National Institute of Standards and Technology • U.S. Department of Commerce

MACHINES, POWER TOOLS, AND ASSOCIATED EQUIPMENT SAFETY

NIST S 7101.65
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1. PURPOSE

The purpose of this program is to establish requirements and associated roles and responsibilities to eliminate or minimize exposure to hazards associated with the use of machines, power tools, and associated equipment (see Section 7, **DEFINITIONS**) used in additive or subtractive manufacturing methodologies and shaping of various materials (*e.g.*, metal, wood, plastic).

2. BACKGROUND

a. NIST O 7101.00, Occupational Safety and Health Management System, requires adherence to OSHA 29 Code of Federal Regulations (CFR) 1910 Subpart O, Occupational Exposure to Machinery and Machine Guarding which was promulgated to protect workers from the hazards associated with the use of machinery in workplaces. 29 CFR 1910 Subpart O requires employers to engage in machine guarding. Machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips, and sparks. Examples of guarding methods are-barrier guards, two-hand tripping devices, and electronic safety devices.

b. In addition to the requirements of 29 CFR 1910 Subpart O, Occupational Exposure to Machinery and Machine Guarding, 29 CFR 1910 Subpart P, Hand Held and Portable Powered Tools and Other Hand-Held Equipment also requires NIST to protect workers from the health hazards associated with their use.

[1] For revision history, see Appendix A.

3. APPLICABILITY

a. The provisions of this suborder apply to all NIST employees and covered associates using machines, power tools, and associated equipment used in additive or subtractive manufacturing of various materials (*e.g.*, metal, wood, plastic).

b. The provisions of this suborder do not apply to the use of hand tools that are powered manually.

4. REFERENCES

a. 29 CFR 1910 Subpart O, *Machinery and Machine Guarding*

b. 29 CFR 1910.241 Subpart P, *Definitions*

c. 29 CFR 1910.242 Subpart P, *Hand and Portable Powered Tools and Other Hand-Held Equipment, General*

d. 29 CFR 1910.243 Subpart P, *Hand and Portable Powered Tools and Other Hand-Held Equipment, Guarding of Portable Powered Tools*

e. 29 CFR 1910.244(a) Subpart P, *Hand and Portable Powered Tools and Other Hand-Held Equipment, Other Portable Tools and Equipment*

f. 29 CFR 1910 Subpart I, *Personal Protective Equipment*

g. ANSI Z87.1; ANSI/ISEA Z 87.1 Eye and Face Protection

h. NFPA 79 Electrical Standard for Industrial Machinery

5. APPLICABLE NIST OCCUPATIONAL SAFETY AND HEALTH SUBORDERS

a. NIST S 7101.20: *Work and Worker Authorization Based on Hazard Reviews*

b. NIST S 7101.21: *Personal Protective Equipment*

c. NIST S 7101.22: *Safety Signage, Symbols, and Markings* (in development)

d. NIST S 7101.23: *Safety Education and Training*

e. NIST S 7101.55: *Hearing Protection*

f. NIST S 7101-56: Control of Hazardous Energy

g. NIST S 7101.58: *Respiratory Protection*

h. NIST S 7101.64: *Electrical Safety* (in development)

6. REQUIREMENTS

a. Hazard Reviews

(1) Hazard reviews shall be conducted in accordance with NIST S 7101.20: *Work and Worker Authorization Based on Hazard Reviews* for the use of machines, power tools, and associated equipment.

(2) The following should be developed for an individual machine, tool, or associated piece of equipment:

(a) Standard operating procedure;

(b) Hands-on training; and

(c) Pre-use inspection checklist.

i. Pre-use inspection check lists, when determined to be appropriate, shall be broad enough to ensure the following:

(i) The machine, power tool, or associated piece of equipment is in good working order;

(ii) Adequate guards and other safety features are present; and

(iii) Any other manufacturer-required or recommended inspection and/or maintenance schedule is followed.

(3) Hazard reviews shall consider whether either or both of the following is required:

(a) Prohibition of lone workers; or

(b) Prohibition of out-of-hours work.

(4) Hazard reviews shall identify engineering and/or administrative controls as necessary to ensure only authorized users operate the machine, power tool, or associated piece of equipment.

(5) Hazard reviews shall identify required PPE for operation.

(a) The following should be consulted when determining appropriate PPE:

i. Manufacturer's instructions/literature;

ii. 29 CFR 1910.243 Subpart P

iii. OU division/group safety representative or equivalent; and

iv. OSHE (x5375, option 3).

(b) Multiple layers of PPE should be considered to protect the worker. An example of this is a requirement to wear a face shield in addition to safety glasses with side shields when the individual may be exposed to flying objects, fragments, or particles.

b. Machines, power tools, and associated equipment should be purchased with appropriate guarding for all points of operation. Guarding shall be in compliance with 29 CFR 1910 Subpart O. If machines, power tools, and associated equipment are not purchased with guarding as required, they must be brought into compliance by retrofits; and should be inspected for adequacy and compliance prior to use.

c. The installation, maintenance and repair of machines, power tools, and associated equipment shall:

(1) Be in accordance with the manufacturer's recommendations; and

(2) Ensure that all electrical disconnects are properly labeled.

d. Usage

(1) When required per the hazard review, a pre-use inspection shall be conducted on machines, power tools, and associated equipment.

(a) Only those machines, power tools, and associated equipment passing inspection shall be used.

(b) If a machine, power tool, or associated piece of equipment fails an inspection, it shall be tagged "Out of Service" and not used until the deficiency is corrected.

(2) When applicable, machines, power tools, and associated equipment shall be operated per standard operating procedures.

(3) Required PPE shall be worn as indicated by the hazard review or standard operating procedure.

(4) If a hazardous situation is encountered during use:

(a) Work shall immediately stop; and

(b) The hazardous situation shall be immediately brought to the attention of the proper individual for hazard abatement.

(5) Upon completion of work, the work area shall be cleaned.

e. OU workspaces with multiple pieces of machines, power tools, and associated equipment (*e.g.*, machine shops) shall be managed to ensure:

(1) Machines, power tools and associated equipment are maintained in a safe working condition;

(a) They meet the design requirements of Subparts O and P, where applicable.

(b) They are maintained in a safe working condition.

(2) Access is limited to individuals who are authorized to access the workspace, are escorted by authorized personnel, are otherwise protected as necessary to ensure their safety

(a) Signs, barriers, and/or caution tape may be used to define a limited access area if the above access controls are not feasible.

(2) Machines, power tools, and associated equipment are operated only by authorized users;

(3) Requirements are met for both individual and a collective grouping of machines, power tools, and associated equipment located in the space; and

(4) Housekeeping is maintained.

f. Training

(1) Training shall be provided, documented, and recorded in accordance with the requirements of the NIST S 7101.23: *Safety Education and Training*.

(2) Employees and covered associates who are to engage in work involving machines, power tools, and associated equipment at NIST shall complete:

(a) The training provided by OSHE on this program; and

(b) The activity-specific training, provided by their Organizational Units, required by applicable hazard reviews.

7. DEFINITIONS

Definitions common to all NIST OSH suborders can be found in Section 6 of NIST O 7101.00: *Occupational Safety and Health Management System*. The definitions specific to this suborder are as follows:

a. Additive Manufacturing – The use of computer-aided-design software to create a physical object by directing hardware (*e.g.*, 3-D printer) to deposit material, layer upon layer, in precise geometric shapes.

b. Associated Equipment – Equipment used in conjunction with machines and power tools. Examples include hydraulic pumps, air compressors, generators, and hoses.

c. Guard – A device that prevents the machine operator or others from being exposed to a hazard.

d. Hand Tools – Tools that are powered manually.

e. Guarding – A means of protecting an operator and/or others in the area from hazards associated with a machine, power tool, and/or associated piece of equipment.

f. Machine Shop – A workspace where a collective grouping of machines, power tools, and associated equipment are located.

g. Machine – Any large piece of equipment used in shaping materials such as metal, wood or plastics, and additive or subtractive manufacturing.

h. Machinery – A collection or assemblage of machines.

i. Power Tools – Smaller than machines, equipment that is typically hand held and actuated by an additional power source (*e.g.*, electric, pneumatic, hydraulic, powder-actuated) or mechanism other than the solely manual labor used with hand tools. They are used in various processes in which a piece of material is formed into a desired shape and size by a controlled material-removal process such as cutting, shaping, drilling, finishing. Examples include drills, grinders, and saws.

j. Subtractive Manufacturing – A process in which a piece of raw material is formed into a desired shape and size by a controlled material-removal process (*e.g.*, cutting, shaping, drilling, finishing)

8. ACRONYMS

Acronyms common to all NIST OSH suborders can be found in Section 7 of NIST O 7101.00: Occupational Safety and Health Management System. The acronyms specific to this suborder are as follows:

a. CFR – Code of Federal Regulations

b. NIST – National Institute of Standards and Technology

c. OSHA – Occupational Safety and Health Administration

d. OSHE – Office of Safety, Health, and Environment

e. OU – Organizational Unit

f. PPE – Personal Protective Equipment

9. RESPONSIBILITIES

Roles and responsibilities common to all NIST OSH suborders can be found in Section 8 of NIST O 7101.00: Occupational Safety and Health Management System. The roles and responsibilities specific to this suborder are as follows:

a. OU Directors are responsible for:

(1) Establishing policies and procedures, as needed, for the requirements of this program to be met as they apply to their employees and covered associates and to machines, power

tools, and associated equipment in their OU-assigned space and ensuring that those policies and procedures are implemented; and

(2) Ensuring subordinate managers have the authority, resources, and training needed to implement OU-established policies and procedures.

b. Line managers are responsible for:

(1) Ensuring those using machines, power tools, and associated equipment assigned to their organization are authorized to do so;

(2) Ensuring required PPE is available for use; and

(3) Ensuring maintenance and repairs are properly performed.

c. Employees and Covered Associates to Whom This Suborder Applies are responsible for:

(1) Using only machines, power tools, and associated equipment they are authorized to use; and

(2) Using machines, power tools, and associated equipment in accordance with the requirements of this suborder.

10. AUTHORITIES

There are no authorities specific to this suborder alone. For authorities applicable to all NIST OSH suborders, see section 9 of NIST O 7101.00: *Occupational Safety and Health Management System*.

11. DIRECTIVE OWNER

Chief Safety Officer

12. APPENDICES

A. Revision History

Appendix A. Revision History

Revision No.	Approval Date	Deployment Start Date	Effective Date	Brief Description of Change; Rationale
0	04/04/19	3/24/21	9/30/23	• None – Initial document • Deployment and Effective Dates added on 4/17/23. (Effective date was previously TBD due to COVID-19 pandemic emergency.)