MODULE FIVE

Tractors and Farm Machinery

Learning Objective:

Upon completion of this unit the participant will be able to identify the safety precautions needed when working with tractors and machinery.

Learner Outcomes:

1. Understand the training that is necessary for employees using tractors and other machinery on your farm.
2. Evaluate your farm procedures to ensure the use of rollover protection, seatbelts, and PTO guards.
3. Identify the requirements of 29CFR1928 Subpart D 1928.57 machine guarding.

Notes

Tractor Safety

- Tractor rollovers are the most fatal of all farm accidents in the United States.
- Tractors accounted for 36.7% fatalities 1993-2009.*
- Farm machines accounted for 26.3% fatalities 1993-2009.*
- Entanglements / being pinned by the machine are 1/3 of the machinery related deaths*

**UW Extension Ag Safety and Health website by Mike Renkin*

Other tractor-related injuries and damage involve:

- Incidents with motor vehicles or roadside objects
- Slipping and falling while mounting and dismounting
- Running over bystanders
- Striking overhead hazards
- Struck by flying objects, broken parts, or hydraulic fluid
- Crushed by a poorly supported tractor during repair work
- Sustaining cuts, bruises, burns and other nuisance, but painful, injuries connected with maintenance and routine operation
- Overcome by exhaust gases inside closed buildings
- Burned by fires that happen during refueling or as a result of a collision
- Human factors involved in fatal tractor-related accidents can include: poor judgment, poor attitude, insufficient knowledge or training, fatigue, haste, stress, depression, intoxication, or showing off.
- Each operator should be physically and mentally fit when operating a tractor. An operator who is tired or not feeling well will have a slower reaction time than someone who is awake and healthy.

Notes

Notes

29CFR 1928

Subpart C Appendix A: employee operating instruction:

1. Securely fasten your seat belt if the tractor has a ROPS.
2. Where possible, avoid operating the tractor near ditches, embankments, and holes.
3. Reduce speed when turning, crossing slopes, and on rough, slick, or muddy surfaces.
4. Stay off slopes too steep for safe operation.
5. Watch where you are going, especially at row ends, on roads, and around trees.
6. Do not permit others to ride.
7. Operate the tractor smoothly - no jerky turns, starts, or stops.
8. Hitch only to the drawbar and hitch points recommended by tractor manufacturers.
9. When tractor is stopped, set brakes securely and use park lock if available.

Tractor Pre-Use Checklist Toolbox M5.1

Employee training items

Starting and stopping your tractor

1. If the tractor is indoors, you must provide adequate ventilation by opening doors or windows and using exhaust fans if available.
2. Start the tractor only from the operator's platform. Newer tractors will not start unless the clutch pedal is depressed however, older tractors still in use can be started while the operator is standing on the ground. People have been killed while attempting to start the tractor while standing next to it. These tractors were in gear or the operator bumped the gear shift, causing the tractor to lurch forward and run over them. Never attempt to bypass the safety start switch.
3. Check the power takeoff controls. Make sure that they are disengaged, and that the transmission is in neutral and the clutch depressed.
4. Start the engine following recommended starting procedures in your operator's manual.
5. Allow the engine to warm up before starting to work.
6. Familiarize yourself with the machine, gauges, and controls. Review the operating procedures in the owner's manual prior to use.

Shutting down the engine:

1. Always allow an engine to cool down at an idle before shutting it off. This allows the valves and pistons to cool down uniformly. Lower all hydraulic lift equipment to the ground.
2. After shutting off, refill the fuel tank when the tractor has cooled. Make sure that the parking brakes are locked. Check that there is no combustible debris near the exhaust system.

Everyone on the farm including family and employees should be taught how to safely shut off machinery. This is especially important in an accident situation. The first person on the scene must know how to shut things off. It could save a life!

Operating large four-wheel-drive tractors with articulated steering requires skills in addition to those necessary for operating a smaller tractor. The operator must be especially concerned about safety because of the increased power and large dimensions of the tractor, faster speeds, and different visual perspective.

Hitching Implements Properly

People have been killed or seriously injured during hitching operations. Observe the following points while hitching your tractor to wagons or implements:

- Make sure that the area is clear and no one is behind the tractor
- Back the tractor up slowly to the implement
- Put the transmission in park
- Dismount the tractor and hitch up; remember the safety clip

If you have someone assisting you in hitching an implement:

- Make sure your helper stands clear while you back up the tractor.
- Back up a little more than necessary and stop the tractor.
- Put the tractor in a forward gear, then allow the helper behind it.

Notes

Notes

- Inch the tractor forward while your assistant drops pin into the hitch point. Make sure to use a safety clip.

If the tractor is in forward gear, and your foot slips off the clutch, it can't run over the person assisting you.

Use quick hitch systems whenever possible to eliminate the need to put yourself or helper between two machines.

Rollover Protection Structure (ROPS):

Roll overs are generally due to driving too fast for conditions, striking surface hazards such as rocks, stumps and holes; running into ditches; hitching higher than the drawbar; driving on steep slopes; and operating front-end loaders improperly.

Standard code 29 CFR 1928.51 states that all tractors used in the farming industry must have an approved ROPS.

- OSHA requires an approved ROPS for all agricultural tractors over 20 horsepower and manufactured after October 25, 1976 which are operated by an employee.
- ROPS must be performance tested and meet the standards set by the Society of Automotive Engineers (SAE) and the American Society of Agriculture Engineers (ASAE).
- The goal of ROPS is to absorb the impact energy without excessive deformation and create a zone of protection for the operator.
- ROPS may be a cab or frame that provides a safe area for the operator in case of a rollover.
- ROPS usually limits the degree of the rollover reducing the damage to the tractor.
- Many tractors came with ROPS which have since been removed.
- There are foldable ROPS that allow the tractor to be used in areas with lower clearance.
- Factory installed ROPS will have a certification label attached to the roll bar starting that it meets the SAE/ ASAE/OSHA standards.

Types of ROPS:

- Two post frame solid construction
- Two post frame with folding capability
- Four post frame with an enclosed cab

Use of seat belts with ROPS:

- All operators of tractors equipped with ROPS must wear a seat belt. This will confine the operator to the protected zone. **ROPS alone will not keep the operator safe from being crushed.**
- If not wearing a seat belt and there is an overturn the operator may be thrown from the protected area or crushed by the tractor.
- Never wear a seat belt on a tractor without ROPS; the operator will not survive because they will be trapped in the seat as the tractor rolls over.

Retrofitting an older tractor:

- ROPS are available from manufacturers and should be installed by the dealer.

Care of roll bars:

- Inspect ROPS condition and functionality of the seat belt regularly; if there are signs of wear they should be replaced.
- Do not drill holes or weld other structures to the ROPS. If adding additional lighting it should be clamped to the roll bars.
- DO NOT use the roll bars as an anchor point for chains, tow straps or other cables. Pulling could damage the roll bar or cause an overturn.
- If a tractor does overturn the ROPS should be replaced because they are designed to bend to absorb energy. They are designed and certified to withstand one overturn.
- DO NOT use homemade roll bars; they have not been tested to meet the minimum standards. This may open you up to liability if there is an overturn. They may not be properly installed or may contain poor welds or underrated bolts.

Notes

Notes

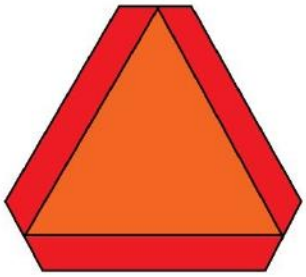
Reducing Roll Over Risks:

- Avoid sharp turns / reduce your speed when turning due to high center of gravity.
- Avoid using a single brake when on an incline or traveling at a high rate of speed.
- Avoid driving on steep embankments, near ditches, and around holes. Drive down slopes and back up slopes, the tractor is more stable.
- When operating downhill on steep slopes with side-mounted equipment keep equipment on the up side of the hill.
- Downshift into lowest gear before starting downhill.
- Reduce speed when crossing slopes on rough, slick, or muddy terrain.
- Avoid rapid engagement of the clutch at high engine speed.
- Front end loaders should be kept as low as possible when turning. A raised bucket is more likely to cause a roll over when making a turn.
- Hitch items to be towed only to the draw bar.
- Safe operation of tractors around ditches / drop-offs: keep as far from the ditch as the depth of the ditch. If the ditch is 6 feet deep keep away 6 feet. If the soil is loose increase the distance.

Road travel:

- Observe all motor vehicle rules and regulations: 1/3 of tractor accidents occur on public roadways.
- Engage the clutch slowly and evenly. •

Farm machinery going less than 25 miles per hour (mph) should display an orange "slow moving vehicle" or SMV emblem on the back.



- Alternatively, the equipment may have an amber strobe light.
- Tractors that can travel up to 40 mph do not require a SMV; Wisconsin has no special sign or symbol to identify these high speed tractors. Many operators use amber strobe lights on these faster-moving tractors.
- Watch for vehicles when making turns and traveling down the road.

Power Take Off (PTO) Safety:

The PTO allows farmers to harness the power from the tractor's engine to run a variety of machines. This power transfer system helped revolutionize North American agriculture during the 1930's. It is also one of the oldest and most persistent hazards associated with farm machinery. There needs to be a respect for the power in the PTO driveline with regards to the potential for injury or death that it may cause.

- Most incidents involve clothing becoming caught by an engaged and unguarded PTO stub.
- Boot laces, pant legs, sweat shirt strings, as well as other loose fitting clothing are all items that can easily get caught.
- A PTO shaft revolving at 540 rpm (9 revolutions / sec) travels more than 2 yards in a second.
- All shield components must be correctly installed and properly maintained to prevent injury when there is contact.

Inspection:

- Proper shields on the PTO
- Look for nicks, dents, or bends that could catch clothing. •

You should be able to rotate the shaft freely.

Master shield: prevents accidental contact with the tractor stub shaft and front universal joint on the shaft. The shield is built to withstand the weight of a 250 pound person using it as a step unless otherwise indicated with stickers.

Power shaft shields: Made of more durable plastic; cones that fit over ends of the power shaft have been improved to be more flexible for easier hook-up and to provide better protection.

Notes

Notes

Proper installation: A PTO shaft may break or separate during operation if improperly used or adjusted; if this happens the tractor-driven end will swing violently with the potential to cause major damage and injury.

Safety practices:

- Keep all components of the PTO system shielded and guarded.
- Regularly test the driveline guards by spinning or rotating them to ensure they are not stuck to the shaft.
- Make sure the tractor's draw bar is adjusted to the correct length for the implement being used to ensure the telescoping shaft and shield will stay together when they lengthen during operation in the field.
- Use the correct size drive line for the machine being powered. Also watch the correct PTO speed for the machine being used.
- Always disengage the PTO, shut off the engine and remove keys before getting off of the tractor.
- Do not make repairs or try to unplug a machine while it is engaged.
- Promptly repair or replace any damaged or missing shields.
- Walk around the tractors and machinery instead of stepping over the rotating PTO shaft.
- Watch your step when moving around a running machine.
- Wear work clothing that doesn't have loose ends or strings that can catch.
- Keep long hair under a cap or hat or tied back to prevent it from being caught in the spinning shaft.
- Reduce PTO shaft abuse by avoiding sharp turns that pinch the rotating shaft between the tractor and the machine. Keep excessive telescoping to a minimum Engage the shaft gradually and avoid over tightening of slip clutches.
- Keep children and non-workers away.

Skidsteers:

Employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. Failure to use control interlock systems or seat belts on a skidsteer loader can create a serious hazard and OSHA may cite an employer for a violation under the General Duty Clause.

Handling:

- Balance is the key to stability and turning of a skidsteer. With no load in the bucket about 2/3 of the weight is on the rear axles. When the bucket is loaded it shifts to the front axle.
- Stability decreases as the loader arms are raised; always keep the bucket as low as possible when turning or traveling.
- Over loading can cause the skidsteer to become excessively front heavy. This reduces stability and handling responses.
- Never attempt to operate the steering levers or other hydraulics from outside the cab.

- Hydrostatic drive means that the skidsteer will respond instantly when the levers are engaged.
- Operation of controls becomes almost instinctive. Novice drivers may become confused; if this happens remove hands and feet from all levers and foot controls. The machine will stop when the pressure of the controls is released.
- Never remove the rollover protection structure from the skidsteer. Keep all side screens in place. Fatal injuries have occurred when people have been pinched between the loader arms and the frame of the skid steer on unscreened machines.
- The seat belt and seat bar should be employed whenever you operate the machine.
- Always make sure the locking devices are in place. If not locked they may break free and roll down the arms of the skid steer, or fall on a bystander.
- Road travel is not recommended.

Notes

Notes

- Avoid crossing steep slopes and rough terrain.
- Move up and down slopes with the heavy end of the loader pointed uphill.
- Try to go around obstacles rather than over them.
- Stay away from ditches, gullies, streambeds; if you get too close to the edge the earth could shear and send the machine to the bottom of the ditch.
- Avoid dumping over a fence or similar obstructions that could enter the cab if the loader were to tip forward.

Work efficiently:

- Drive slowly into the pile then raise the bucket; back away with the load in the tilted-up position.
- Drive to the unloading site with loader arms low; stop, raise the arms, and drive forward slowly until the bucket is just over the spreader or pile.
- Use the hydraulics to keep attachments level while raising the lift arms at a slow, even rate.

Work safely:

- Familiarize yourself with the warning devices, gauges, and controls. Study the operating procedures in the owner's manual.
- Check the soil conditions and for obstacles in the work area.
- Check for overhead power lines.
- Never allow passengers in the cab or in the bucket. Do
- not use the bucket as a work platform. Adjust the speed
- to the terrain.
- Never lift a load over another person or animal.
- When lifting rocks or other loose material; lifting the bucket too high and rolling it all the way back could cause the material to fall into the cab.

- Be careful when backfilling.
- Never under cut an embankment.
- If repairs need to be made with the arms up make sure they are locked in place.

Recognize Secondary Hazards

Many accident victims recognize hazardous situations but they misjudge the seriousness of the hazard because of secondary factors. For example, icy, muddy or manure-covered surfaces make the work area slick and increase the risk of injury. Bystanders or children in the work area can distract the operator or limit operator vision.

In many situations you can't eliminate the hazard while working but you can reduce the hazard. Remove or eliminate secondary factors that are under your control. Keep the work area clean and uncluttered. Control access to the work area and shut down operations when others enter it.

Consider human factors

Skid steer operators can misjudge their ability to stop or avoid a dangerous situation. This is common when operators work around powerful equipment every day and become comfortable with their ability to control the machinery. However, operators are limited by their reaction time. Reaction time varies by individual, age, and physical condition. Human reaction time is not quick enough to avoid accidents with machinery.

Gravity

Gravity also is faster than human reaction. For example, it is very dangerous to reach underneath the hydraulic loader arm of a skid steer loader. If the hydraulic line breaks, gravity could pull the loader bucket to the ground at a rate of about 9 feet in 3/4 of a second, and crush the extended arm of the operator.

Notes

Notes

Batteries: HANDLE WITH CARE!

Batteries contain sulfuric acid which can cause considerable harm if it comes into contact with your skin. They can also produce mixtures of hydrogen gas and oxygen which can explode if contacted with heat or sparks. Remember these safety points:

1. Perform work or adjustments in an area free of sparks and heat sources. Don't smoke while working near the battery. Make sure the area is well ventilated.
2. Always wear personal protective equipment covering the eyes and hands. A full face shield will offer the most protection.
3. Never work leaning directly over the battery.
4. Always disconnect the ground cable first and identify the cables as positive and negative so that you don't re-attach them incorrectly.
5. Make sure that you clean the terminals and cable connections before re-attaching them. Make sure the new battery is secured with the hold-down assembly provided.
6. While installing the battery make sure that the terminals don't come into contact with metal parts on the engine or tractor body.
7. Make sure that you connect the ground cable last to prevent sparks as well as tighten the connections.

Hydraulics:

- Hydraulic lines carry a pressure of 2900 pounds per square inch, or psi. A pinhole leak can easily penetrate the skin and cause tissue damage.
- Looking for invisible leaks should always be done with paper or cardboard-not your hands.
- Failure in the hydraulic system or an unexpected movement of the control can allow a machine to unexpectedly drop.
- Never work under any machine supported by hydraulics unless it is blocked up or a safety stop in place.
- Children should never be allowed to play around equipment.
- Parked equipment should always be lowered to the ground.

Machine Guarding: 29 CFR 1928 Subpart D, 1928.57

The purpose of this section is to provide protection for the employees from the hazards associated with moving machinery parts of farm field equipment, farmstead equipment, and cotton gins used in any agricultural operation.

The machine guarding standard of agricultural equipment took effect on October 25, 1976.

Definitions

"**Cotton gins**" are systems of machines which condition seed cotton, separate lint from seed, convey materials, and package lint cotton.

"**Farm field equipment**" means tractors or implements, including self-propelled implements, or any combination thereof used in agricultural operations.

"**Farmstead equipment**" means agricultural equipment normally used in a stationary manner. This includes, but is not limited to, materials handling equipment and accessories for such equipment whether or not the equipment is an integral part of a building.

"**Ground driven components**" are components which are powered by the turning motion of a wheel as the equipment travels over the ground (side rakes).

A "guard" or "shield" is a barrier designed to protect against employee contact with a hazard created by a moving machinery part.

"**Power take-off shafts**" are the shafts and knuckles between the tractor, or other power source, and the first gear set, pulley, sprocket, or other components on power take-off shaft driven equipment.

Notes

Notes

Training on safe operation and servicing of equipment shall happen at the time of the initial hire and then at least annually.

- Keep all guards in place when the machine is in operation.
- Do not allow riders on farm field equipment other than persons required for instruction or assistance in machine operation.
- Stop engine, disconnect the power source, and wait for all machine movement to stop before servicing, adjusting, cleaning, or unclogging the equipment, except where the machine must be running to be properly serviced or maintained, in which case the employer shall instruct employees as to all steps and procedures which are necessary to safely service or maintain the equipment.
- Make sure everyone is clear of machinery before starting the engine, engaging power, or operating the machine.
- Lock out electrical power before performing maintenance or service on farmstead equipment.

Methods of guarding

Each employer shall protect employees from coming into contact with hazards created by moving machinery parts as follows:

- Through the installation and use of a guard or shield or guarding by location;
- Whenever a guard or shield or guarding by location is infeasible, by using a guardrail or fence.

Strength and design of guards

- Where guards are used to provide the protection required by this section, they shall be designed and located to protect against inadvertent contact with the hazard being guarded.
- Unless otherwise specified, each guard and its supports shall be capable of withstanding the force that a 250 pound individual, leaning on or falling against the guard, would exert upon that guard.
- Guards shall be free from burrs, sharp edges, and sharp corners, and shall be securely fastened to the equipment or building.

Guarding by location

A component is guarded by location during operation, maintenance, or servicing when, because of its location, no employee can inadvertently come in contact with the hazard during such operation, maintenance, or servicing.
(mechanical room for rotary parlors).

Where the employer can show that any exposure to hazards results from employee conduct which constitutes an isolated and unforeseeable event, the component shall also be considered guarded by location.

Guarding by railings

Guardrails or fences shall be capable of protecting against employees inadvertently entering the hazardous area.

Servicing and maintenance

Whenever a moving machinery part presents a hazard during servicing or maintenance, the engine shall be stopped, the power source disconnected, and all machine movement stopped before servicing or maintenance is performed, except where the employer can establish that:

- The equipment must be running to trouble shoot the situation: use alternative protective methods
- The equipment needs to be unguarded to service: the machine must be shut down (lock-out/tag-out)

Farm Field Equipment

Power take-off guarding

- All power take-off shafts, including rear, mid- or side-mounted shafts, shall be guarded either by a master shield or by other protective guarding.
- All tractors shall be equipped with an agricultural tractor master shield on the rear power take-off except where removal of the tractor master shield is permitted.

Notes

Notes

- The master shield shall have sufficient strength to prevent permanent deformation of the shield when a 250 pound operator mounts or dismounts the tractor using the shield as a step.
- Power take-off driven equipment shall be guarded to protect against employee contact with positively driven rotating members of the power drive system.
- Where power take-off driven equipment is of a design requiring removal of the tractor master shield, the equipment shall also include protection from that portion of the tractor power take-off shaft which protrudes from the tractor.
- Signs shall be placed at prominent locations on tractors and power take-off driven equipment specifying that power drive system safety shields must be kept in place.

Other power transmission components

- The mesh or nip-points of all power driven gears, belts, chains, sheaves, pulleys, sprockets, and idlers shall be guarded.
- All revolving shafts, including projections such as bolts, keys, or set screws, shall be guarded, except smooth shaft ends protruding less than one-half the outside diameter of the shaft and it's locking means.

Functional components

Functional components, such as snapping or husking rolls, straw spreaders and choppers, cutter bars, flail rotors, rotary beaters, mixing augers, feed rolls, conveying augers, rotary tillers, and similar units, which must be exposed for proper function, shall be guarded to the fullest extent which will not substantially interfere with normal functioning of the component.

- Restrict access to moving parts
- Guards, shields, and access doors shall be in place when the equipment is in operation

Where removal of a guard or access door will expose an employee to any component which continues to rotate after the power is disengaged, the employer shall provide, in the immediate area, the following:

- A readily visible or audible warning of rotation; and
- A safety sign warning the employee to:
  - Look and listen for evidence of rotation; and
  - Not remove the guard or access door until all components have stopped.

Farmstead equipment

Power take-off guarding

- All power take-off shafts, including rear, mid-, or side-mounted shafts, shall be guarded either by a master shield or by other protective guarding.
- Power take-off driven equipment shall be guarded to protect against employee contact with positively driven rotating members of the power drive system.
- Where power take-off driven equipment is of a design requiring removal of the tractor master shield, the equipment shall also include protection from that portion of the tractor power take-off shaft which protrudes from the tractor.
- Signs shall be placed at prominent locations on power take-off driven equipment specifying that power drive system safety shields must be kept in place.

Other power transmission components

- The mesh or nip-points of all power driven gears, belts, chains, sheaves, pulleys, sprockets, and idlers shall be guarded.
- All revolving shafts, including projections such as bolts, keys, or set screws, shall be guarded, with the exception of:
  - Smooth shafts and shaft ends (without any projecting bolts, keys or set screws), revolving at less than 10 rpm, on feed handling equipment used on the top surface of materials in bulk storage facilities; and
  - Smooth shaft ends protruding less than one-half the outside diameter of the shaft and its locking means.

Notes

Notes

Functional components

- Functional components, such as choppers, rotary beaters, mixing augers, feed rolls, conveying augers, grain spreaders, stirring augers, sweep augers, and feed augers, which must be exposed for proper function, shall be guarded to the fullest extent which will not substantially interfere with the normal functioning of the component.
- Sweep arm material gathering mechanisms used on the top surface of materials within silo structures shall be guarded. The lower or leading edge of the guard shall be located no more than 12 inches above the material surface and no less than 6 inches in front of the leading edge of the rotating member of the gathering mechanism. The guard shall be parallel to, and extend the fullest practical length of, the material gathering mechanism.
- Exposed auger flighting on portable grain augers shall be guarded with either grating type guards or solid baffle style covers as follows:
  - The largest dimensions or openings in grating type guards through which materials are required to flow shall be 4 3/4 inches. The area of each opening shall be no larger than 10 square inches. The opening shall be located no closer to the rotating flighting than 2 1/2 inches.
  - Slotted openings in solid baffle style covers shall be no wider than 1 1/2 inches, or closer than 3 1/2 inches to the exposed flighting.

Access to moving parts:

- Guards, shields, and access doors shall be in place when the equipment is in operation.
- Where removal of a guard or access door will expose an employee to any component which continues to rotate after the power is disengaged, the employer shall provide, in the immediate area, the following:
  - A readily visible or audible warning of rotation; and
  - A safety sign warning the employee to:
    - Look and listen for evidence of rotation; and
    - Not remove the guard or access door until all components have stopped.

Electrical disconnect

Application of electrical power from a location not under the immediate and exclusive control of the employee or employees maintaining or servicing equipment shall be prevented by:

- Providing an exclusive, positive locking means on the main switch which can be operated only by the employee or employees performing the maintenance or servicing
- In the case of material handling equipment located in a bulk storage structure, by physically locating on the equipment an electrical or mechanical means to disconnect the power.

All circuit protection devices, including those which are an integral part of a motor, shall be of the manual reset type, except where:

- The employer can establish that because of the nature of the operation, distances involved, and the count of time normally spent by employees in the area of the affected equipment, use of the manual reset device would be infeasible;
- There is an electrical disconnect switch available to the employee within 15 feet of the equipment upon which maintenance or service is being performed; and
- A sign is prominently posted near each hazardous component which warns the employee that, unless the electrical disconnect switch is utilized, the motor could automatically reset while the employee is working on the hazardous component.
- When guarded by railings, any hazardous component within 15 horizontal inches of the rail shall be completely enclosed.
- Railing height shall be approximately 42 inches off the floor, platform, or other working surface, with a midrail between the top-rail and the working surface.

Panels made of materials conforming to the requirements in table below or equivalent, may be substituted for midrails. Guardrails shall be strong enough to withstand at least 200 pounds force on the toprail.

Notes

Notes

Examples of Minimum Requirements for Guard Panel Materials

Material	Clearance from moving part at all points (in inches)	Largest Mesh Opening Allowable (in inches)	Minimum Gage (US Standard or thickness)
Woven Wire	Under 2	3/8	16
	2 to 4	1/2	16
	4 to 15	2	12
Expanded Metal	Under 4	1/2	18
	4 to 15	2	13
Perforated Metal	Under 4	1/2	20
	4 to 15	2	14
Sheet Metal	Under 4		22
	4 to 15		22
Plastic	Under 4		(1)
	4 to 15		(1)

(1) Tensile strength of 10,000 lbs. /in

Belts guarded by railings shall be inspected for defects at least daily. The machinery shall not be operated until all defective belts are replaced.

Pulleys of V-belt drives shall be completely enclosed or guarded by location whether or not railings are present. The open end of the pulley guard shall be not less than 4 inches from the periphery of the pulleys.

Chains and sprockets shall be completely enclosed, except that they may be guarded by location if the bearings are packed or if accessible extension lubrication fittings are used.

Where complete enclosure of a component is likely to cause a fire hazard due to excessive deposits of lint, only the face section of nip-point and pulley guards is required. The guard shall extend at least 6 inches beyond the rim of the pulley on the in-running and off-running sides of the belt, and at least 2 inches from the rim and face of the pulley in all other directions.

Projecting shaft ends not guarded by location shall present a smooth edge and end, shall be guarded by non-rotating caps or safety sleeves, and may not protrude more than one-half the outside diameter of the shaft (conveyor belts).

In power plants and power development rooms where access is limited to authorized personnel, guard railings may be used in place of guards or guarding by location. Authorized employees having access to power plants and power development rooms shall be instructed in the safe operation and maintenance of the equipment (rotary milking parlor component room).

REVIEW MODULE FIVE:

1. What are the nine areas that 1928 addresses with tractors?

2. How often must you train your employees on the use of tractors and equipment?

3. What is the difference between farmstead equipment and farm field equipment?

4. How often should you inspect your machine guards?

Notes

Notes