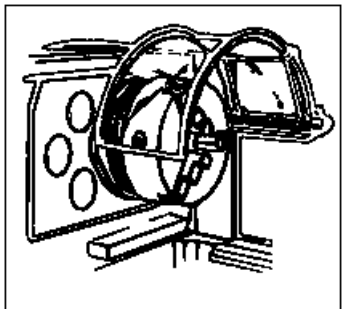
6121

Machine Tools

Introduction

Machine tools are a class of powered equipment, usually installed in a fixed location in contrast to portable power tools.



Machine tools typically have powerful electric motors producing rotational motion or hydraulic force. They often employ cutting surfaces.

Machine tools are capable of causing amputations and other serious personal injury. Also, some machine tools use a lubricant to cool the working surface. This coolant is a potential source of injury and illness in that a spill could be a slip hazard, and bacteria can grow in the fluid mixture. Cutting oils present other health and environmental hazards and are used in certain types of machine tools.

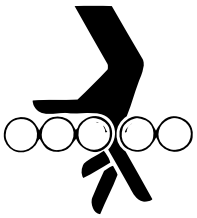
This chapter provides guidance to help ensure that machine tools are used safely. The chapter applies to everyone who uses permanently mounted machine tools, those who work in the vicinity of machine tools, and even those who just pass through an area where machine tools are in use.

Machine tools are used in several places at Jefferson Lab. The main machine shop is located in the Experimental Equipment Laboratory. A few satellite shops are located in staff work areas.

Because the mechanical transmission of power is frequently associated with machine tools, the general subject of safety guards is also addressed.

Hazard Avoidance

The most common injuries in our machine shops are hand and eye injuries.



You can avoid the hazards associated with machine tools by standing outside of the work area. If you have business to conduct in the area, wear appropriate eye protection and remain a safe distance away from the machinery.

- Do not distract operators from their work.
- Do not attempt to use the machine tools unless you have been trained and are so authorized by your supervisor and the appropriate machine shop supervisor.
- Make sure the machine is in working order.
- Use the proper tool or blade for the job and the material you are working.
- Do not purchase or requisition surplus machine tools unless you are certain they have adequate guarding features.

Businesses that rely heavily on industrial machinery have some of the highest injury rates in the U.S.

Responsibilities

Machine tool operator

- Use only those machine tools for which you have received authorization from the machine shop supervisor or the local shop manager
- Verify that the machine is in working order and that proper guards are in place prior to using the machine
- Use necessary personal protective equipment. See Chapters **6620** *Personal Protective Equipment* and **6640** *Hearing Conservation*.

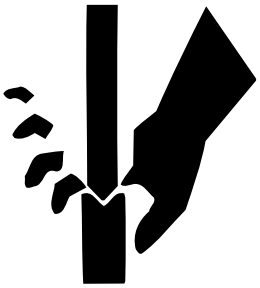
Machine shop supervisors

- Establish a program for qualifying operators for each machine tool
- Ensure that the operator is properly trained and qualified prior to using each machine tool
- Ensure that the electrical power distribution to each machine tool is adequate and installed according to applicable codes
- Ensure that equipment-specific lockout procedures are available for machinery as required, and those who operate and service machine tools know how to safely de-energize them for service and maintenance. See Ch. 6610, “LO/TO” for more info.
- Prescribe necessary personal protective clothing and equipment for machine tool operations. Enforce the rules. See Chapters **6620** *Personal Protective Equipment* and **6640** *Hearing Conservation*. Assistance with hazard awareness is available from the ESH&Q staff.
- Post appropriate safety signs in the vicinity of machine tools and at entrances to the shop
- Ensure that each machine tool has proper guards in place
- Establish an effective preventive maintenance program for all equipment
- Do not allow any temporary or make-shift repairs to machine tool equipment
- Ensure that machine lubricants are properly stored, handled, and disposed of in accordance with the Material Safety Data Sheet (MSDS)
- Appoint a safety warden for the machine shop area

Required Safe Practices

Wear appropriate eye and hearing protection. Safety signs in machine shops will indicate the **minimum** level of eye and ear protection. If there is any doubt or when working in a new area, wear PPE and request ESH&Q staff assistance.

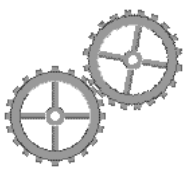
General machine tool use



- Ensure that all required machine guards are in place and stay in place.
- Be trained and qualified in a particular machine prior to using it.
- Keep hands away from pinch points and cutting surfaces.
- Inspect and ensure that all required machinery is working properly before use.
- Ensure that the work area is kept clean and neat.
- Wear prescribed personal protective clothing and equipment.
- Do not get distracted from the work in progress.
- Do not leave a machine tool running while unattended.
- Clean up spilled lubricant immediately.
- Do not wear rings, watches, loose clothing, or other apparel that can be snagged by moving objects.

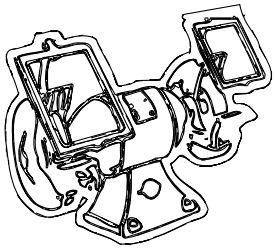
Machinery and machine guarding

- Machine guards protect the operator and other employees in the area from hazards such as those created by point of operation, rotating parts, flying chips, and sparks.
- Examples of guarding methods include barrier guards, two-handed tripping devices, and electronic safety devices. Guards should not be a hazard themselves.
- Power presses, power saws, and portable power tools are examples of tools which may be equipped with guards at the point of operation.
- Ensure covers for attached light fixtures are in place and lights are functioning.
- Remove chuck keys from lathes before starting equipment. Flying chuck keys cause injuries.
- All machinery that can “walk” or tip over from vibration must be secured to the floor.
- Ensure machinery is equipped with anti-auto-restart protection as required.
- For additional safety rules about machinery and machine guarding, consult OSHA regulations 29 CFR 1910.211-212. Also, see American National Standards Institute (ANSI) *B11* series documents. A list of applicable ANSI standards is provided at the end of this chapter.



The sections that follow provide rules that apply for specific equipment.

Abrasive wheel machinery



This section does not apply to natural sandstone wheels and metal, wooden, cloth, or paper discs which have a layer of abrasive on the surface. Refer to Chapter **6120** *Hand and Power Tools.*

- ❖ Do not grind wood or aluminum on an abrasive wheel
- ❖ Ensure that all machines are equipped with guards for abrasive wheels except for the following:
  - Wheels used for polishing or buffing
  - Wheels used for internal work while within the object being ground
  - Wheels 2 inches (5.08 cm) or less in diameter used in portable operations
  - Specific types of cones, plugs, and balls where the work offers protection
- ❖ Ensure that the guard covers the spindle end, nut, and flange projections and that it maintains proper alignment with the wheel. Ensure also that the strength of the fastenings exceeds the strength of the guard. The spindle end, nut, and outer flange may be exposed on machines designed as portable saws

When the work itself provides protection

- Ensure that work rests are rigidly constructed and are adjusted to compensate for wheel wear. The maximum opening between the wheel and the rest is **one-eighth inch (.32cm)** to prevent the work from being jammed.
- Securely clamp the work rest after each adjustment, and do not make an adjustment with the wheel in motion. The edge of the work rest must be kept horizontal.
- Grinding operations can produce sparks and therefore a fire. Choose a location for the grinder that avoids contact with combustibles. See Chapter **6122** *Welding, Brazing, Cutting, and Grinding Safety.*

For additional safety rules about abrasive wheel machinery, consult Part 215 of Section 29 CFR 1910, OSHA Regulations

Woodworking machinery

- ❖ Secure circular saw fences firmly to the table, whatever their alignment. For saws with tilting arbors or tables, ensure that the fence remains in a line parallel with the saw, regardless of the angle of the saw with the table.
- ❖ Ensure that machine control circuits prevent restart or restoration of power after a power failure if this could cause injury, for example by material ejected from the machine on restart.
- ❖ Remove from service dull, badly set, improperly filed, or improperly tensioned saw blades to prevent material from sticking, jamming, or kicking back.
- ❖ Remove from service all cracked or bent saw blades.
- ❖ Keep all knife edges and cutting heads sharp, properly adjusted, and firmly secured.
- ❖ Keep bearings well lubricated and functioning properly.
- ❖ Ensure push sticks or blocks are available in several sizes and types suitable for the work to be done.

Fact:
Band saws cause more injuries than any other piece of shop machinery.

- ❖ Do not insert wedges between the circular saw disc and the collar or guard.
- ❖ Keep band-saw blade guards adjusted to the minimum opening required for the material thickness.

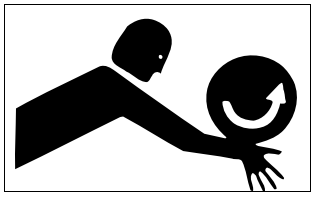
For additional safety rules about woodworking machinery, consult Part 213 of Section 29 CFR 1910, OSHA Regulations.

Mechanical power-transmission apparatus

Machinery equipped with belts, flywheels, chain drives, cranks, connecting rods, and shafting must be equipped with guards to protect employees from the moving parts. The integrity of the guards is weakened with time through vibration, abuse, and incomplete reinstallation after removal for maintenance. Safety is maintained by inspecting the integrity of the guards prior to use and during operation. If safety deficiencies are detected, the equipment must be shut down and tagged out until repaired and tested.

The OSHA regulation for transmission apparatus contains some general and many specific rules. For example:

- Keep shafting aligned and free from rust and excess oil or grease.
- Keep bearings in alignment and properly adjusted.
- Oil machinery when not in motion.
- Ensure keys, set-screws, and other projections in revolving parts are removed or made flush or are guarded by metal cover, except for gears inside casings, and pulleys less than 20 inches (50.8 cm) in diameter.



For additional rules about mechanical power-transmission apparatus, consult Part 219 of Section 29 CFR 1910, OSHA Regulations.

ANSI standard reference list

ANSI standards are nationally recognized authorities on the safety requirements for construction, care, and use of specific machine tools. The ANSI standards listed below are available in the appropriate main and satellite machine shops. Machine tool operators should consult their supervisor before taking action contrary to an ANSI standard. Division ESH&Q staff should also be consulted.

ANSI Designation Equipment
B11.1-1988Mechanical Power Presses
B11.3-1982Power Press Brakes
B11.6-1984Lathes
B7.1-1970Abrasive Wheels
B11.8-1983Drilling, Milling, and Boring Machines
B11.9-1975Grinding Machines
B11.10-1990Metal Sawing Machines
B11.11-1985Gear-Cutting Machines
B11.12-1983Roll-Forming and Roll-Bending Machines
B11.14-1983Coil-Slitting Machines/Systems
B11.15-1984Pipe, Tube, and Shape Bending Machines
B11.16-1988Metal Powder Compacting Presses