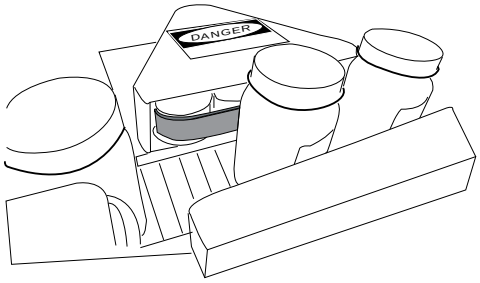
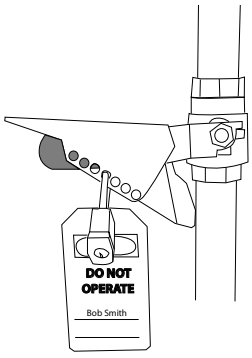
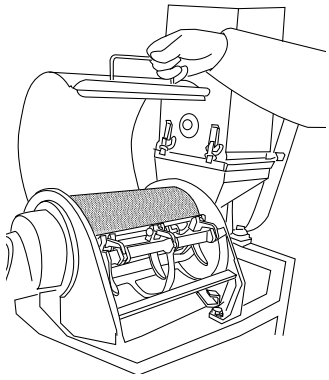
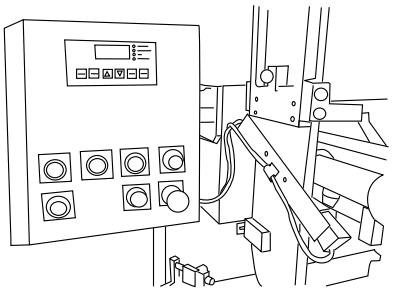
Machine Hazards

For the Fruit and Vegetable Preserving and Specialty Foods Manufacturing Industry









K-STATE Research and Extension
Kansas State University

"Knowledge for Life"

Machine Hazards

Contents

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Disclaimer

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This booklet was produced by K-State Research and Extension, Kansas State University, Manhattan, Kansas.

What's Inside?

This booklet outlines safe operation of machines used in the fruit and vegetable preserving and specialty foods manufacturing industry. Safety tips, along with real accident reports, have been combined to give you a better understanding of the risks associated with this type of work.

Use this booklet along with hands-on safety training.

Lesson 1

Objectives

1. Discuss common causes of serious injury or death.

2. Identify safety messages and signs on machines and in work zones.

Take Control of Your Own Safety

Greatest Dangers

The most commonly reported causes of serious injury and death while operating machines are:

1. Moving Parts

Many machines have danger zones where you can be caught in moving parts. Do not bypass or remove guards that protect you from danger zones.

Accident Report
Worker Killed in Mixer

Summary of OSHA Accident Investigation 303885859
A worker reached inside a mixer he was cleaning. He was pulled into the machine by the moving parts and was killed. He did not shut down and lock out power to the machine, and overrode the two-hand controls.

Never override safety devices; shut down and lock out power before cleaning a machine.

Accident Report
Worker Crushed in Case Sealer

Summary of OSHA Accident Investigation 170196760
A worker was cleaning the bottom rollers of a case sealing machine. He shut off the power, but did not lock it out. When he reached inside, he accidentally tripped a switch that started the machine. He was struck by a moving part and seriously injured.

Shut down and lock out power before you reach into a machine.

2. Burns

You can be shocked or electrocuted if you use damaged cords or operate a machine in a wet environment.

Accident Report
Worker Burns Arm in Heat Sealer

Summary of OSHA Accident Investigation 105627749
A worker was repairing a machine that seals frozen food trays. The heat element lowered and pinned his arm against another machine part. He suffered third-degree burns. He did not lock out power before beginning repairs.

Always shut down and lock out power if you must reach into a danger zone. Be alert around hot machine parts.

3. Electrocution and Electric Shock

Operating machines in wet environments and using damaged cords are ways you can be shocked or electrocuted.

Accident Report
Worker Electrocuted While Repairing Machine

Summary of OSHA Accident Investigation 170384655
Two employees were repairing a machine's conveyor. Although the machine had a shut off switch nearby, neither employee shut down and locked out power. One employee stood and touched a live electrical part and was electrocuted.

Always shut down and lock out power before repairing machines.

Help Yourself

Safe work habits are important. Here are three actions you can take to be safe on the job site:

1. Learn all you can

To prevent machine accidents, read and follow directions in the operator's manual. Pay attention to safety instructions in the manual and warning labels you see on equipment. If you have questions, stop and ask your supervisor immediately.

2. Concentrate on working safely

Sometimes you may be tempted to take risky shortcuts. Remember that an accident can leave you permanently injured or cut your life short. For your safety and the safety of those around you, do not take unnecessary risks. No deadline is so pressing you can't take the time to do your work safely.

3. Additional Precautions

Do not operate machines if you are fatigued or have taken drugs or alcohol. If you are on medication, discuss with your doctor or pharmacist if you are capable of safely operating machines.

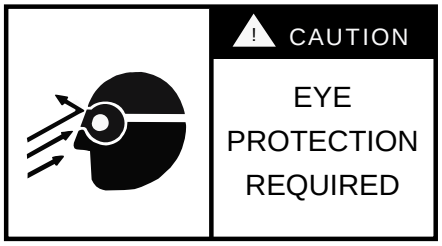
Safety Messages and Signs

Manufacturers put important safety messages on equipment and in the operator's manual. It is critical to read, understand and follow safety messages.

The triangle shape is the symbol for caution. The exclamation mark in the center means Pay Attention. In some instances, the triangle-shaped sign will show a picture. Other times, words explain why the sign is used.

Many safety messages use the words Caution, Warning and Danger to get your attention. Following are safety messages and their meanings. Each of these signs will have a written message, and perhaps a picture, about an unsafe condition. Generally, caution signs are yellow, warning signs are orange and danger signs are red.

CAUTION means you need to be careful. Follow the directions on the sign or you could get hurt.



WARNING is more serious and means you need to follow the directions on the sign or you could be seriously injured or killed.

DANGER is the most serious safety message. If you don't follow the directions, you will be seriously injured or killed.

Images displayed in the caution, warning and danger boxes have been recreated from images taken with permission from ASAE S441.4, FEB04, Safety Signs.

Quiz Yourself

Answers can be found on page 33.

Use the list of words to fill in the blanks:

damaged
fatigued
burned
yellow

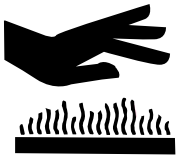
1. You can be _____ from machines' hot parts.

2. Operating machines in wet environments and using _____ cords are ways you can be shocked or electrocuted.

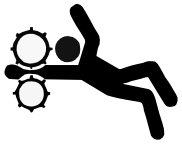
3. Do not operate machines if you are _____ or have taken drugs or alcohol.

4. Caution signs are _____ , warning signs are orange and danger signs are red.

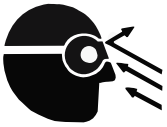
Match the safety sign with its meaning:



You Can Get Caught in Moving Parts



Eye Protection Required



Burn Hazard

Prepare for Safe Operation

Dress for Safety

Always dress to protect yourself from machine hazards. While on the job you should:

- Wear form-fitting clothing. Loose or baggy clothing could get caught in moving parts.

Accident Report
Worker's Injured When Caught in Rollers

Summary of OSHA Accident Investigation 170742019
An employee saw a box stuck on a conveyor. He reached over the conveyor to push the box. His coat sleeve got caught. The conveyor pulled his sleeve and hand between the belt and roller. His hand was severely cut.

Do not wear loose clothing that could get caught in moving parts.

- Make sure buttons are fastened and zippers are zipped up. Loose clothing could get caught in moving parts.
- If you have long hair, make sure it is tied back or secured under a hat or hair net.

Accident Report
Worker Catches Hair in Shaft, Hospitalized

Summary of OSHA Accident Investigation 170762082
A worker was cleaning a labeling machine. She placed her head close to a rotating drive shaft and it knocked off her bump cap. Her long hair was not pulled back, and it became entangled in the rotating shaft. She was hospitalized with serious head injuries.

Always tie back long hair or secure it under a hair net while working near moving parts. Shut down and lock out power before cleaning.

- Wear sturdy, non-skid shoes. Always check to make sure your shoelaces are tied.
- Take off all jewelry, including rings, neckaces, bracelets or anything else that could get caught in equipment.
- If you are wearing a shirt that has a front pocket, keep it shut, and make sure nothing will fall out of it if you lean over.

Lesson 2

Objectives

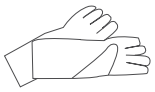
1. Identify safe clothing and personal protective equipment.
2. Describe how to safely start up and shut down machines.

Protect Yourself:


Hard Hat


Goggles/Face Shield


Hearing Protection


Gloves


Apron/Coveralls


Respirator


Footwear

Personal Protective Equipment

Talk to your supervisor about what Personal Protective Equipment (PPE) is required for your job. PPE may include:

- A hard hat to protect you from falling objects,
- Eye protection, such as safety goggles or glasses, or a face shield to protect you from splattering liquids and flying objects,
- Gloves to protect your hands from chemicals, hot liquids, sharp edges or other hazards,

  Note: *Gloves can get caught in moving parts. Talk with your supervisor about when you should wear work gloves near machines.*
- Hearing protection, see guidelines on page 11,
- An apron or coveralls, and safety footwear, to protect from chemicals or spills,
- In order to wear a respirator, you must be in your employer's respiratory protection program. As part of this program your employer will provide you with a medical evaluation and an annual respirator fit test. Your employer will also provide you with more training beyond the scope of this manual.

Working in a Noisy Environment

Working around noisy machines can cause permanent hearing damage. See OSHA requirements on page 11 for when you are required to wear hearing protection.

Hearing Protection May Be Needed If:

- You have to raise your voice significantly to be heard by someone three feet away.
- After leaving a noisy area, your ears feel plugged or you hear a mild ringing or whooshing noise that goes away after an hour or two.
- When you start your car in the morning, the radio is so loud from the evening before that you have to turn it down.

When You Use Hearing Protection:

- Keep your hearing protectors clean. Do not re-use disposable ear plugs.
- Talk to your doctor or your supervisor if your ears hurt after you use hearing protection. Ask your supervisor for another type of hearing protection to try.
- Hearing protection may make it hard to hear your coworkers-pay attention to your surroundings.

Daily Pre-Start Inspections

Machine Checks

- Make sure there are no tools, papers, boxes or other materials on or near the machine.
- Locate the emergency stop buttons. Machine emergency stop buttons are red.
- Look under the machine for puddles. Puddles under the machine could cause slips, falls and increase your chance of electrocution.
- Make sure machine guards and safety devices are secured in place. Talk to your supervisor if there are any missing guards, or if safety devices are not working.

Accident Report
Worker's Arm Broken in Conveyor

Summary of OSHA Accident Investigation 119797710
A worker was cleaning the pulley of a conveyor while it was running. The conveyor had a guard, but it was not fully attached. The employee reached around the guard and her arm was pulled in and broken.

Never reach around a guard while a machine is running. Make sure all guards are secured in place before you start a machine.

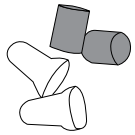
When to Wear Hearing Protection

OSHA Standard 1910.95 (i) (l) requires hearing protection to be worn when sound levels exceed certain limits (generally, a daily average of 85 or 90 decibels, depending on the circumstances). These levels can be measured with a sound level meter. A hearing conservation program requiring hearing tests and other precautions, as well as training in the use of hearing protectors, may also be necessary. Check with the equipment operator's manual, as well as your supervisor, for suggestions on hearing protection for each machine as well as instructions on how to wear it properly.

** OSHA requires employers to monitor noise exposure levels to identify employees exposed to noise at or above 85 decibels averaged over an 8-hour workday.*

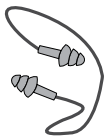
Types of Hearing Protection:

Expandable Foam Ear Plugs



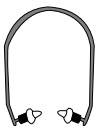
- Roll plugs into a cylinder, and put in ear. Hold in place and count to 30 aloud while the plug expands.
- Do not re-use disposable plugs.

Pre-molded, Reusable Ear Plugs



- Make sure you have the right size plug for your ear. You may need to wear a different size in each ear.
- Wash these plugs regularly to keep them free of dirt and wax buildup.

Canal Caps



- Place band around your head, neck or chin–wherever is most comfortable.
- Wash caps regularly to keep them free of dirt and wax buildup.

Earmuffs

- Make sure the earpiece makes a good seal around your ear.
- Eyewear, sideburns, beards and long hair may prevent the earmuff from blocking noise.

Refer to OSHA pamphlet 3074, "Hearing Conservation" for more information.

Electrical Equipment

- Machine cords should be in good condition–not frayed, cracked or showing exposed wires. Cords should not be spliced and should be out of traffic areas. Do not nail or staple cords; this could cause a fire.
- Circuit breakers, fuses and disconnect switches should be clearly labeled so you can find them in case of emergency.
- Do not use extenstion cords around water. Make sure there are no puddles of water on the floor near cords or wires.
- Contact your supervisor if outlets and switches are unusually warm or hot to touch.

Work Area

- Make sure your work area is clean and free of clutter. You should be able to safely walk around the machine.
- Keep unauthorized personnel away from the machine while you are working.
- Contact your supervisor if your work area is poorly lit.

Safe Startup and Shutdown

Before You Start a Machine:

- Communicate with your coworkers. Tell everyone in the area that you are starting the machine, and do not start it until you know everyone is out of the way.

Accident Report
Employee Suffocated in Hopper

Summary of OSHA Accident Investigation 107241036
An employee was standing on a lift used to dump material into a hopper. When his coworker started the machine, he fell into the hopper. He suffocated.

Let your coworkers know you are starting a machine, and check to make sure everyone is out of the way.

- Make sure machine controls are set to the right position before operation. Check with your supervisor or the operator's manual for instructions.

When You Shut Down a Machine:

- After you shut down the machine, make sure all moving parts come to a complete stop before leaving the machine unattended.
- Shut down and lock out power before reaching into a danger zone.

Choose safety

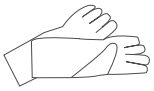
Quiz Yourself

Answers can be found on pages 33 and 34.

Match the Personal Protective Equipment name with its picture:

Gloves

Goggles



Hearing Protection

Hard Hat

Use the list of words to complete the sentences:

moving parts
hearing
electrical cord
stopped

1. Do not use nails or staples on an _____; this could cause a fire.

2. Loose clothing could get caught in _____.

3. Make sure all moving parts have _____ before you leave a machine unattended.

4. Working around noisy machines can cause permanent _____ damage.

Safe Machine Operation

Stay Away from Danger Zones

- Do not reach over moving parts while a machine is running. Your clothing could get caught.
- Do not operate a machine that has missing or damaged guards. You could get caught in moving parts or be struck by a flying object.
- Do not climb over or under conveyor belts. Use stairways and walkways.

Accident Report
Worker Injured When Caught By Conveyor Roller

Summary of OSHA Accident Investigation 171045529
A worker climbed under a conveyor belt to clean while it was running. He grabbed the conveyor frame to get up, and his glove got caught in the rollers. He was pulled in and struck the rollers. He suffered two broken ribs, a broken collar bone and a punctured lung.

Do not go under a conveyor belt, especially while it is running.

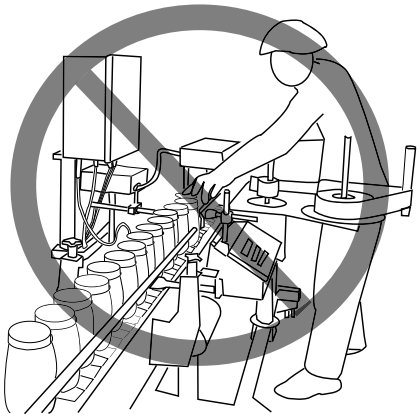
- Keep all body parts out of danger zones while a machine is running.
- Stay off machines unless they are designed for you to operate from that position.
- Never sit on or ride a conveyor belt — you could get caught in its moving parts.

Lesson 3

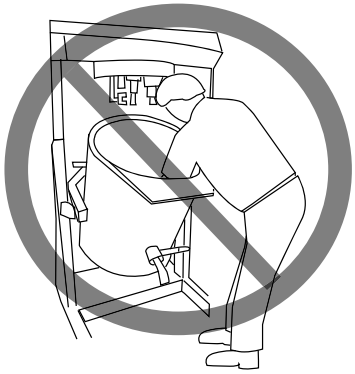
Objectives

1. Describe danger zones.
2. Classify areas to be guarded on machines.
3. Discuss procedures for cleaning machines and clearing jams safely.
4. Outline precautions for working with electricity.

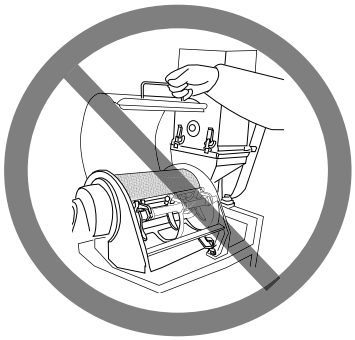
Stay Away from Danger Zones



Do not reach over moving parts while a machine is running.



Do not reach into a machine unless you have shut down and locked out power.

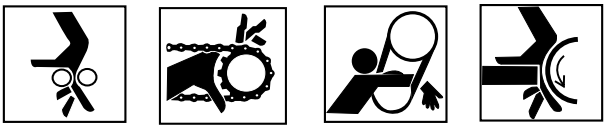


Do not remove guards or shields until you have shut down and locked out power.

Danger Zone Hazards

Before you begin working, locate the danger zones on a machine. These danger zones are usually labeled with safety messages or signs.

Nip/Pinch Points



Nip points, also called bites or pinch points, happen when parts rotate toward each other. You or your clothing can become caught in a nip point and be pulled into the machine. Machines with rollers, belts, pulleys, chains, sprockets and rack and pinions all have nip points.

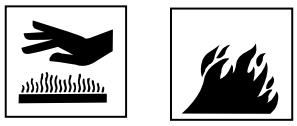
Shear Points

Shear points happen where the edges of two machine parts move across or close to each other. They can cut through skin, clothing and body parts. They include blades, choppers, augers and screw conveyors.

Crush Points

Crush points happen where moving parts come together, or meet an obstacle. Crush points are different than nip points because the parts are not rotating. Be sure to not walk between a machine and a fixed object. You could be crushed against the object by moving parts.

Burn Hazards



You can be burned by machines designed to heat up, such as a dryer or oven. You can also be burned by parts that become hot from friction, hot liquid or steam.

Electrical Hazards

Only trained, authorized personnel are allowed to work on electric parts. All machines should be grounded. If someone is shocked, report this to your supervisor immediately.

Other Dangers

Fall Hazards

High Pressure Liquids

Fluid Injection Hazards

Wrap Points

Stored Energy

Pay attention to all warning signs located on the machine. Identify all danger zones and stay away from them.

Maintain Machine Guards and Shields

Machine guards and shields block you from getting close to danger zones. They are usually built onto the machine when it is made, but they can also be added later. Tell your supervisor if you see a danger zone that needs guards.

Be safe with machine guards:

- Never reach over a machine guard while the machine is running. If you must reach into a machine, shut down and lock out power first.
- Do not tamper with guards. Modified guards might be weakened, and fail to protect you.

Accident Report
Worker's Finger Amputated While Cleaning Conveyor

Summary of OSHA Accident Investigation 170681944
A worker was cleaning an overhead conveyor while it was running. He lifted a shield and reached into the conveyor. His finger was cut off by moving gears.

Always shut down and lock out power first. Do not open guards while a machine is running.

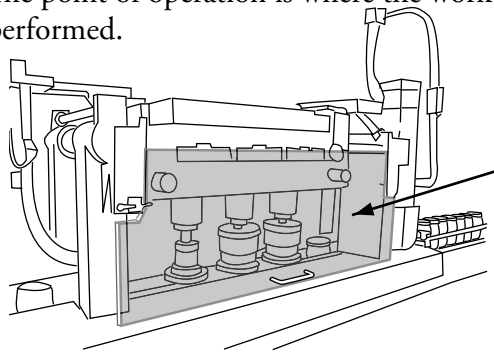
- Do not operate a machine that has missing guards. Tell your supervisor immediately if you think a guard is missing.

Images used for identifying hazards recreated and used with permission from ASAE S441.4, FEB04, Safety Signs.

Guards Protect You From Danger Zones:

1. Point of Operation

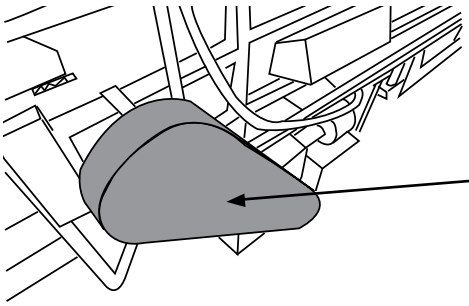
The point of operation is where the work of the machine is being performed.



A clear shield blocks the point of operation on this machine, but still allows the worker to see inside. Interlocks will shut the machine off if the shield is opened.

2. Power Transmission

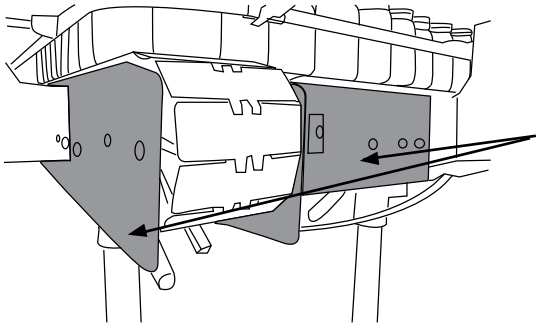
Pulleys, belts, flywheels, chains, gears and cranks should be guarded.



This guard covers a pulley and belt on the outside of this machine.

3. Other Moving Parts

Rollers, conveyors, feeders and other moving parts should be guarded.



These guards protect the worker from the conveyor's moving parts.

Do not use a machine that has missing or damaged guards.

Do not remove guards while a machine is running.

Do not reach around guards into a danger zone.

Accident Report

Worker's Thumb Amputated by Unguarded Machine

Summary of OSHA Accident Investigation 111892287

A worker was operating a food capping machine. She removed a guard and reached into the machine while it was running. Her right thumb got caught in the machine's belt/pulley drive and had to be amputated.

Do not remove guards while a machine is running.

Safety Devices

Safety devices are different than guards. Instead of blocking you from a danger zone like a guard, safety devices protect you in other ways. Examples of safety devices are:

Pullbacks/Restraints

These are attached to your hands or arms and keep you from reaching into a danger zone.

Interlocks

Interlocks shut down the machine if guards, doors and switches are not in the safe operating position.

Sensors

Sensors shut down the machine or block it from starting if you are near a danger zone.

Two Hand Controls

Two hand controls make sure you have both hands away from the machine's point of operation. You must be using both hands on the controls to start the machine.

Accident Report

Worker's Hands Burned in Vacuum Seal Machine

Summary of OSHA Accident Investigation 120069505

An employee and a coworker were using a vacuum seal machine. The machine was designed for only one operator. One of the employees thought his coworker's hands were out of the way so he pushed the machine's start button. His coworker's hands were still under the machine's hot sealer bars and were severely burned.

Do not override safety devices. Never allow two operators on a machine designed for one operator.

Safety Device Guidelines:

- Do not disable a control or an interlock. You could be caught in moving parts if the machine starts up while you are in a danger zone.
- Do not use two people to operate a machine with safety devices designed for one operator. A second operator will not be protected.
- Make sure safety devices are adjusted to fit each operator. Pullbacks and restraints must be fitted each time they are used.

Do not disable safety devices.

Do not operate a machine with safety devices that have been disabled.

Report any disabled safety devices to your supervisor immediately.

Do not allow two operators on a machine designed with safety devices for one operator.

Clean Machines Carefully

Do not clean a machine while it is running. You could get caught in moving parts, be burned or suffer an electric shock. Always stay away from danger zones and do not bypass guards or safety devices. If the machine must be running to be cleaned make a plan with your supervisor.

- Read your operator's manual for cleaning instructions.
- Do not clean a machine unless you are trained and authorized to do so.

Accident Report

Worker's Hand and Arm Injured in Conveyor

Summary of OSHA Accident Investigation 111934287

An employee was working at the end of a belt conveyor. He tried to clean dried fruit from the conveyor rollers by reaching behind a guard while it was running. His left hand and arm went into the nip point and were injured.

Do not reach around guards. Always shut down and lock out power before reaching into a danger zone.

- Shut down the machine and lock out power if you must reach into a danger zone.
- Use a brush to clean crevices. If you must use compressed air the pressure must be less than 30 p.s.i. and you must use chip guarding and personal protective equipment.

Clear Jams Safely

You can be seriously injured or killed while attempting to clear a jammed machine. Do not try to clear a jam unless you have been trained and authorized to do so.

- Do not clear a jam while the machine is running. Make a plan with your supervisor to avoid entering any danger zones.
- Shut down and lock out power before:
  - reaching into a danger zone.
  - removing a guard to clear a jam.
- Make sure to replace the guard before starting the machine.
- Do not reach over moving conveyors, rollers, or other parts to clear a jam. Your clothing could get caught.

Accident Report
Worker Amputates Fingers in Auger

Summary of OSHA Accident Investigation 201140357

A worker was operating a fruit juice extractor. The machine uses an auger inside a duct to push out the fruit. The employee reached in to unclog fruit without turning off the machine. The auger amputated three of his fingers.

Do not use your hands to unclog the machine while it is running.

Work Safely Around Electricity

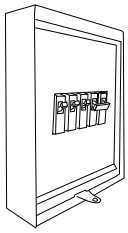
Talk to your supervisor if you think the machine has an electrical problem. Do not try to fix an electrical problem yourself.

Effects of Electric Current on the Body

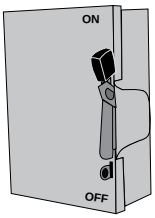
1 milliamp	Slight tingle.
5 milliamps	Slight shock. Average person can let go.
6-30 milliamps	Painful shock is felt; "freezing" reaction starts at this point – it may not be possible for victim to let go.
50-100 milliamps	Extreme pain is felt, and breathing can stop. Severe muscle contractions can occur. *Death is possible.*
1,000-4,300 milliamps	The rhythmic pumping action of the heart stops. Severe muscle contractions and nerve damage can happen. *Death is possible.*
10,000 milliamps	Cardiac arrest. Person is burned severely. *Death is probable.*
15,000 to 20,000 milliamps	Circuit breaker trips or fuse blows in a common lighting circuit.
1,000 milliamps = 1 Amp	

Responding to an Electric Shock Victim:

1. Disconnect the machine's power at the circuit breaker or manual disconnect switch. Do not touch the victim or the machine until the power is disconnected, or you could be shocked.



Circuit Breaker



Manual Disconnect

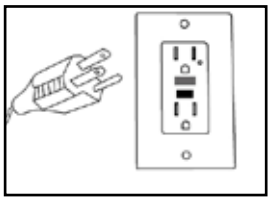
2. Have a qualified person provide first aid. Call 911 if injuries are severe.

3. Have a qualified person check the machine and repair any problems before it is returned to service.

Ground-Fault Circuit Interrupters

A Ground-Fault Circuit Interrupter (GFCI) is a device that monitors electrical current and protects you from being electrocuted.

These devices are most often placed in outlets and special extension cords. A GFCI has a sensor and a microchip that can tell if electricity is going to the wrong place, such as through your body. When the GFCI senses a problem, it shuts off the electricity in 1/40th of a second. You might receive a shock, but that is quick enough to save your life.



- Test GFCIs regularly.
- GFCIs should not be used for machines or equipment that have open heating coils or machines that must run continuously, like ovens, refrigerators and freezers.
- If you cannot avoid using an extension cord in wet conditions, make sure it is equipped with a GFCI.

Safety Around Electrical Equipment

- Do not splice cords, remove prongs from a three-prong plug, overload outlets, or use machines that have damaged wiring.
- If a machine begins to feel unusually warm, or shows sparks or flickering in lights, shut down the machine and tell your supervisor.
- Shut down and lock out power before working on equipment.
- Use caution when working in wet environments. Make sure your machine is properly grounded. Use a Ground Fault Circuit Interrupter (GFCI) to protect you in a wet environment.

Accident Report

Employee Electrocuted While Working Near Brine Vats

Summary of OSHA Accident Investigation 014253769

Two workers were standing on a wet wooden platform adding brine to vats. One worker stepped on a spliced cord that was on the deck and told his coworker that he was being shocked. The coworker also felt the shock through his deck shoes and called for the power to be disconnected. Investigation showed that the current passed from the cord through the wet deck. One worker was electrocuted and his coworker suffered an electric shock.

Do not use spliced cords, especially in a wet environment.

- Never carry a tool by its power cord. The cord could be damaged, and become an electrical hazard.
- Disconnect power immediately if someone is being shocked. Do not touch the person until the power is off, or you could be shocked or electrocuted.

Quiz Yourself

Answers can be found on page 34.

Use the list of words to fill in the blanks:

point of operation
conveyor
machine guard
operator's manual
bites

1. Never sit on or ride a _____ belt. You could get caught in its moving parts.

2. Nip points, also called _____ or pinch points, happen when parts rotate toward each other.

3. The three danger zones a machine should have guarded are the: _____, power transmission and other moving parts.

4. Read your _____ for cleaning instructions.

5. If you must remove a _____to clear a jam, shut down and lock out power first.

Lesson 4

Objectives

1. Identify situations when lockout/tagout is necessary.
2. Give examples of confined spaces.

Service and Maintenance Hazards

Lockout/Tagout Procedures

What is Lockout/Tagout?

Lockout/Tagout refers to shutting down a machine and locking and/or tagging out power.

You must use lockout/tagout if:

- You have to remove or bypass a guard or other safety device.
- You have to put your hand, arm or other body part into a danger zone.

Lockout/tagout protects you when you service, repair, adjust, clean, or unclog equipment that uses or generates any hazardous source of power, such as:

- moving blades
- pulleys and belts
- fans
- flywheels
- hydraulics
- other moving parts
- natural gas
- electricity
- hazardous chemicals
- compressed springs
- suspended weights
- compressed air
- steam
- heat

Accident Report

Worker Injured While Cleaning Machine

Summary of OSHA Accident Investigation 120335005

A worker turned a machine off to clean a tape cutting knife. He did not lock out the power. While he was working, a coworker hit the ON button. The employee suffered a deep cut to his hand and loss of skin and flesh on his fingers.

Always follow lockout/tagout procedures before you put any part of your body in a danger zone.

If you do not observe lockout/tagout procedures, you or a coworker can be seriously injured or killed:

- The machine could start up, and you could be injured in moving parts.
- You could be electrocuted.
- You could be injured by pressurized fluid, springs or falling objects.
- You could be burned by hot liquids, chemicals or steam.

Standard Lockout/Tagout Procedures

Shut Down Equipment:

1. Talk to your supervisor and check the operator's manual so you know all of the machine's hazards.
2. Tell your coworkers the equipment is being shut down and locked/tagged out. Make sure everyone knows not to remove locks or tags.
3. Shut down the equipment using the switch, button, valve or other device.
4. Shut off the power at its source (circuit breaker, manual disconnect switch, valve, etc.) and apply the lock and/or tag.

Make Sure Hazards are Controlled:

1. Release or control any stored power. This includes blocking suspended parts that could fall on you, allowing hot parts to cool, chaining flywheels, relieving air or hydraulic pressure, blocking springs and other parts that could fall, spring, move or spray unexpectedly.
2. If you will be using only tags, you must take an additional safety measure. For example, block a controlling switch or close an additional valve.
3. Make sure everyone is out of the way and then try to start the equipment to see if all power is locked out.
4. Test electrical circuits and electrical parts to make sure they do not still have power.
5. Return all operating controls to the neutral or "off" position.

Service the Machine

1. Work on the machine while the power is locked out.
2. If more than one maintenance person is working, each worker must use his or her own lock and tag.

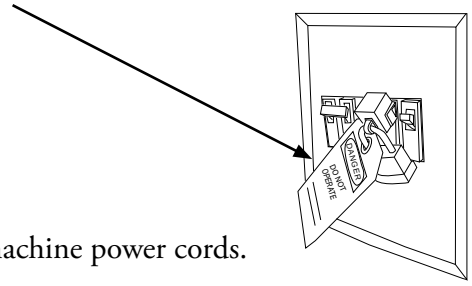
Return Equipment to Service

1. When you are finished working, make sure tools have been removed and guards are in place.
2. Make sure coworkers are out of the way and that machine controls are in the neutral or "off" position.
3. Remove locks and/or tags and turn on power at the circuit breaker, manual disconnect switch, valve, etc.
4. Let your coworkers know that the service or repair is finished and that the machine is ready to be used.

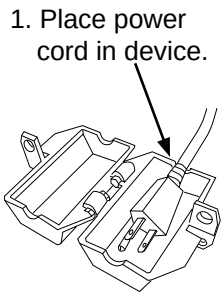
Examples of Lockout/Tagout:

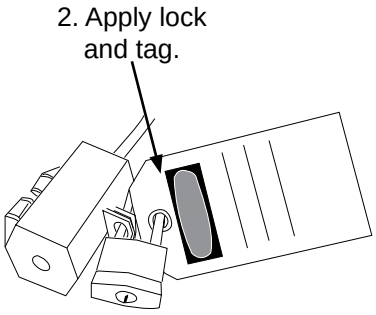
Electrical Power Sources:

- Use a circuit breaker lockout device to keep anyone from turning the breaker on.



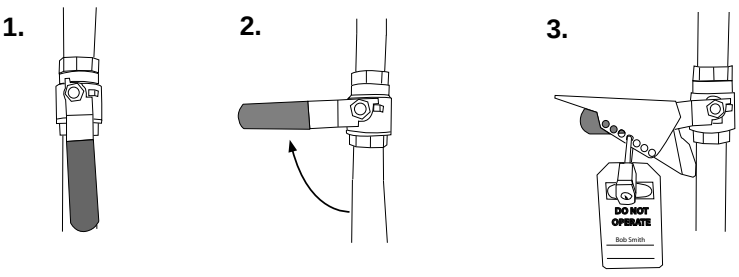
- Use a plug lockout for machine power cords.



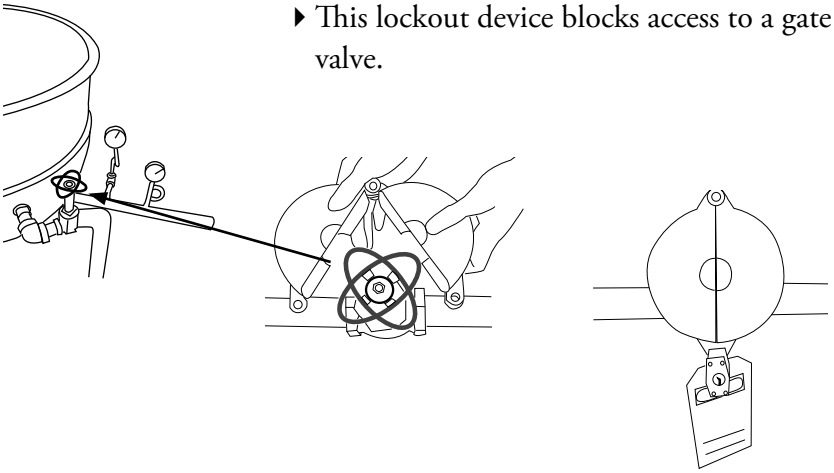


Valves:

- Shut off a ball valve before attaching lockout device.



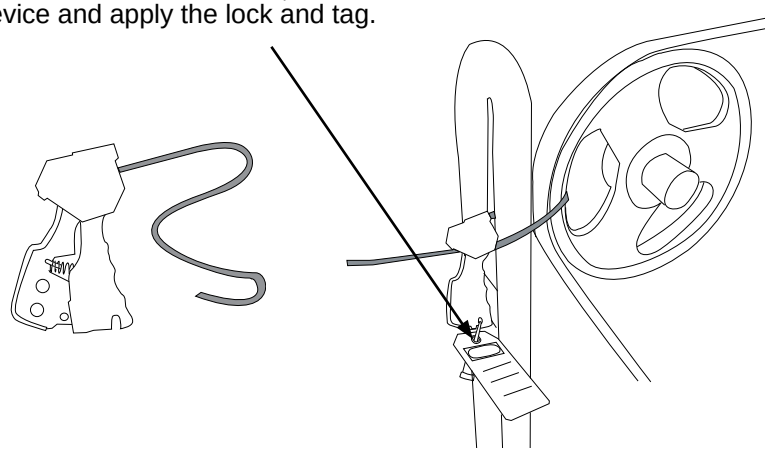
- This lockout device blocks access to a gate valve.



Pulleys/Flywheels:

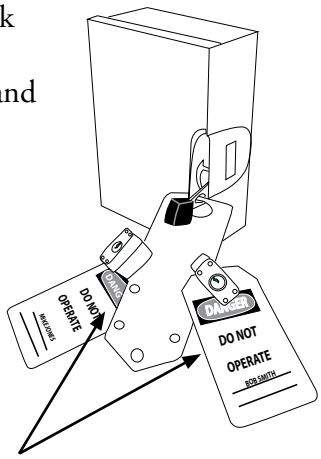
- This lockout device has a cable that can be threaded through a flywheel or pulley and secured to a post or other fixed object.

Once the cable is secured, close the device and apply the lock and tag.



When there will be more than one maintenance worker:

- Each worker must have their own lock and tag.
- All workers must remove their locks and tags before the power is turned on.



This manual disconnect switch is locked out using two separate locks.

If one lock is removed, the switch is still blocked until the second maintenance worker removes his or her lock.

⚠ Confined Spaces ⚠

This is a brief introduction to the hazards of working with confined spaces.

Before you work in a permit-required confined space, you must complete training that is beyond the scope of this book.

Do not enter a permit confined space until you have beem trained, have an approved permit, and have the proper procedures in place.

Working in Permit-Required Confined Spaces

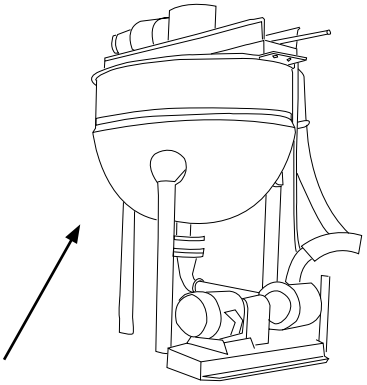
You could be seriously injured or killed when working in confined spaces. You can get caught in moving parts or be overcome by gasses and vapors. You could also suffocate if you are covered by water, fruit or vegetables, pulp or other loose materials.

Confined spaces have all of the following characteristics:

- Limited ways to enter or exit, like a small hatch or manhole.
- Large enough for an employee to enter.
- Not designed for continuous work.

Examples of confined spaces include:

- hoppers
- mixers
- digesters
- boilers
- pits
- freezers
- vats
- storage tanks
- underground vaults
- degreasers
- silos
- tunnels



This kettle is an example of a confined space. It is large enough for you to get inside, but is not designed for you to be in all the time.

Accident Report
Worker Overcome in Nitrogen Filled Tank

Summary of OSHA Accident Investigation 119831063
A worker entered a syrup tank that had been cleaned with nitrogen. The tank was still full of nitrogen gas and there was not enough oxygen. The worker did not ventilate the tank. He had to be rescued from the tank and was taken to the hospital for observation.

Do not enter a permit confined space unless you have completed your employer's permit space training program.

Permit-Required Confined Spaces

A permit-required confined space is a confined space with hazards that could injure or kill you. You must be approved by your company to enter this type of confined space.

Health and safety risks include:

1. Unsafe air, such as: too much oxygen (more than 23.5%) or too little oxygen (less than 19.5%), a toxic gas such as carbon monoxide or a flammable gas, such as methane.
2. Materials that could cover you and drown or suffocate, such as water, fruit or vegetables, pulp or other loose materials.
3. A floor that slopes into a small opening, like a hopper, where you could be trapped and suffocate.
4. Any other serious hazards such as unguarded moving parts or exposed electrical parts.

Quiz Yourself

Answers can be found on page 34.

Use the list of words to fill in the blanks

hopper
locks and tags
confined space
remove

1. Follow lockout/tagout procedures when you have to _____ or bypass a guard or other safety device.

2. One characteristic of a _____ is that it has limited ways to enter or exit.

3. Make sure coworkers know to not remove _____ while equipment is being serviced.

4. A _____ is an example of a confined space.

Conclusion

Practicing safe work habits around machines can help you avoid accidents on the job.

You have been presented with checklists, safety tips and exercises designed to help you avoid the most commonly reported causes of machine operation injuries and deaths, as well as other important safety precautions to consider. Use this information to keep your workplace safe.

Quiz Yourself

Answers can be found on page 35.

Use the list of words to fill in the blanks:

emergency stop
lockout/tagout
tamper
running
alcohol

1. Never _____ with a machine guard or safety device.

2. Locate machine _____ buttons. They should be within your reach at all times.

3. Do not operate machines while under the influence of _____.

4. Follow _____ procedures whenever you must reach into a machine danger zone.

5. Never clear a jammed machine with your hands while it is _____.

Quiz Yourself Answers

Lesson 1, Page 8

1. You can be burned from machines' hot parts.

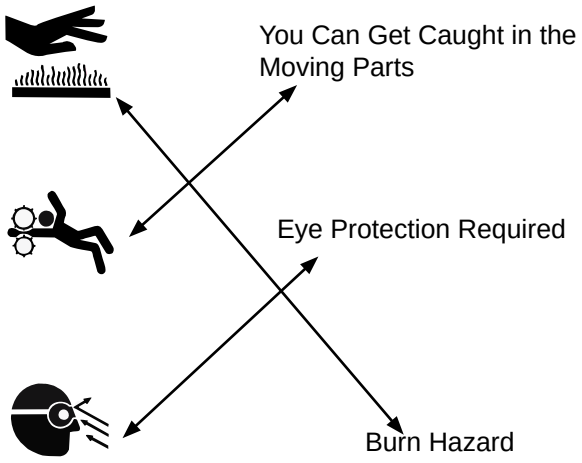
2. Operating machines in wet environments and using damaged cords are ways you can be shocked or electrocuted.

.

3. Do not operate machines if you are fatigued or have taken drugs or alcohol.

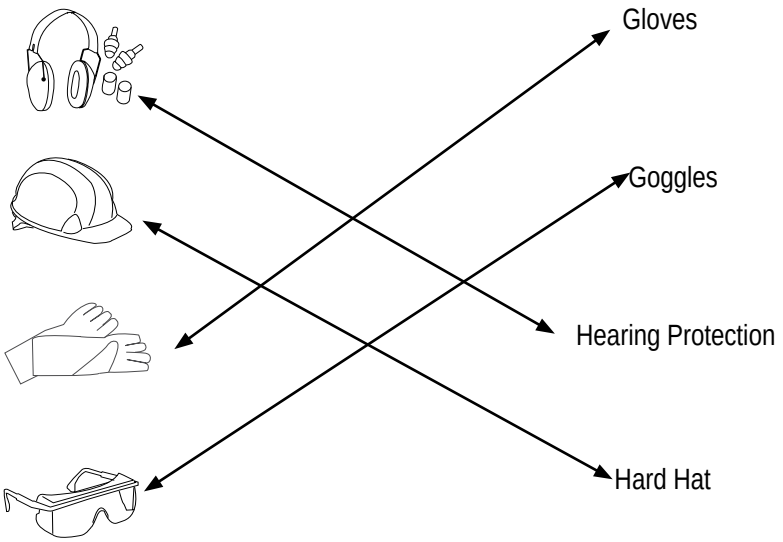
4. Caution signs are yellow , warning signs are orange and danger signs are red.

Match the safety sign with its meaning:



Lesson 2, Page 14

Match the Personal Protective Equipment name with its picture:



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Lesson 2, Page 14 (cont.)

1. Do not nail or staple an electrical cord; this could cause a fire.

2. Loose clothing could get caught in moving parts.

3. Make sure all moving parts have stopped before you leave a machine unattended.

4. Working around noisy machines can cause permanent hearing damage.

Lesson 3, Page 23

1. Never sit on or ride a conveyor belt – you could get caught in its moving parts.

2. Nip points, also called bites or pinch points, happen when parts rotate toward each other.

3. The three danger zones a machine should have guarded are the: point of operation, power transmission and other moving parts.

4. Read your operator's manual for cleaning instructions.

5. If you must remove a machine guard to clear a jam, shut down and lock out power first.

Lesson 4, Page 30

1. Follow lockout/tagout procedures when you have to remove or bypass a guard or other safety device.

2. One characteristic of a **confined space** is that it has limited ways to enter or exit.

3. Make sure coworkers know to not remove locks and tags while equipment is being serviced.

4. A hopper is an example of a confined space.

Conclusion, Page 32

1. Never tamper with a machine guard or safety device.

2. Locate machine emergency stop buttons. They should be within your reach at all times.

3. Do not operate machines while under the influence of alcohol.

4. Follow lockout/tagout procedures whenever you must reach into a machine danger zone.

5. Never clear a jammed machine with your hands while it is running.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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