Safety and Health Policy and Procedure Manual

ELECTRICAL and MACHINE SAFETY PROGRAM
Section 0120

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SECTION 0120

I. INTRODUCTION

This section provides UNCG employees with the minimum safety requirements for protecting themselves from potential hazards associated with electricity and machines. By following these basic safety principles and maintaining proper safety awareness, employees should be able to avoid serious injury.

II. STANDARDS

There are numerous safety standards and regulations which pertain to electrical and machine safety, including, but not limited to:

American National Standards Institute (ANSI) Standards. In most cases there are specific ANSI standards for specific machines, types of machines, and type of hazards. Contact the Office of Safety for specific standard information.

- Occupational Safety and Health Administration (OSHA) Standards
- OSHA 29 CFR 1910, Subpart O - Machinery and Machine Guarding
  OSHA 29 CFR 1910, Subpart S - Electrical
- National Electrical Code, NFPA 70

NOTE*: Copies of these standards are available in the Office of Safety.*

III. OBJECTIVE

This section provides UNCG employees with the basic information for assuring a safe and healthful workplace free from recognized electrical and machine hazards which may cause serious injury. Each employee is expected to follow the guideline provided within this section. Supervisors shall be responsible for initiating disciplinary action against employees who do not follow the guidelines within this section.

IV. SCOPE

The information in this section applies to all UNCG employees working on, near, or with electricity and machines. **Thus, all UNCG employees are covered by this section.**

V. ELECTRICAL SAFETY

Electrical safety at UNCG is achieved through the proper use and installation of electrical equipment in university facilities. Also, all employees must be properly instructed concerning electrical hazards in their workplaces and understand the necessary safe work practices to avoid injury. Specific electrical hazards in each department shall be addressed to employees that have responsibilities to operate equipment. ***Due to the potential for serious injury, all electrical hazards should be reported to the Physical Plant Work Center at 334-3456.*** All training to meet this requirement must be documented by each employee's supervisor.

The basic cause of electrical accidents usually is one of a combination of the following:

- unsafe equipment and installation,
- unsafe environment, and
- unsafe acts.

This section provides the basic minimum procedures for installing electrical equipment properly and the electrical safety related work practices for working on, near, or with electricity. Additional detailed information should be obtained from the National Electrical Code (NFPA 70) and OSHA standards 29 CFR 1910, Subpart S - Electrical, as needed to ensure proper electrical safety. See Appendix A for a list of the most often violated OSHA standards. Refer to Appendix B for a Self-Inspection Electrical Checklist for use by supervisor and employees as needed.

A. Examination, Installation, and Use of Electrical Checklists

1. All electrical equipment shall be installed and examined to ensure it is free from recognized hazards that are likely to cause death or serious physical harm to UNCG employees. **Proper safety shall be determined** by using the following considerations:

a. Suitable installation of Underwriters Laboratory listed and labeled equipment and use per OSHA standard 29 CFR 1910, Subpart S and the National Electrical Code, NFPA-20.

b. Proper mechanical strength and durability, including parts enclosing and protecting equipment.

c. Protection from heating effects under normal usage.

d. Arc protection

e. Proper classification by type, size, voltage, current capacity, and specific use.

f. Any other factors that should be considered to ensure employee safety.

B. Splices

Electrical conductors must be spliced or securely joined by splicing devices suitable for the use, or by brazing, welding, or soldering with a suitable metal or alloy. All splices and free ends of conductors must be covered with insulation equivalent to that of the conductor or a suitable insulating device.

C. Arcing Parts

All parts of electrical equipment which in normal operation may produce arcs, sparks, flames, or molten metal must be enclosed or separated and isolated from all combustible material.

D. Marking

Electrical equipment must not be used unless marked with the manufacturer's name, trademarks, or other markings identifying the organization responsible for the product. Other markings shall be provided indicating voltage, current, wattage, or other ratings as necessary and shall be of sufficient durability to withstand the given environment.

E. Identification of Disconnects

Each electrical disconnect switch and its service required for motors and appliances must be legibly marked indicating its purpose, unless located so the purpose is evident.

F. Working Clearances

Indoor areas containing electrical equipment such as disconnects and electrical panels shall be maintained in a clean and orderly fashion, shall not be used as storage, and will have adequate illumination. ***Under no circumstances shall any employee place any object within 36 inches of the front of an electrical panel.***

G. Wiring Methods

1. A conductor used as a grounded conductor must be permanent, continuous, identifiable and distinguishable from all other conductors.
2. No grounded conductor shall be attached to any terminal or lead so as to reverse designated polarity. Grounding devices must not be used for any other purpose.
3. All non-current-carrying metal parts of portable equipment and fixed equipment, including associated equipment, **must be grounded**.
4. Temporary wiring of an electrical classification required for permanent wiring may be used:

   a. During remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, and similar activities;
   b. For experimental or development work, and
   c. For a period not to exceed ninety days

5. Open conductors must be separated from contact with walls, floors, wood cross members, or partitions through which they pass by tubes or bushings of noncombustible, nonabsorbent insulated material.
6. All conductors within seven feet from the floor are exposed to physical damage and must be protected. Flexible cords and cables must be approved and suitable for the conditions of use and location and used only in continuous lengths without splice or tape.
7. Flexible cords must be connected to devices and fittings so that strain relief is provided.

H. Equipment for General Use

Fixtures installed in wet or damp locations must be approved for the purpose and be water-tight so water cannot enter or accumulate so as to contact electrical parts.

Provisions must be made for sufficient diffusion and ventilation of gases from storage batteries to prevent the accumulation of explosive gases.

I. Hazardous Locations

Hazardous (classified) locations are locations which are electrically classified depending on the properties of flammable vapors, liquids or gases, or combustible dusts or fibers which may be present normally or in case of an accidental release. All electrical equipment installed or used in hazardous locations must be approved (labeled) for that specific service.

HAZARDOUS (classified) LOCATIONS

CLASS	DIVISION	DESCRIPTION
I	1	Volatile flammable liquids or gases are present normally.
I	2	Volatile flammable liquids or gases were handled, processed or stored, but normally confined and can escape only in an accident.
II	1	Combustible dust normally present.
II	2	Combustible dust is not normally in air in quantities sufficient to produce explosive or ignitable mixtures.
III	1	Easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.
III	2	Easily ignitable fibers are stored or handled, except in process or manufacture.

J. Electrical Safety-Related Work Practices

See UNCG's Electrical Safety-Related Work Practices Procedures, Section 0190.

VI. MACHINE SAFETY

Machine hazards are a major cause of accidents and must be identified and controlled to avoid injury to employees working on/or near one of the machines. A hazard is an existing or potential condition which has the potential to harm people, property, or the environment. Thus, any machine motion or condition which can cause injury is considered hazardous and must be guarded. In addition, any guarding supplied by the manufacturer must remain in place on the equipment, except during properly protected repair and maintenance that utilizes energy neutralization procedures, such as Lockout/Tagout. (See UNCG's Lockout/Tagout Procedure, Section 0100). **All guards shall be re-installed before the equipment is returned to service.**

For definitions of machine guarding terminology, see Appendix G.

There are four major areas of safety which must be considered for every machine:

- Maintenance,
- Servicing and adjustment,
- Points of operation where the machine works on materials, and
- Protection from moving parts, other than points of operation.

A. Maintenance, Servicing and Adjustment

All personnel performing servicing and maintenance of machines must be properly trained, qualified, and competent to perform the task.

Only authorized employees are permitted to perform servicing and maintenance on machines in accordance with UNCG's written Lockout/Tagout Procedures, Section 0100.

B. Points of Operation

Points of operation are areas of machines where material is processed or changed by the machine, and where work is actually being performed on the material, such as a saw blade cutting a board.

Points of operation safeguarding depends on the nature of the specific machine and the materials being processed. Normally each machine has specific guards as specified by ANSI and/or OSHA standards, such as ANSI B 7.1 and OSHA 1910.215 for Abrasive Wheels.

A description of various safeguards for machines, their advantages and limitations are shown in Appendix C. Also, refer to Appendix E for a Safeguard Checklist to be completed by employees evaluating machine safeguards.

C. Mechanical Motions

Mechanical motions which may be hazardous include:

- Rotating Motion
- Reciprocating Motion
- Transverse Motion

1. **Rotating Motion**: Even slow smooth rotating shafts can pull body parts into dangerous positions. The resulting injuries can be severe or even deadly.

Such things as collars, couplings, cams clutched flywheels, shaft ends, spindles and horizontal or vertical shafting are examples of common rotating parts that are dangerous. Those dangers are increased by bolts, nicks, abrasions, projecting keys, or set screws which can serve as a cleat to grab clothing and/or as a protruding cutter head. These projections are difficult to see during rotation and must be made flush with the shaft if possible.

There are three basic in-running nip point hazards that are created by rotating parts.

- If there are parts rotating in opposite directions that are touching or there are rotating parts that are in close proximity, then a hazard exists where workers could be pulled in-between the rotating parts. This type of hazard is commonly found on rolling mills and calendars or machines with intermeshing gears.
- Another nip point is created between rotating and tangential moving parts such as chain and sprocket drives, v-belt drives, or a rack and pinions.
- Nip points can also occur between fixed and rotating parts which create a shearing, crushing or abrading hazard. They include: spoked wheels, or flywheels, screen conveyors, or an abrasive wheel and the workrest.

2. **Reciprocating Motion**: Reciprocating motions create hazards during their back and forth or up and down motion that may strike a worker or cause him to be caught between a moving and a stationary part. This could include a bed of a milling machine.

3. **Transverse Motion**: Transverse motion or movement in a straight or continuous line creates a hazard when the worker is pulled into the pinch or shear point or is dragged by the moving parts into other moving parts.

D. Mechanical Actions

Mechanical actions are machine motions (actions) which include:

- Cutting
- Punching
- Shearing
- Bending

1. **Cutting Action**: A cutting action may be created in any rotating, reciprocating or transverse motion. The hazards of a cutting action are created in many points of operation activities. Injuries may occur to fingers, hands, head, arms, or where flying chips or scrap material may strike the eyes or face. Many examples include the cutting hazards of bandsaw, circular saw, boring or drilling machines, turning lathes, or milling machines.

2. **Punching Actions**: A punching action is created when power is applied to a stud or dies for the purpose of blanking, drawing, or stamping material. A hazard is created at the point where material is inserted, held, or withdrawn by hand. These hazards could be created on power presses, or iron workers.

3. **Shearing Action**: Shearing action hazards are created when power is applied to a slide or knife in order to shear or trim materials, such as metal or paper shears.

4. **Bending Action**: A bending action occurs when two dies are brought together under power in order to bend, draw, or stamp metal or other material. The hazard is created at the point where hands are used to insert, hold or withdraw material from the point of operation.

Equipment creating hazards due to bending action are power presses, press brakes, or tube benders.

E. Machine Safeguards

One or more methods of machine guarding must be used to protect the operator and others in the machine area from hazards such as:

- Points of operation
- in-going nip points,
- rotating parts,
- flying chips and sparks.

See Appendix C for examples.

F. Safeguard Requirements

All machine safeguards must:

- Conform to or exceed ANSI and OSHA requirements,
- be considered a permanent part of the machine,
- afford maximum protection,
- prevent access to danger zone during operation,
- not weaken the structure of the machine,
- not interfere with machine operation,
- be designed for the specific machine and job,
- be fire and corrosive resistant,
- be durable, and
- not be a source of additional hazard

G. Methods of Machine Guarding

All machines have hazardous motions and/or energy which must be effectively guarded to prevent employee injury.
Machines purchased or fabricated must be properly guarded prior to use.

Refer to Appendix C for the various methods of machine guarding. All fabricated or purchased guards shall meet OSHA's Specifications for Guards (Subpart O).

Refer to Appendix D for specific distances of guard openings from point of operation hazards.

VII. HAZARD CHECKLIST

To assist UNCG employees in checking workplaces to assure that recognized hazards are identified and any defects are promptly corrected, a comprehensive Hazard Checklist is provided in Appendix F.

Each department is responsible for establishing monthly self-inspections of their facilities. The Hazard Checklist (Appendix F) should be completed by the inspectors (designated) and copies forwarded to the Department Head and the Office of Safety. Each department must ensure the proper follow-up to correct all defects. All inspection reports must be filed by the department for future reference.

VIII. TRAINING REQUIREMENTS

The training for this policy is contained under Section 0190, Electrical Safety Related Work Practices.

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO

MOST OFTEN VIOLATED ELECTRICAL STANDARDS

- Subject Suitability for safe installation
- Unused openings-cabinets/boxes knockouts
- Secure mounting of equipment
- Electrical terminal connections
- Electrical splices
- Working space about equipment
- Guarding live parts
- Disconnect and circuit identification
- Reverse polarity
- Receptacles, cords, and plugs
- Ground fault circuit interrupters
- Maintenance worker receptacles
- Grounding fixed equipment
- Effective grounding
- Grounding cord connected equipment
- Flexible cord and cable uses
- Flexible cord and cable splices
- Pull at joints and terminals
- Receptacles damp/wet locations
- Motor disconnect means

Appendix B, Section 0120

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO SELF-INSPECTION ELECTRICAL CHECKLIST for ELECTRICIANS		
Date:_____	**Proper Protection Provided**	
Description	**Yes***	**No**
Electrical insulation adequate		
Splices 1. Conductors properly spliced or joined with splicing devices		
Arcing parts 1. Arcing/sparking equipment isolated from combustibles		
Marking 1. Manufacturer, voltage, current, wattage, and other ratings listed		
Identification of disconnecting means and circuits 1. Disconnecting means for motors/appliances legibly marked 2. Service, feeder, and branch circuit, at its disconnecting means or overcurrent device legibly marked		
600 volts, nominal or less 1. Working space about electrical equipment a. Sufficient access and working space provided/maintained about all electrical equipment b. At least one entrance provided to working space c. Illumination adequate d. Minimum head room six feet, three inches e. Live parts of electrical equipment operating at 50+ volts guarded against accidental contact or elevated at eight feet or more above working surface f. Entrances to rooms and other guarded locations containing exposed live parts marked with conspicious warning signs		
Over 600 volts, nominal 1. Electrical installations with exposed live parts accessible only to qualified persons 2. Kept locked and guarded 3. Access to electrical installations to unqualified persons prohibited		
Work space about equipment 1. Sufficient space provided/maintained to permit safe operation/maintenance		
Wiring design and equipment 1. Use/identification of grounded/grounding conductors a. Grounded conductors identifiable and distinguishable from other conductors b. Equipment grounding conductor identifiable and distinguishable from other conductors 2. Clearance from ground/other a. Open conductors: ten feet above finished grade b.twelve feet over areas subject to vehicles c. fifteen feet if subject to truck traffic d. eighteen feet over public streets and driveways e. Minimum of three feet clearance from windows, doors, fire excapes, or similar locations f. Conductors eight feet from highest point of roofs over which they pass		
Services 1. Means provided to disconnect all conductors from service entrance conductors 2. Disconnecting means indicates whether it is open or closed		

3. Disconnecting means installed at a readily accessible location 4. Each service disconnecting means indicates whether it is open or closed 5. Service entrance conductors installed as open wires guarded to make them accessible only to qualified persons		
High voltage warning signs posted overcurrent protection 1. Conductors and equipment protected from overcurrent 2. Cartridge fuses on circuits over 150 volts to ground 3. Overcurrent devices accessible to employees 4. Overcurrent devices located away from physical damage or combustibles 5. Breakers indicate whether open (off) or closed (on) 6. Feeders and branch circuits over 600 volts have short-circuit protection		
Grounding 1. Neutral conductor grounded on 3-wire DC systems 2. Path to ground permanent and continuous 3. Metal cable trays, metal raceways, and metal enclosures for cnoductors grounded 4. Noncurrent carrying metal parts of fixed equipment grounded 5. Noncurrent carrying metal parts of cord and ploy-connected equipment grounded 6. Fixed equipment, grounding conductors in same raceway, cable or cord, as circuit conductor 7. Equipment grounding conductor separate from circuit conductors for DC currents		
Wiring Methods 1. Metal raceways, cable armor, and other metal enclosure make continuous electric conductor 2. So connected to all boxes, firings, and cabinets as to provide electrical continuity 3. 300 volts or less temporary wiring used only during/or remodeling, maintenance, or repair 4. Temporary wiring use limited to ninety days 5. Feeders originate in distribution center 6. Conductors run as multi-condutor cord cable assemblies 7. Open conductors on insulators not more than ten feet apart 8. Branch circuit originate in power outlet or panelboard 9. Open conductors fastened at ceilng height every ten feet 10. Grounding type receptacles 11. Branch circuits contain separate equipment grounding conductor 12. Receptacles electrically connected to grounding connector 13. Bare conductors and earth returns avoided 14. Disconnecting switches or plug connectors on ungrounded conductors 15. Lamps protected from accidental contact or breakage 16. Flexible cords and cables protected from accidental damage 17. Sharp corners and projected avoided 18. Flexible cords and cables protected against damage		
Flexible nonmetallic tubing 1. In dry locations not exposed to severe physical damage 2. Tubing in continuous lengths not exceeding fifteen feet and secured to surface by straps at intervals not exceeding four feet, six inches		
Cabinets, boxes, and fittings 1. Conductors entering boxes, cabinets, or fittings protected from abrasion 2. Openings effectively closed 3. Unused openings effectively closed 4. Pull Boxes, junction boxes, and fittings provided with covers. 5. Metal covers grounded 6. Outlet boxes have cover face plates 7. Outlet boxes with flexible cords provided with bushings or smooth, well-rounded surfaces		

Pull/junction boxes over 600 volts 1. Cover permanently marked "HIGH VOLTAGE" 2. Marked readily visible and legible		
Switches 1. Knife switches have blades dead when switch is in open position 2. Single throw knife switches not capable of being closed by gravity 3. Single throw knife switches in inverted position have locking device to keep blades open		
Face plates for flush-mounted snap switches 1. Flush snap switches in ungrounded metal boxes and with in reach of conducting floors or surfaces have face plates of nonconduting, noncombustible material 2. Switchboards with exposed live parts in permanentlyu dry locations 3. Panelboards mounted in cabinets, cutout boxes, or enclosures approved with dead front 4. Panelboards accessible only to qualified persons 5. Exposed blades of knife switches dead when open 6. Switches, circuit breakers, and switchboards enclosed in weatherproof enclosures 7. Conductors for general wiring insulated 8. Conductor insulation approved for voltage, operating temperature, and location of use 9. Insulated conductors colore/identified as to type		
Flexible cords and cables 1. Not used as substitute for fixed wiring 2. Not run through holes in walls, ceilings or floors 3. Not run through doorways, windows, or similar openings 4. Not attached to building surfaces 5. Not concealed behind walls, ceilings, or floors 6. Flexible cords used without splice or tap 7. Flexible cords provided with strain relief		
Motor disconnecting means 1. Means in sight from controller location 2. If out of sight, is controller marked, giving the location and identification of the disconnect 3. If motor and machinery not in sight from controller, is controller locked in open position		
Equipment for general use 1. Manually operable switch in sight from motor 2. Disconnect indicate whether it is open (off) or closed (on) 3. Disconnect readily accessible 4. Individual disconnect provided for each motor		
Motor overload, short circuit, and ground-fault protection 1. Motors, motor-control apparatus, and motor branch-circuit conductors protected against overheating short circuits and ground faults		
Electric welders-disconnecting means 1. Disconnect provided in supply circuit for arc welder 2. Ampere rating of disconnect not less than supply conductor		
Data processing systems-disconnecting means 1. Disconnect provides power to all electronic equipment in data processing/computer rooms 2. Disconnect controlled from locations accessible to operator at principal exit 3. Disconnect to air conditioning serving area		
Hazardous locations 1. Equipment and wiring used in classified locations are intrinsically safe, approved, oor safe for the location 2. Equipment marked to show class, group, and operating temperature for which it is approved		

3. Temperature marking exceeds ignition temperature of specific gas or vapor		
Conduits 1. Conduits threaded and wrench tight 2. Bonding jumpers utilized where not threaded joint tight		
Emergency power systems 1. Emergency circuitwiring independent of other wiring and equipment 2. Kept from same raceway, cable, box, or cabinet of other wiring 3. Emergency lighting arranged due to the failure of individual lighting element cnanot leave any space in total darkness		

Signature:	Date:
Forwarded to: Office of Safety	Date:

Appendix C, Section 0120

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO
TYPES OF MACHINE SAFEGUARDING

Date: _____

All guard methods have their advantages and limitations. The following is a list of many types of guards showing the advantages and limitations:

GUARDS

Method	Safeguarding Action	Advantages	Limitations
Fixed	Provides a barrier	Can be constructed suit may specific applications. Inplant construction is often possible. Can provide maximum protection. Usually requires minimum maintenance. Can be suitable to high production, repetitive operations.	May interfere with visibility. Can be limited to specific operations. Machine adjustment and repair often require its removal, thereby necessitating other means of protection for maintenance personnel.
Interlocked	Shuts off or disengages power and prevents starting of machine when guard is open; should require the machine to be stopped before the worker can reach into the danger area.	Can provide maximum protection. Allows access to machine for removing jams without time-consuming removal of fixed guards.	Requires careful adjustment and maintenance. May be easy to disengage.
Adjustable	Provides a barrier which may be adjusted to facilitate a variety of production operations.	Can be constructed to suit many specific applications. Can be adjested to admit varying sizes of stock.	Hands may enter danger area - protection may not be complete at all times. May require frequent maintenance and/or adjustment. The guard may be made ineffective by the operator. May interfere with visibility.
Self-Adjusting	Provides a barrier which moves according to the size of the stock entering.	Off-the-shelf guards are often commercially available.	Does not always rovide maximum protection. May interfere with visibility. May require frequent maintenance and adjustment.

DEVICES

Photoelectric (optical)	Machine will not start cycling when the light field is broken by any part of the operator's body during cycling process, immediate machine braking is activated	Can allow freer movement for operator.	Does not protect against mechanical failure. May require frequent alignment and the calibration. Excessive vibraion may cause lamp filament damage and premature burnout. Limited to machines that can be stopped.
Radio frequency (capacitance)	Machine cycling will not start when the capacitance field is interrupted. When	Can allow freer movement for operator.	Does not protect against mechanical failure. Antennae sensitivity must be properly

	the capacitance field is disturbed by any part of the operator's body during the cycling process immediate machine braking is activated.		adjusted. Limited to machines that can be stopped.
Electro-mechanical	Contact bar or probe travels a predetermined distance between the operator and the danger area. Interruption of this movement prevents the starting of machine cycle.	Can allow access at the point of operation.	Contact bar or probe must be properly adjusted for each application; this adjustment must be maintained properly.
Pullback	As the machine begins to cycle, the operator's hands are pulled out of the danger area.	Eliminates the need for auxiliary barriers or other interference at the danger area.	Limits movement of operator. May obstruct workspace around operator. Adjustments must be made for specific operations and for each individual. Requires frequent inspections and regular maintenance. Requires close supervision of the operator's use of the equipment.
Restraint (holdback)	Prevents the operator from reaching into the danger area.	Little risk of mechanical failure.	Limits movements of operator. May obstruct workspace. Adjustments must be made for specific operations and each individual. Requires close supervision of the operator's use of the equipment.
Safety trip controls: Pressure-sensitive body bar; Safety tripod; Safety tripwire	Stops machine when tripping.	Simplicity of use.	All controls must be manually activated. May be difficult to activate controls because of their location. Only protects the operator. May require special fixtures to hold work. May require a machine brake.
Two-hand control	Concurrent use of both hands is required, preventing the operarot from entering the danger area.	Operator's hands are at a predetermined location. Operator's hands are free to pick up a new part after first half of cycle is completed.	Requires a partial cycle machine with a brake. Some two-hand controls can be rendered unsafe by holding with blocking, therby permitting one-hand operation. Protects only the operator.
Two-hand trip	Concurrent use of two hands on separate controls prevents hands from being in danger area when machine cycle starts.	Operator's hands are kept away from danger area. Can be adapted to multiple operations. No obstruction to hand feeding. Does not require adjustment for each operation.	Operator may try to reach into danger area after tripping machine. Some trips can be rendered unsafe by holding with arm or blocking, thereby permitting one-hand operation. Protects only the operator. May require special features.
Gate	Provide a barrier between danger area and operator or other personnel.	Can prevent reaching into or walking into the danger area.	May require frequent inspection and regular maintenance. May interfere with operator's ability to see work.

Appendix D, Section 0120

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO
DESIGN OF GUARDS

When designing and building barrier guards the size and design of the openings in the guard must be taken into consideration. The table below show the acceptable safe distance away from the hazardous zone.

Distance of Opening from Point of Operation Hazard (inches)	**Maximum Width of Opening (inches)**
1/2 to 1 1/2	1/4
1 1/2 to 2 1/2	3/8
2 1/2 to 3 1/2	1/2
3 1/2 to 5 1/2	5/8
5 1/2 to 6 1/2	3/4
6 1/2 to 7 1/2	7/8
7 1/2 to 12 1/2	1 1/4
12 1/2 to 15 1/2	1 1/2
15 1/2 to 17 1/2	1 7/8
17 1/2 to 31 1/2	2 1/8

Appendix E, Section 0120

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO REQUIREMENTS FOR ALL SAFEGUARDS		
REQUIREMENTS	**YES**	**NO**
1. Do the safeguards provided meet the minimum OSHA requirements?		
2. Do the safeguards prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts?		
3. Are the safeguards firmly secured and not easily removable?		
4. Do the safeguards ensure that no objects will fall into the moving parts?		
5. Do the safeguards permit safe, comfortable, and relatively easy operation of the machine?		
6. Can the machine be oiled without removing the safeguard?		
7. Is there a system for shutting down the machinery before safeguards are removed?		
8. Can the existing safeguards be improved?		

Appendix F, Section 0120

THE UNIVERSITY OF NORTH CAROLINA at GREENSBORO HAZARDS CHECKLIST		
Date: _____ Department: _____		
Mechanical Hazards	**Yes**	**No**
The point of operation: 1. Is there a point-of-operation safeguard provided for the machine? 2. Does it keep the operator's hands, fingers, body out of the danger area? 3. Is there evidence that the safeguards have been tampered with or removed? 4. Could you suggest a more practical, effective safeguard? 5. Could changes be made on the machine to eliminate the point-of-operation hazard entirely?		
Power transmission apparatus: 1. Are there any unguarded gears, sprockets, pulleys, or fly-wheels on the apparatus? 2. Are there any exposed belts or chain drives? 3. Are there any exposed set screws, key ways, or collars? 4. Are starting and stopping controls within easy reach of the operator? 5. If there is more than one operator, are separate controls provided?		
Other moving parts: 1. Are safeguards provided for all hazardous moving parts of the machine, including auxiliary parts?		
Non-mechanical Hazards 1. Have appropriate measures been taken to safeguard workers against noise hazards? 2. Have special guards, enclosures, or personal protective equipment been provided, where necessary, to protect workers from exposure to harmful substances used in machine operation?		
Electrical Hazards 1. Is the machine installed in accordance with National Fire Protection Association and National Electrical Code requirements? 2. Are there loose conduit fittings? 3. Is their machine properly grounded? 4. Is the power supply correctly fused and protected? 5. Do workers occasionally receive minor shocks while operating any of the machines?		
Training 1. Do operators and maintenance workers have the necessary training in how to use the safeguards and why? 2. Have operators and maintenance workers been trained in where the safeguards are located, how they provide protection, and what hazards they protect against? 3. Have operators and maintenance workers been trained in how and under what circumstances guards can be removed? 4. Have workers been trained in the procedures to follow if they notice guards that are dangerous, missing, or inadequate?		
Protective Equipment and Proper Clothing 1. Is protective equipment required? 2. Have operators and maintenance workers been trained in where the safeguards are located, how they provide protection, and what hazards they protect against?		

3. Is the operator dressed safely for the job (that is, no loose fitting clothing or jewelry)?		
Machinery Maintenance and Repair 1. Have maintenance workers received up-to-date instruction on the machinery they service? 2. Do maintenance workers lock out the machine from its power sources before beginning repairs? 3. Where several maintenance persons work on the same machine, are multiple lockout devices used? 4. Do maintenance persons use appropriate and safe equipment in their repair work? 5. Is the maintenance equipment itself properly guarded?		
Other Items to Check 1. Are emergency stop buttons, wires, or bars provided? 2. Are the emergency stops clearly marked and painted red? 3. Are there warning labels or markings to show hazardous areas? 4. Are the warning labels or markings appropriately identified by yellow, yellow and black, or orange colors?		

GUARDING TERMINOLOGY

Guard - Prevents contact with moving parts.

Enclosure - A fixed physical barrier.

Fence - Fence or rail enclosure restricting access.

Location - Physical inaccessibility under normal operating conditions. Hazards within three feet of the floor are considered accessible.

Point of Operation - Where work is actually performed on materials

Mechanical Power - Mechanical components including gears, cams, shafts, pulleys, belts, etc. that transmit energy and motion from source of power to points of operation.

In-going Nip Points - Two or more mechanical components rotating in opposite directions in the same plane and in close conjunction or interaction.

Shear Points - A reciprocal (sliding) movement of a mechanical component past a stationary point on a machine such as the blades of a screw conveyor.