# Machine Guarding



## Purpose

Shops for carpentry, metal-working and finishing, heating, ventilating and air conditioning, electrical work, machinery, plumbing, electronics, glassblowing, printing, scenery, musical instrumentation, and artistry, present special hazards for New College of Florida employees assigned to such areas. The operation of powered machinery, hand tools and powered tools in these shops can result in a variety of serious accidents.

NCF shall take every precaution to protect its employees against possible injury from machinery, while in the vicinity of the machinery or while in the process of operating the machinery. Personnel shall be trained in the safe use of hand tools, power tools and other machinery, and counseled to take every precaution to prevent accidents. Personnel shall be properly supervised and provided the correct type of equipment, personal protective devices and safely guarded machinery to perform their assigned tasks.

## General Requirements

### Electrical Power/Controls

Each machine must be equipped with a master switch that can be locked and tagged during repair or maintenance operations.

Power controls and operating controls must be located within easy reach of the operator at his/her regular work station. Controls should be brightly marked and easily identified allowing the operator to cut off power at the point of operation.

Each machine must be provided with an appropriate electrical ground.

A trip device must be provided on machinery where injury might result if motors were to restart after power failures. This prevents the machine from operating when electric service is restored.

Main "kill" switches should be centrally installed, easily identified and accessible to shop supervisors or co-workers for use in interrupting power in emergency situations.

**Guarding**

Appropriate guards must be provided to protect the operator and other employees from hazards such as exposed belts, pulleys, sheaves, drive shafts, drive couplings, chains rotating parts, flying chips and sparks.

No employee shall operate and/or cause to be operated, any machinery without proper protective devices in place.

Combs (featherboards) or suitable jigs must be provided for use when a standard guard cannot be used as in dadoing, grooving, jointing, moulding and rabbeting.

**Personal Protective Equipment**

Appropriate eye protection must be worn by all machine operators and helpers where the operation of the machine may produce flying objects or dust.

Hearing protection must be utilized for jobs that involve the risk of loss of hearing as specified in the NCF Hearing Conservation Program.

Personnel must not wear loose fitting clothing or neckties while operating shop equipment. Gloves, rings, neck chains and other jewelry can be hazardous and must not be worn while operating or working on moving machinery. Long hair must be restrained to prevent poor visibility and being caught in the machinery.

Personnel are encouraged to wear heavy aprons when operating machinery that may produce kickbacks of stock.

**Housekeeping**

Metal slivers, sawdust and other debris should be cleaned from the machine using a brush or rag. Never use bare hands for the task. NEVER clean a machine while it is in motion.

Compressed air may be used for cleaning purposes only where reduced to less than 30 P.S.I. Eye protection must be worn while using compressed air to clean equipment.

Oily rags, waste, and other materials saturated with combustible substances must be disposed of in approved metal containers equipped with self-closing lids. These containers should be clearly marked for disposal of oily waste materials and must be emptied on a daily basis.

Local exhausts should be installed on machines where large amounts of dust are produced, such as sanders and planers.

Safety zones surrounding machines should be established and marked. Machines should be spaced to allow for the establishment of safety zones.

**Lockout and Tagging**

Before any maintenance is attempted, the machine must be completely shut down and the control switch locked and tagged by the person performing the repairs, following the NCF Lock Out Tag Out Program. This will prevent accidental starting during the repair process.

**Training**

Machines must be operated only by those personnel thoroughly trained by the supervisor in the operation of the specific piece of equipment. All manufacturer's operation manuals and diagrams should be kept by the shop supervisor and made available to employees responsible for operating the machine. The shop supervisor should contact the manufacturers in writing or contact the Department of Environmental Health and Safety if insufficient information on the machinery could result in unsafe operations.

Shop supervisors are responsible for constant observation of shop practices to ensure that all safety regulations are being followed. When unsafe acts are noted, it is the supervisor's responsibility to ensure that they are corrected and do not recur.

A safety procedure should be written for each machine, kept by the shop supervisor, and made available to operators. This procedure should include, but not be limited to:

- Clearing the operating area of obstructions. Designating the dimensions of a "safety" zone for the machine being used;
- Specifying the personal protection devices required during operation of the machine or when assisting the operator within the machine operating zone;
- Removing or checking for the wearing of loose fitting clothing, long free-flowing hair, jewelry, such as rings and neck chains, neckties or any other wearing apparel that would increase the risk of accidents;
- Inspection of the machine prior to each start. This should include:
    - check of operating controls;
    - check of safety devices;
    - check of power drives, sharpness of cutting edges and other parts which are to be used. Any deficiencies noted must be corrected prior to operating the equipment.

## Machines used for both Wood-Working and Metal-Working

**Buffing and Wire Brushing Wheels**

Operators must wear eye protection when using buffing wheels, in order to protect against the dust particles generated during the buffing operation. Goggles are preferred where the buffing operation is likely to produce large amounts of dust.

Operating wire brushing wheels can be especially hazardous because the wires tend to break off during operation, becoming high speed missiles. Goggles or face shields and leather gloves must be worn when operating wire brushing wheels. Use of an apron is encouraged to allow greater body protection.

### Drill Presses

The most common causes of injury in drilling operations are: coming in contact with the drill bit; being struck by insecurely clamped materials being worked on; flying metal chips, or wood shavings; leaving the key in the chuck; and brushing shavings away with the bare hand.

General requirements include:

- Stock must be properly secured to the press to prevent accidental movement during drilling;
- The operator must not attempt to make measurements near the tool, reach across the table, or adjust the machine or stock while the machine is in motion;
- Operators and assistants must wear eye protection when operating or within close proximity of the drill press when it is being operated;
- All power transmission parts must be effectively guarded. A spring-safety guard is recommended to guard the drill bit and catch metal slivers and wood chips.

### Lathes

The most common cause of injury in lathe operations are: contact with projections on work or stock; flying metal chips or wood shavings; hand braking the machine; leaving the key in the chuck; and catching loose clothing or wiping rags in the revolving parts.

General requirements include:

- Operators and assistant must wear eye protection when operating the lathe or within close proximity of the lathe during operation;
- Operators must allow lathes to stop of their own accord. Hand pressure should never be used to stop spinning chucks after power has been turned off;
- Each exposed power transmission part must be effectively guarded for complete operator protection;
- Operators must avoid taking deep cuts when working with wood since this can result in the cutting tool being forcibly ejected;
- Operators must not wear loose clothing, long hair and jewelry that may become tangled in the revolving parts of the machinery;
- Stock must not be measured or calibrated while the lathe is in motion;
- Cutting heads must be covered as completely as possible by metal hoods or shields. The guard should be designed in such a manner as to allow easy access to make adjustments to the stock or cutting head. Where an exhaust system is used, the metal guard must form part or all of the exhaust hood.

## Metal-Working Machines

### Milling Machines

Most milling machine accidents occur when operators unload or make adjustments. Examples include: failure to draw the job back to a safe distance when loading or unloading; leaving the cutter to remove chips while the machine is in motion; and using incorrectly dressed cutters.

General requirements include:

- Eye protection must be worn while operating such machinery;

- Shims, blocks and clamps must be used to hold stock in place. The operator must make certain that such clamping devices are mounted low enough to clear the arbor and cutter;
- The table must be lowered before backing work under a revolving cutter;
- Adjustments must not be made to the speed of the machine, the rate of feed or coolant flow, or other function, while the machine is in operation. If the machine is equipped with hand-adjusting wheels, they must be mounted on the shaft by clutches or ratchet devices, so that the wheels do not revolve when the automatic feed is used;
- Horizontal machines must have a splash guard and pans for catching thrown cutting lubricant and lubricant running from the tools;
- Hand tools must not be left on the worktable at any time;
- Operators must not reach around cutters to remove metal chips or debris. Brushes should be used to clean machines.

**Metal Shapers**

- The most common causes of injury in shaping operations are: placing the hand or fingers between the tool and work; running the bare hand over sharp metal edges; measuring the job while the machine is running; and failing to clamp the work or tools securely before starting the cut.
- General safety procedures include:
- Eye protection must be worn when operating power presses;
- Mechanical presses containing full revolution clutches must incorporate a single stroke device and an anti-repeat mechanism into the press system;
- Pressure on hydraulic presses must be bled off and switches locked out before maintenance is performed;
- Point of operation guards must protect the operator by one of the following methods:
    - by preventing and/or stopping' normal stroking of the press if the operator's hands are inadvertently placed in the point of operation;
    - by preventing the operator from inadvertently reaching into the point of operation;
    - by designing the controls such that the operator must use both hands to operate the press and locating the controls at a safe distance from the point of operation;
    - by enclosing the point of operation before a press stroke can be initiated.
- Hand tools must be used to free and remove stuck work or scrap pieces from the die. This should never be attempted with hands.
- A regular inspection program must be established and maintained to ensure that all parts, auxiliary equipment and safeguards are in good repair and properly adjusted.

## Wood-Working Machines

**Band Saws**

The most common type of injury associated with band saws results when the operator's hand(s) make contact with the saw blade.

General regulations for the use of band saw include:

- Eye protection must be worn when operating band saws;
- The cutting edge of the blade must be completely enclosed by an adjustable guard, except at the point of operation.
- Both upper and lower drive wheels must be completely enclosed by solid metal, woven wire mesh or expanded sheet metal and securely fastened to the metal framework.
- Each saw must be provided with a tension control device to ensure proper operating tension at all times.

- Effective brakes must be provided to stop the wheel in case of blade breakage.
- The operator must use extreme caution to ensure that his hands do not come in contact with the saw blade during operation.

**Circular Saws**

Table saws, radial arm saws, overhead swing saws, straight line pull cutoff saws, electrical miter saws and other machines containing circular saw blades are included in this section.

Circular saw operators are most frequently injured when their hands slip off the stock while pushing it into the saw, or when holding the hands too close to the blade during the cutting operations. Injuries involving kickbacks are also quite common.

General regulations include:

- Eye protection must be worn when operating circular saws;
- Table saws must be equipped with a guard which protects the portion of the saw above the table. The guard must automatically adjust itself to the thickness of the material being cut in order to provide continuous protection from the blade.
- Table saws (unless self-fed with rollers or a wheel in the back of the saw) must be provided with a spreader fastened securely behind the saw. Circular ripsaws must be provided with sectional non-kickback fingers or dogs.
- The part of the saw blade underneath the table must be completely enclosed.
- Swing saws, radial saws and cutoff saws must be designed to return gradually and automatically to the starting position when released by the operator.
- Stock must be held against a gage, never sawed freehand. Freehand sawing endangers the hands and may cause work to get out of line and bind on the saw.
- The operator should stand out of the line of the stock he is ripping to avoid being injured by kick backs. A heavy leather or plastic apron or abdomen guard gives additional protection.
- A circular saw should be stopped when the operator leaves it. Injuries have been caused by saws still coasting with the power off.

**Sanding Machines**

General requirements for personnel operating sanding machines including:

- Eye protection must be worn by operators and assistants;
- Dust respirators must be worn by those operating the machine, in close proximity of the operation, and/or when cleaning up;
- Belt sanders must have guards placed at each in running nip point on the power transmission and feed roll parts;
- The unused run of the sanding belt must be guarded.
- Manually fed sanders must have a work rest which is used by the operator to support the work properly;
- Sanding belts should be the same width as the pulley-drum, should be free of cracks and badly worn spots and frays, and should be adjusted tightly against the pulley-drum before use.

**Jointers**

Hand-feed jointers are one of the most dangerous machines in wood working shops. They are responsible for injuries caused when operators catch their hands and/or fingers on the knives, especially when short lengths of stock are being jointed.

General requirements for jointers include:

- Operators must wear eye protection when working with the jointer;
- The jointer blade should be guarded as work is fed into it. A guard which adjusts itself covering the table on the working side of the gage is recommended. The unused end of the gage should be enclosed at all times.
- Push blocks with handles for both hands should be used for surfacing work or when jointing short pieces of stock.
- Jointers should have rounded heads no deeper than 7/16 inch, no wider than 5/8 inch. The openings between the table and the head should be just large enough to clear the knife.
- The clearance between the edge of the rear table and the cutter head must not be more than 1/8 inch. The table throat opening must not be more than 2 1/2 inches when tables are set with each other for zero cut.

**Wood Shapers**

Shapers can be dangerous when operator's hands come in contact with revolving knives. Severe accidents also result from broken knives thrown by the machine.

General requirements for shapers include:

- Eye protection must be worn by operators;
- The cutting heads of wood shapers must be enclosed with a cage or adjustable guard;
- Knives must be of the best shaper steel and set by fully qualified installers;
- Knives and the grooves in the collars must fit perfectly and be free of dust;
- Knives must not be used after they are worn down to the middle point of the collar. Knives must be balanced perfectly;
- Operators should avoid deep cuts and should start the work in short starts and stops, bringing the spindle up to operating speed slowly. The operator should listen for any evidence that the knives are out of balance;
- There should be a braking device on the shaper to stop the spindle after the power is shut off;
- Only a long-handled brush should be used to remove chips and dust from the blades;
- Shaper work should be held against guide pins or a fence.

**Planers**

General regulations for the use of power-fed planers include:

- Operators and assistants must wear eye protection and dust respirators. It is recommended that hearing protection if the planer is not sound insulated;
- Cutter heads must be completely enclosed in solid metal guards which should be kept closed when the planer is running;
- All belts and pulleys should be completely enclosed on the backside of the planer;
- Feed rolls must be guarded by a wide metal strip or bar keeping operator's fingers out of the rolls while allowing boards to pass. Sectional kickback finger devices must be provided in lieu of feed rolls;
- The operator should stand out of the way of board travel.