

Chapter 25: [Machine and Portable Tools](#)

Machine Tool Requirements

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URL: <https://www-group.slac.stanford.edu/esh/eshmanual/references/toolsReqMachine.pdf>

1 Purpose

The purpose of these requirements is to ensure the safe use of machine tools. They cover the procurement, safeguarding, use, and maintenance of such tools. They apply to workers, supervisors, machine and shop custodians, and area and building managers.

2 Requirements

Use of *machine tools* must meet the following general requirements.

2.1 Procurement

All machine tools must comply with the applicable external requirements (see [Chapter 25, “Machine and Portable Tools”](#), Section 6.1, “External Requirements”).

2.2 Authorization

- Only authorized workers will be permitted to operate machine tools. Machine tool use is authorized through a machine-specific competency evaluation, as described in [Chapter 25, “Machine and Portable Tools”](#), Section 4, “Training”, for each machine to be operated.

2.2.1 Working Alone

The shop custodian will determine if a machine tool requires a second person, in addition to the operator, to be present while it is in use. For this purpose, “present” means that the second person would know if the machine operator needs emergency assistance. This determination must be documented in shop-specific safety rules or the machine-specific competency standard. That second person must, at a minimum, be able to shut the machine off and contact emergency services.

2.3 Use

All tools will be restricted to the use for which they are intended and will be used properly, according to the manufacturer’s instructions, the requirements of this program, and any tool- or shop-specific requirements and procedures.

Workers will visually inspect all tools before each use. Malfunctioning machinery or safeguards must be reported immediately to the shop or machine custodian. If the malfunction presents a safety hazard, the machine must be taken out of service by disconnecting and locking out the power source(s). A warning sign indicating the problem should be placed on the machine to communicate its status to affected personnel.

2.3.1 Safety Rules

Machine users will follow shop-specific safety rules and meet machine-specific competency standards. Safety rules should cover

- Personal protective equipment
- Apparel
- Actions/behaviors
- Equipment use
- Housekeeping
- Cleanup

The shop custodian is responsible for developing shop-specific safety rules and ensuring they are followed, and contacts the machine tool user's supervisor and restricts access if the user fails to follow safety requirements.

2.4 Guarding

Any tool designed to accommodate guarding must be equipped with that guard during use and the guard must not be altered.

Safeguards must be provided at three basic locations:

1. At the point of operation
2. On or at the mechanical power transmission apparatus
3. At other moving parts which could potentially create a hazard

Machinery containing moving parts with rotating, transverse, or reciprocating action will be effectively guarded according to federal Occupation Safety and Health Administration (OSHA) regulations. One or more methods of machine safeguarding must be provided to protect from hazards such as those created by point of operation, nip points, rotating parts, flying chips, sparks and so on. Safeguards must conform to OSHA and American National Standards Institute (ANSI) B11 series ([ANSI B11](#)) standards.

Note OSHA does not grant a grandfather clause for old equipment. All equipment must be safeguarded. Equipment must also be installed in conformance to applicable facility standards, such as electrical and seismic.

For requirements on using safeguards on common machine tools, see [Machine and Portable Tools: Machine Safeguarding Requirements](#).

2.4.1 Selecting Guarding Methods

Neither OSHA regulations nor third-party standards offer guarding requirements for every possible machine configuration; therefore each machine must be evaluated by a knowledgeable, trained person and compared to the appropriate machine safeguarding standard.

A uniform process should be applied and used to evaluate each of the hazards on a machine to develop the required level of safeguarding. The evaluation may be performed by a knowledgeable and experienced person internal to SLAC, or for more complicated machine designs and safeguarding issues, by a qualified third party.

The OSHA/ANSI hierarchy for controlling machine hazards is as follows:

1. Eliminate the hazard by design
2. Control the hazard by guarding or devices
3. Warnings
4. Personal protective equipment
5. Training

If the results of the hazard evaluation show the equipment to be safe (that is, poses no hazard to the employee), changes to the equipment may not be necessary. This may be true for manually powered equipment.

The standards agree that the first step to safeguarding must be to attempt to eliminate the hazard completely. To eliminate the hazard totally or enclose the exposure on a machine such that the employee has almost zero exposure may not be practical. However, it can be approached very closely to minimize employee exposure to injury.

The second step in determining what level of protection is necessary is often driven by specific regulatory requirements and hazard identification. OSHA regulations point to the need to reduce, through the use of physical safeguarding, the employee's exposure to the identified hazards. This approach is where safeguarding may be applied through proven concepts and designs such as distance and time, barriers, interlocked guards, presence sensing devices such as light curtains, enclosures, and various other guarding combinations.

Once hazards have been identified and prioritized, the third step is to determine what level of protection is necessary. Perform a risk assessment, an evaluation procedure to verify the level of safeguarding needed. In simple terms, there are only two significant factors that must be considered when evaluating the associated risk in a danger zone or at a point of operation:

1. The severity of foreseeable injuries which could occur at a location. The severity of possible injury can vary tremendously from minor cuts to fatality. Most injuries happen immediately but some injuries are chronic in nature and may not manifest themselves until years later.
2. The probability of injuries occurring while the employee is working with the machine. The following should be considered in the evaluation of injury probability:
 1. Machine operation, all phases (operating and maintenance, including set-up, start-up, service adjustments, lubrication, clearing jams or malfunctions, loading and unloading, cleaning, shutting down, preventive maintenance)

2. Foreseeable misuse of the machinery and equipment
3. Evaluating human response to determine the frequency of exposure to danger points

One thing that should be clearly understood is that the absence of an injury from a particular exposure or hazard should not be taken to mean that the injury will never occur or the machine is completely safe. Accidents occur more or less randomly and usually result in pain and suffering in addition to the loss of productivity.

Some of the issues to address when determining the potential degree of injury are as follows:

1. What types of physical or mechanical hazards are involved?
2. What types of injuries can be foreseen?
3. Given the conditions under which access to the danger zone or point of operation occurs, what is the probability of each possible severity of injury?
4. What potential loss to the employee as well as to production does each possible severity of injury represent?

For guidance on selecting safeguarding methods, see [Machine and Portable Tools: Machine Safeguarding Guideline](#).

2.5 Housekeeping

The work area must be kept free of clutter and debris that could create tripping or slipping hazards.

2.6 Cleaning and Maintenance

Machine custodians will establish and follow a program of periodic and regular inspections and maintenance of their equipment to ensure that machines, parts, and auxiliary equipment are in a safe operating condition and necessary safeguards are present. Records of these inspections should be maintained and made available for inspection upon request.

Only authorized personnel will be permitted to maintain or repair machine tools. When service occurs that requires entry of any body part into a danger zone within the equipment, or unexpected startup or energizing of the machine could cause injury, maintenance personnel will first isolate hazardous energies as required by [Chapter 51, “Control of Hazardous Energy”](#).

2.7 Personal Protective Equipment

Workers must wear attire and personal protective equipment (PPE) appropriate for the tool they are using and the work they are performing. (See [Chapter 19, “Personal Protective Equipment”](#) for general PPE requirements.)

- Long pants and closed-toed shoes are required when entering an area with operating machine tools.
- Long sleeves, gloves, neckties, or other loose-fitting clothing must not be worn when operating machine tools.

- Long hair or beards must be suitably secured or covered to prevent entanglement with revolving or moving machinery.
- Jewelry or other items that could catch on or be grabbed by moving parts must not be worn.
- Safety glasses with side shields or goggles are required entering an area with operating machine tools.
- Face shields are required if flying fragments/particles are likely to be generated.
- Properly selected gloves, as well as protective sleeves, aprons, and so on, are required when using hazardous chemicals and handling scrap metal or wood, sharp-edged stock, and unfinished lumber.

Warning Gloves must not be worn while machining, as they can get caught in moving equipment.

- Safety-toed boots may be required where potential dropping of heavy objects exists.
- For loud work or operations with respiratory hazards, contact ESH for assessment and recommendations. (See [Chapter 18, “Hearing Conservation”](#), [Chapter 29, “Respiratory Protection”](#), and [Chapter 56, “Respirable Crystalline Silica”](#).)

2.7.1 Other Requirements

2.7.1.1 Positive Disconnecting Means

To enable proper isolation of hazardous energies before and during equipment maintenance and repair, machines and equipment operated by electric motors or other hazardous energy will be provided with a positive disconnecting means. Examples of positive disconnecting means include service disconnects, circuit breakers, valves, and power cords and plugs. Push buttons, selector switches, software interlocks, control circuit type devices, and computer controlled software cannot be used to isolate hazardous energy.

2.7.1.2 Stop Buttons and Power Controls

Machines should have an EMERGENCY POWER OFF or STOP button or other readily accessible and clearly designated power switch within easy reach of the operator to cut off the power to each machine, rendering it unable to injure personnel. The power controls must be located so as to make it unnecessary to reach over or near the hazard to make adjustments. For larger machines, power switches should be located in multiple locations on various sides so that power can be easily deactivated by bystanders in case of emergency.

2.7.1.3 Machine Anchoring

Machines designed for a fixed location will be securely anchored per SLAC seismic requirements, to prevent walking or moving due to vibration, rotation, or seismic activity.

2.7.1.4 Manual Reset

Proper restart systems must be installed on all powered equipment and tools so that manual reset is required to restart the tool after it has been stopped by any safety device or mechanism. For example, if an interlocked guard stops tool operation when the guard is removed; manual reset is required to restart the tool after the guard is replaced. Replacing the guard alone must not allow the tool to restart.

2.7.1.5 Anti-restart Devices

Anti-restart devices (ARDs) or other effective provisions must be present on all machines, presses, and power tools that could create hazardous conditions to workers if motors were to restart suddenly after a restoration of voltage conditions following a power failure. It is strongly recommended that any machine that could pose a hazard to workers upon restoration of power also be provided with an ARD.

In addition, the machine should be evaluated (see Section 2.4, “Guarding”) to determine the risk to employees if an ARD is not present. A sudden restoration of power following an interruption should not create hazardous conditions to workers. (See [Machine and Portable Tools: Machine Safeguarding Anti-restart Device Requirements](#), for more information.)

3 Forms

The following forms and systems are required by these requirements:

- None

4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- None

5 References

[SLAC Environment, Safety, and Health Manual](#) (SLAC-I-720-0A29Z-001)

- [Chapter 25, “Machine and Portable Tools”](#)
 - [Machine and Portable Tools: Portable Tool Requirements](#) (SLAC-I-730-0A21S-027)
 - [Machine and Portable Tools: Machine Safeguarding Requirements](#) (SLAC-I-730-0A21S-005)
 - [Machine and Portable Tools: Machine Safeguarding Anti-restart Device Requirements](#) (SLAC-I-730-0A21S-006)
 - [Machine and Portable Tools: Machine Safeguarding Guideline](#) (SLAC-I-730-0A21T-016)
- [Chapter 2, “Work Planning and Control”](#)
- [Chapter 18, “Hearing Conservation”](#)
- [Chapter 19, “Personal Protective Equipment”](#)
- [Chapter 29, “Respiratory Protection”](#)
- [Chapter 51, “Control of Hazardous Energy”](#)
- [Chapter 56, “Respirable Crystalline Silica”](#)

Other Documents

- American National Standards Institute (ANSI) B11 standard series, “Machine Safety” ([ANSI B11](#))
- Stanford University, Office of Environmental Health and Safety. [Safe Operation of Shop Machinery](#)