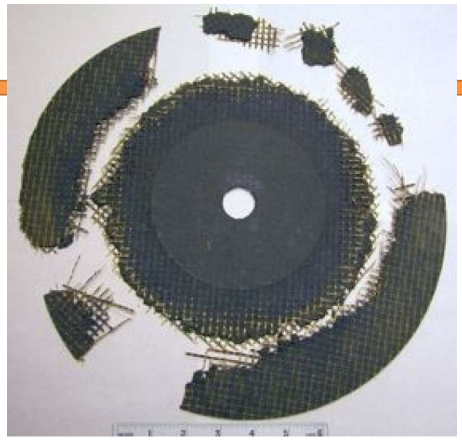

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Proper Disc Grinder Guard

- Serves two purposes

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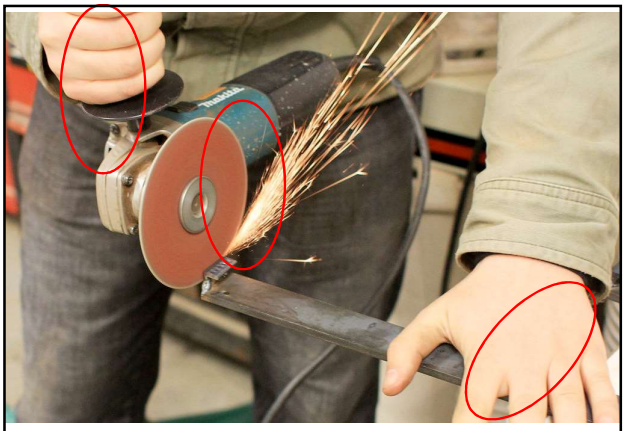

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Pneumatic Tools

- Injury/Illness Prevention:
  - Securely fasten the pneumatic tool to the air hose
  - Install a safety clip or a retainer to prevent attachments such as chisels on a chipping hammer from being ejected during tool operation
  - Set up screens to protect nearby workers from being struck by flying fragments
  - Use heavy rubber grips to reduce fatigue and strain caused by operating jackhammers
  - Use appropriate hearing protection

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Pneumatic Tools

Hazards:

- Getting hit by one of tool's attachments
- Air hose (disconnection, tripping hazard)
- Flying fragments
- Fatigue and strains while
- Noise

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Air / Pneumatic Power Tools

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Compressed Air

- Air forced into body tissues through the skin can cause an air embolism (air bubbles in the blood stream) which can be fatal if it reaches the heart, lungs, or brain.
- Inflation injuries of the intestine can be caused by air being directed at private body areas. A worker in the U.K. died of injures sustained through horseplay with a compressed air hose. This act of horseplay can be deadly!
- Air blown into the mouth at only 5 PSI can rupture the esophagus or the lungs.
- Eye and ear injuries can occur from a blast of air or flying particles. These types of eye and ear injures can cause partial or total loss of sight or hearing.
- The sound from a compressed air hose can reach 120-130 dB which is well above OSHA's 90 dB permissible exposure limit.
- 40 PSI can blow out an ear drum from 4 inches away and possibly cause brain damage.
- As little as 12 PSI can blow an eye out of its socket!
- Flying particles can cause cuts and bruises to any part of the body.

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Compressed air guns

- Instrument Air – 20-25 psi
- Plant Air – 80-120 psi
- Cleaning wands – 30 psi
  - Or safety tip

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Powder Actuated Tool Hazards

- Hazards:
  - Using tools on unsuitable materials
  - Thorough penetration
  - Ricochet of fasteners
  - Spalling of material
  - Misfiring
  - Operating near explosive materials
- A.K.A "Hilti Gun"

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Powder Actuated Tools

- Injury / Illness Prevention:
  - Only trained operators must use powder-actuated tools
  - An appropriate powder level must be selected to perform the work without using excessive force
  - Suitable ear, eye, and face protection must be worn
  - If a powder actuated tool misfires, the user must hold the tool in the operating position for at least 30 seconds before trying to fire it again

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Powder Actuated Tools

- Injury / Illness Prevention:
  - Do not use the tool in an explosive or flammable atmosphere
  - Inspect the tool and the barrel before using
  - Do not load the tool unless it is to be used immediately
  - Do not leave a loaded tool unattended
  - Keep hands clear of the barrel end
  - Never point the tool at anyone
  - Avoid improper fastening that may lead to penetration, spalling, edge failure, and ricochets

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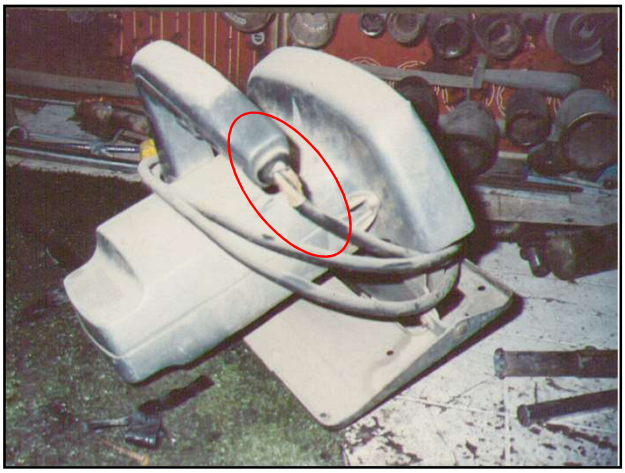

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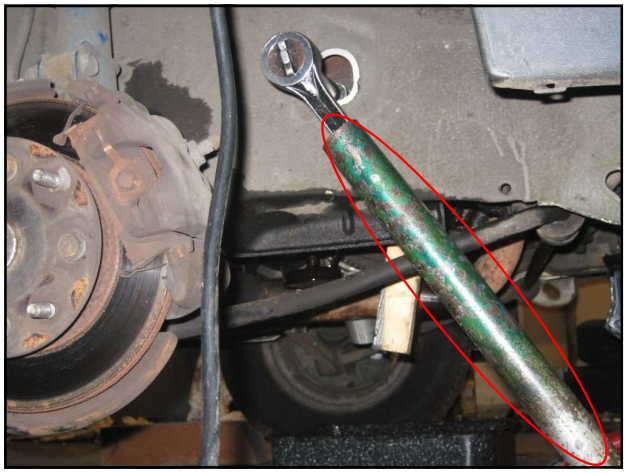

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Hand Tools

- Rules to live by:
  - Never use a damaged or broken tool
  - Never use a tool modified beyond manufacturers spec and recommendation
  - Only use a tool for its intended purpose
  - Inspect tools before use
  - Never remove/bypass guards

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Summary

- Hand and power tools range from simple to complex and are of various types
- Hand and power tools pose various hazards
- Injury prevention techniques include
  - Use of safe operating practices
  - Maintaining safe working conditions
- Understanding the hazards associated with hand and power tools and their injury prevention techniques are critical to improve worker safety

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