Machine Guarding SPP#1910.212

Quick Reference

Contents

1.0 Purpose

The purpose of this safety policy and procedure is to establish requirements for the safety of North Carolina Department of Transportation (NCDOT) employees while working with machines or near machines with hazardous moving parts.

2.0 Scope and Applicability

The purpose of this safety policy and procedure is to establish requirements for the safety of North Carolina Department of Transportation (NCDOT) employees while working with machines or near machines with hazardous moving parts.

A wide variety of mechanical motions and actions on machines may present hazards to NCDOT employees. These can include point of operation, power transmission components, ingoing nip points, rotating parts, reciprocating arms, moving belts, flying chips, and sparks.

This safety policy and procedure provides guidelines for safeguarding and recognizing mechanical hazards due to dangerous moving parts on machinery used at DOT. It includes provisions for training, discussion on where these hazards occur, machine guarding requirements, machinery maintenance and repair requirements, labels, signs, and marking requirements for machines with hazardous moving parts.

This safety policy and procedure also details the areas of responsibility for managers/unit heads, supervisors, employees, and Safety and Risk Management.

This safety policy and procedure includes but is not limited to the following equipment typically used in NCDOT:

- Drill Presses
- Lathes
- Shears
- Fans
- Metal Working Machines
- Abrasive Wheel Machines (Grinders)
- Concrete Circular Saws
- Woodworking Machines
- Jointers and Sanding Machines
- Power Lawnmowers
- Walk-Behind Rotary Mowers
- All classes of mechanized field equipment

This document also affects any employee who is exposed to mechanical hazards due to a machine's point of operation or other moving parts including machine operators, maintenance personnel and affected employees exposed to the mechanical hazards.

3.0 Reference

This This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for General Industry (29 CFR 1910.212) and Construction (29 CFR 1926.300).

4.0 Policy

It is the policy of NCDOT to provide a place of employment free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, any machine part, function, or process that may cause injury must be guarded. When mechanical hazards exist that cannot be eliminated, then engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Machine Guarding will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation of NCDOT's safety policy and procedure on Machine Guarding. It is also the responsibility of each NCDOT employee to report immediately any unsafe act or conditionto his or her supervisor. Specific responsibilities are found in Section 6.3.

6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies responsibilities required by NCDOT's safety policy and procedure on Machine Guarding.

6.1 Definitions

Abrasive Wheel
A bench grinder wheel consisting of various particles bonded together and used for grinding objects to a particular shape or size.

Guard
An enclosure designed to protect employees from rotating or moving mechanical parts.

Kickback Device
Any device that protects the operator from equipment throwing the work back towards the operator.

Portable
Hand-held operated.

Ring Test
The use of a non-metallic object to tap a grinding wheel at 45 degree intervals. If the wheel exhibits a dead sound, the wheel is unsafe to use.

Shield
An enclosure or barrier designed to protect employees from processes involving the possibility of disintegrating machine parts or parts being ground upon, pressed, or struck.

6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- Recognizing Where Hazards Occur
- Machine Guarding Requirements
- Machinery Maintenance and Repair
- Label, Signs, and Marking Requirements

6.2.1 Employee Training

Employees who operate machines with hazards due to moving parts shall be trained on how to use the machine guards and why the guards are in place. Employee training should include the following instructions and hands-on training:

- Description and identification of the hazard associated with the machine
- The guards, how they provide protection, and the hazard for which they are intended
- Precautions to take when machine is unguarded during maintenance and repair
- What to do and who to contact if a guard is damaged, missing, or defective

Employees shall be trained upon initial assignment or when any new guards are put in place.

6.2.2 Recognizing Where Hazards Occur

Dangerous moving parts on machines present hazards that require guarding. The three basic are:

- Point of Operation
- Power of Transmission Apparatus
- Other Moving Parts

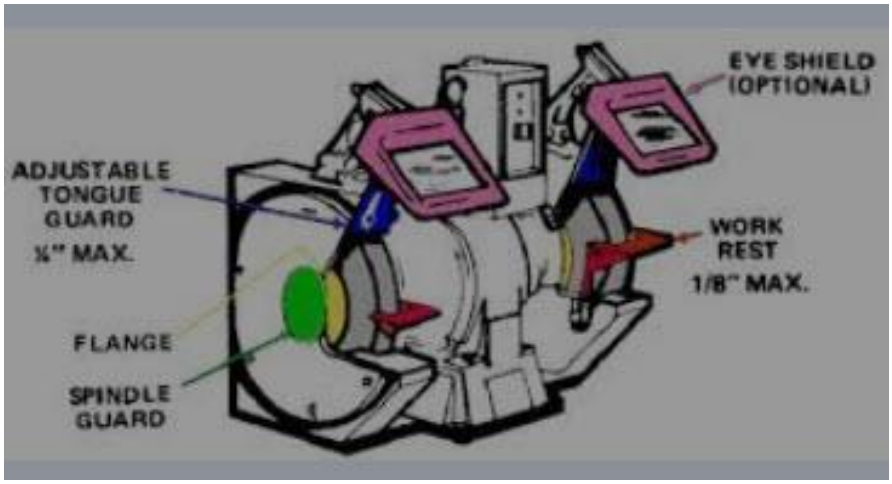
The point of operation is the point where work is performed on the material, such as cutting, shaping, boring, drilling, grinding, using compressed air for cleaning and any other tasks.

Power transmission apparatuses are all components of the mechanical system which transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, crank, and gears.

Other moving parts include all parts of the machine which move while the machine is in operation. These can be reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

All bench and pedestal grinders must be properly guarded to prevent injury from rotating grinding wheels and potential for wheel breakage.

- Safety guards shall cover the spindle end, nut and flange projections.
- Work rests shall be properly adjusted with the maximum distance within 1/8" of the grinding wheel to prevent the work being jammed between the wheel and work rest which may cause wheel breakage. The work rest must be adjusted for grinding wheel wear to maintain maximum spacing between grinding wheel and work rest.
- The tongue guard shall be adjusted within ¼" of the grinding wheel to protect operator in the event of wheel breakage. Tongue guard must be adjusted for grinding wheel wear to maintain maximum spacing between to grinding wheel and tongue guard.
- A bench grinder safety gauge is recommended to ensure work rest and tongue guard are maintained withing requirements.
- Worn grinding wheel must be replaced if the work rest and tongue guard maximum distances cannot be maintained.



Compressed air used for cleaning must be reduced to less than 30 psi or fitted with air blowoff nozzles fitted with air relief device that drops the pressure to less 30 psi if dead ended. The following photos show examples of compressed air guns meeting this requirement.



6.2.3 Machine Guard Types

Guards are barriers which prevent access to danger areas. The four general types of guards are:

- Fixed
- Interlocked
- Adjustable
- Self-adjusting

Fixed Belt/Pulley Guard on Blower Unit

A fixed guard is a permanent part of the machine. It is not dependent upon moving parts to perform its intended function. Figure 1 shows an example of a fixed guard covering power transmission belt/pulley on blower unit.

Figure 1

Interlocked Guard on Lathe

Interlock guards, when they are opened or removed, automatically shuts off or disengages the machine. Figure 2 shows an example of interlocked plexiglass shield on lather rotating chuck.

Figure 2

Adjustable Guard on Drill Press

Adjustable guards allow flexibility to accommodate various sizes of stock and machine set-ups. Adjustable guards protect the operator by placing a barrier between the point of operation and the operator. Figure 3 shows an adjustable guard on a drill press.

Figure 3

Self-Adjusting Guard on Table Saw

Self-adjusting guards allow flexibility in allowing various sizes of stock to enter the point of operation while protecting the operator. After the stock is removed, the guard returns to its rest position. Figure 4 shows an example of a self-adjusting guard on circular table saw.

Figure 4

6.2.4 Machine Guard Requirements

Machine guards must protect employees from mechanical hazards. To do so, these machine guards must:

- Prevent contact with point of operation, power transmission components of the machine and any other moving components.
- Be secured to the machine
- Not create new hazards
- Not interfere with job performance
- Allow for safe lubrication of the machine
- Appendix A lists Specific Machine Guarding Requirements on Selected NCDOT Equipment.

6.2.5 Machinery Maintenance and Repair

Machine design should permit lubrication and adjustment without removal of guards. If machine guards must be removed, maintenance personnel must reinstall them after completion.

Maintenance work should never be performed until the machine is disconnected and locked out. Refer to SPP # 1910.147, Lockout/Tagout, for details on Lockout/Tagout Procedures.

All woodworking machines will be maintained in good condition. This includes replacing dull blades, cutting heads, and damaged or unserviceable parts. Equipment blade changes or adjustments will be performed only when the power source has been disconnected to comply with the lockout, tagout standard. Equipment in which guards cannot be installed shall be removed from service. This includes older equipment which never had factory- installed guards.

All bearings will be lubricated, and any debris removed from their surface to prevent fires. All adjustments will be made by an employee who is trained and knowledgeable about the particular piece of equipment being serviced.

6.2.5 Label, Signs, and Marking Requirements

All safety labels, signs or other markings provided by the manufacturer of machines must not be removed and must remain legible.

6.3 Specific Responsibilities

6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted for the purchase of machine guards for their operation

6.3.2 Supervisors

Supervisors will ensure that affected employees are trained in the safe operation of all machines which will be used in the performance of their duties.

Supervisors will ensure that an adequate supply of Personal Protective Equipment (PPE) is maintained in inventory and that employees are provided with PPE as necessary for their job.

6.3.3 Employees

Employees shall immediately inform their supervisor if any safety guard or shield is missing, damaged or becomes inoperable.

Employees shall also report immediately any recognized hazard to their supervisor.

Employees shall not operate any machine which does not have an operable guard as originally designed.

Employees shall not remove or otherwise modify any machine guard except to perform allowed routine maintenance or service.

6.3.4 Safety & Risk Management

Safety and Risk Management will provide prompt assistance to managers/unit heads, supervisors, or others as necessary on any matter concerning this safety policy and procedure. Safety and Risk Management will assist in developing or securing required training. Safety and Risk Management will also work with Purchasing to ensure that all newly purchased machines with hazardous moving parts comply with this safety policy and procedure.

Additionally, Safety Engineers will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

APPENDIX A: Specific Machine Guarding Requirements

Bandsaws

All portions of the blade on a bandsaw must be guarded except for the portion of the blade being used to cut. The adjustable guard should be adjusted for different thicknesses of stock. All roller or guide wheels will be enclosed to protect against pinching. Tension adjustments must be made to ensure the blade is at the proper tension level to reduce breakage and injury. Proper PPE shall be worn at all times.

Bench and Pedestal Grinders

On offhand grinding machines, work rests are used to support the material while grinding. Gloves should never be worn while holding the material on the work rest, since the glove may be pulled the into the rotating grinding wheel resulting in serious injury. The work rest must be adjusted to allow for wheel wear and be positioned no more than 1/8” from the wheel to prevent the material from being jammed between the wheel and guard which can cause wheel breakage.

Tongue guards must be adjusted to allow for wheel wear and be positioned no more than 1/4" from the wheel to prevent operator from being struck in the event of broken wheel.

Work rest, tongue guard and wheel replacement shall be performed only after the equipment has been turned off, unplugged, or locked and tagged out.

Circular Saw

Any circular saw provided with manufacturer installed guards shall have these guards in place and in operable conditions when the saw is in operation. This will include guards protecting pulleys, chains, gears, shafts, and other moving parts. All saw fences and kickback devices such as kickbackpawls or "dogs" will be in use during operation regardless of the angle or the thickness of the cut being performed. If fences or other safety devices are removed during the change of blades, etc. they shall be replaced prior to operation. If conditions arise in which the supplied guard cannot be used, then a suitable jig will be used in place of the guard provided the limits of the saw are not exceeded. Unusual shaped materials will not be cause for routine removal of guards. If conditions are such that the saw blade is exposed and contact with the blade from either beneath or behind the saw table is possible, then that portion of the blade must be guarded against contact. Proper PPE shall be worn at all times.

Compressed Air

Compressed air used for cleaning purposes shall be equipped with an air blow gun which restricts it to a maximum of 30 psi if dead ended. Employees operating gun shall wear PPE as well as take measures to protect adjacent workers from flying debris.

Concrete Saw (Circular)

All factory supplied blade guards will be placed in the lowered position prior to start up. Blade guards will be raised only when cutting is completed and the engine has been shut down. The bladeguide bar shall be installed and maintained to deem it unnecessary to raise the guard to see the surface guide mark. Only the proper type of blade will be used in these saws. Concrete saws shall be equipped with an integrated water dust suppression system. If not equipped, proper PPE shall be worn at all times.

APPENDIX A: Specific Machine Guarding Requirements (Continued) 2

Chain Saws

Operators shall check controls, chain tension, all bolts, handle, and ensure throttle lock operates properly and chain catcher is in place to ensure they are functioning properly and adjusted according to the manufacturer's instructions. Shut off or engage the chain brake whenever the saw is carried more than 50 feet or on hazardous terrain. When carrying the saw, keep the bar facing behind you. Never start the chainsaw until you are at the location where you intend to use the saw. The preferred method is to start the chainsaw engine on the ground. Do NOT drop start or air drop start a chain saw. The leg lock method may also be used to start a chainsaw. The following PPE shall be worn when using a chainsaw:

1. DOT Loggers hard hat w/ mesh face shield and hearing protection earmuffs
2. are preferred head, face, eye, and hearing protection. Safety glasses are
3. required under the mesh face shield.
4. Safety glasses
5. Hard-hat with chip shield, ear plugs or earmuffs (chainsaws run at 119dB
6. typically)
7. 4. Full Wrap Around Chain Saw Chaps
8. 5. Cut resistant leather gloves
9. 6. Sturdy construction safety toe work boots

Fans

When the periphery of the blades of a fan is less than 7' above the floor the blades muse be guarded. The guard shall have openings no larger than ½". This includes floor and wall cooling fans.

Portable Circular Saws (Skill Saw)

Guards will be used and maintained in good condition on portable circular saws to prevent contact with the operator or support surface. The upper guard will cover the entire upper portion of the blade down to the shoe. The bottom or cutting portion of the blade will be covered by a retractable guard designed to rotate and expose only the portion of the blade being used to cut.

Power Lawnmowers

All mowing equipment shall be operated with the manufacturer installed guards in operable condition. Pieces of guards missing, or damaged guards shall be repaired before mowers are returned to service. All walk-behind, riding rotary, and reel power mowers will have guards in place to protect the operator from power chains, belts, gears, and thrown objects.

Openings in the deck for the discharge will not exceed 30 degrees of the entire surface of the deckitself. The opening will be labeled "Danger Keep Hands and Feet Clear" or stronger wording.

All controls will be clearly identified, and operators trained before operation. A stop or kill switch shall be provided to quickly shut down the mower. Proper PPE shall be worn at all times.

APPENDIX A: Specific Machine Guarding Requirements (Continued) 3

Portable Power Tools

NCDOT supervisors shall be responsible for ensuring all hand tools are in good working condition and that tools are used as designed for specific tasks, such as hammering, cutting, or driving screws,bolts, and nuts. Proper PPE shall be worn at all times when employees' duties require use.

Radial Saws (Radial Arm)

Radial saws will be designed with an adjustable guard to prevent the blade from extending beyond the material being cut. The table used for installation of the saw will be elevated in the front so as to allow the blade to return to the back of the table when the cut is complete. Radial saws with functioning auto return springs need not be tilted. Radial saws will be operated with an upper hood that fully encloses the upper portion of the blade. The hood will be constructed in such a manner that it will protect the operator from flying debris (i.e., sawdust or chips). Radial saws will use safety kickback devices such as pawls or "dogs" to reduce the risk of wood being kicked back at the operator. The saw will be labeled with information advising the operator of the direction of travel ofthe blade. Proper PPE shall be worn at all times.

Sanding Machines

Each sanding machine will be provided with guards in place at all nip points where the sanding beltruns onto a pulley (roller). Any portion of the sanding belt not in use will be guarded against contact while the machine is in use. Proper PPE shall be worn at all times when operating this equipment.

Wheel Inspections

Immediately before mounting, all grinding wheels will be inspected and "ring" tested. The wheel must have two blotters before it can be installed. Wheel washers must fit properly against blottersand the nut hand tightened only.

Woodworking Machines

All woodworking machines will be operated with the manufacturer-installed guards in place at all times. Removal of guards will be allowed only for adjustment or repair. Equipment will be locked and/or tagged out of service during adjustments or repair in accordance with NCDOT safety policy and procedure on lockout and tagout.