Machine Guarding Program

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1. PURPOSE

To establish uniform procedures based on MSHA, OSHA and industry consensus standards for the design, installation, inspection and maintenance of machine guards.

2. SCOPE

The Machine Guarding Program applies to all Mosaic Phosphate Business Unit facilities.

3. DEFINITIONS

3.1 Safeguards

3.1.1 Device - A mechanism or control designed for safeguarding at the point of operation, such as presence-sensing, pull-back, two-hand trip devices, etc..

3.1.2 Enclosure - Safeguarding by fixed physical barriers that are mounted on or around a machine to prevent access to the moving parts. Enclosures are most effective when designed as part of the machine, but they can be bolted or welded to the frame or the floor.

3.1.3 Fencing - Safeguarding by means of a locked fence or rail enclosure that restricts access to the machine, except by authorized personnel.

3.1.4 Location - A hazard is physically inaccessible under normal operating conditions or use. Both fencing and location are very limited as safeguarding techniques, and they are permitted only if caution restrictions can be met.

3.1.5 Interlocked - The machine will not operate if the guard, or its hinged sections, do not enclose the point of operation.

3.1.6 Safeguarding - Any means of preventing personnel from contacting the moving parts of machinery or equipment, which could potentially cause physical harm. The word guard is often used to refer to barriers designed for safeguarding at the point of operation. The

word enclosure is used to describe a barrier or cover that protects workers from other danger zones in the operation.

3.2 Machine Motion

3.2.1 Inch (crawl) - An intermittent motion of the machine by momentary operation of the "inching" device. It is not to be used during production. It is only used to adjust settings.

3.2.2 Jog - An intermittent motion of the slide by momentary operation of the drive motor, after the clutch is engaged and the flywheel is at rest.

3.3 Machine Danger Zones

3.3.1 Nip points or bites - A hazardous area created by two or more mechanical parts rotating in opposite directions within the same plane and in close interaction.

3.3.2 Pinch Point - Any place where a body part can be caught between two or more moving parts.

3.3.3 Point of Operation - The area on a machine where material is positioned for processing, where work is actually being performed on the material.

3.4 Power Transmission - All mechanical parts, such as couplings, gears, cams, shafts, pulleys, belts, clutches, brakes, and rods, that transmit energy and motion from the source of power to the equipment or machine.

3.5 Shear Points - A hazardous area created by a cuffing movement of a mechanical part past a stationary point on a machine.

4. GENERAL REQUIREMENTS

4.1 Guards or devices shall be installed on machinery to protect the operator and other employees from hazards created by the point of operation, in-running nip points, rotating parts, flying chips and sparks. Machine guards shall be installed, even if a proper safeguard was not manufactured and installed for that particular machine at the time of purchase. The plant personnel must safeguard equipment before starting it up. All guards should be made of a durable material that withstands normal use.

4.2 Machines should not be operated if the installed guards are not in place. The operator of the machine should check the equipment prior to each work shift to ensure that the installed guards are in place. If not, the equipment should be isolated (LOTO), barricaded off, if necessary, and guard replaced.

4.3 Guards shall prevent hand, arms, or any other part of an employee’s body or clothing from contacting moving parts. A guard shall ensure that no objects can fall into moving parts.

4.4 Guards should be firmly secured to the machines. Operators should not be able to easily remove safeguards.

4.5 Inch, jog, and crawl controls may operate a machine at reduced speeds with the guards open provided the inch, jog or crawl controls are under the exclusive control of the operator, designed to prevent exposure to the worker at the point of operation and emergency stop devices are within reach of the operator.

4.6 When a machine continues to have motion (cycle) after being de-energized, the interlock if practical should prevent the guard from being opened until the movement completely stops.

4.7 Guards should be designed so they do not need to be removed to make mechanical adjustments or lubricate critical parts. If a guard must be removed for machine repair or maintenance, a lockout/tagout system to isolate all hazardous energies should be used. Stored energy such as that contained in springs, counterweights, flywheels, hydraulic, steam or water pressure, etc. shall be relieved, disconnected, restrained, or otherwise rendered safe prior to removing guard.

4.8 Other machine parts that move during operation should also be guarded. These include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary machine parts. All moving parts of the machine should be guarded, not just at the point of

operation. This includes parts that move up and down, around, sideways, in operation with other parts, at locations where product is fed, and any auxiliary parts.

4.9 Splash protection guards should be installed on machines where liquids and fluids are dispensed or filled. Splash guards should isolate or enclose the work area, prevent contact of the material by the operator (for example, a splash to the eyes). This also improves housekeeping and reduces the possibility of trips, slips, and falls.

4.10 Machinery and equipment shall be considered guarded when:

4.10.1 Guard openings do not exceed the dimensions for guard openings shown in the illustrations listed in Appendix 1A & 1B.

4.10.2 Guards with openings larger than 6" meet the dimensions for barrier guarding listed in Appendix 2A & 2B.

4.10.3 Moving parts are located at least 8' above the walkway, platform or workspace or protected by a barrier meeting the dimensions for barrier guarding in Appendix 2A & 2B.

4.10.4 Shaft ends that are smooth and do not project more than 1/2 of their diameter.

a. Guards and safety devices shall be made of durable materials that will withstand the conditions of normal use.

4.10.5 Engineering should be consulted when there is a question about the strengths of guarding materials.

a. Guards shall be capable of containing broken parts where there is a reasonable probability of moving parts failing and causing injury. Components whose rim speed or linear velocity exceeds 7,000 feet per minute may be considered potential hazards.

4.11 A guard shall not be easily tampered with or removed. Guards shall be firmly secured to the machine with devices that require the use of a tool or key to remove.

4.12 A guard shall not create an additional hazard, such as a shear point, a ragged edge, or an unfinished surface.

4.13 A guard shall not impede an employee from doing the job efficiently and comfortably.

4.14 Guards shall be designed to allow lubrication of the machine without removing the guard whenever practical.

4.15 Interlocked guards shall not be defeated or by-passed while machinery is in operation. Interlocks shall fail in a manner that does not create a hazard to employees.

4.16 Guards and devices removed from machinery due to servicing and/or maintenance shall be replaced before activation of the machinery.

4.17 Repairs and/or maintenance to machinery or equipment shall be performed only after the equipment is de-energized, and the machinery or equipment is blocked against hazardous motion (zero energy state - LOTO). Machinery or equipment motion or activation is permitted only to the extent that adjustments or testing cannot be performed without such motion or activation. Precautions shall be taken to protect persons from hazardous motion during such activity.

4.18 Machines designed for a fixed location shall be securely anchored (bolted to floor or bench) to prevent walking or moving.

4.19 The portion of an open frame pump shaft that is exposed for packing/seal adjustment need not be guarded if:

4.19.1 The shaft is protected from inadvertent contact by the pump frame.

4.19.2 The shaft is round, machined smooth, clean, and free of keyways, set screws, or burrs.

4.19.3 No other moving parts are exposed.

4.20 Vibrators that can create a hazard when their mounts fail shall be equipped with a safety cable or other suitable device to prevent their falling.

4.21 Overhead chain valve operators shall be equipped with safety cable to prevent the operator from falling in the event of failure.

4.22 Fan inlets shall be guarded regardless of location, not only to prevent contact with fan blades, but where free flying blades would create a hazard.

4.23 Reaching over, under, though, or around guards during machine operation should be prohibited.

4.24 Abrasive Wheel Tools

4.24.1 Bench grinders shall be equipped with a work rest adjusted to within 1/8" of the wheel and a tongue guard adjusted to within 1/4".

4.24.2 All abrasive wheel tools shall meet the requirements of ANSI B7.1, Use, Care, and Protection of Abrasive Wheels.

4.25 Conveyors

4.25.1 Counterweights supported by belts, cables, chains, and similar means shall be confined in an enclosure to prevent the passage of personnel beneath the weight. When an enclosure is not practical, counterweight guides will be blocked by a bar to prevent the counterweight from dropping to ground level in case of belt breakage. For additional safety, cables shall be fastened from the conveyor bed to the counterweight structure.

4.25.2 Emergency stop cables shall be installed along the entire length of an unguarded conveyor were persons can walk. Cables shall be maintained in a reasonably taut condition and be positioned where as a person falling on or against the conveyor can readily deactivate the conveyor drive motor.

4.25.3 All in-running nip points at terminals, drives, take-ups, pull-ups, and snub rollers shall be guarded.

4.25.4 The minimum distance from the in-running nip point at head or tail pulleys to where the guard framework ends shall be 42 inches or protected by a guard meeting dimensions in Appendix 2A & 2B.

4.25.5 Where walkways pass under conveyors, return idlers within a 8' reach will be guarded or protected by a barrier meeting the dimensions for barrier guarding listed in Appendix 2A & 2B.

4.26 Electric Motors

4.26.1 Motor cooling fan guard openings that give direct access to the fan shall be limited in size by the design of the structural parts, screens, grills, or expanded metal. An opening in a guard and/or opening between the guard and the motor is acceptable if a probe as illustrated in Appendix 3 cannot be made to touch any moving part other than a smooth shaft when inserted through the opening. Exception: Openings may be 3/4" to 1-1/2" wide if the width is not more than one-eighth of the distance to the nearest moving part other than a smooth shaft.

4.27 Machine Tools

4.27.1 Due to the unique requirements of guarding all the different types of Machine Tools, Lathes, Milling Machines, Shears, Press Brake, Metal Rollers, Iron Workers, Drill Presses, Metal Saws, etc. shall be guarded per the specific ANSI standards for that particular tool.

4.27.2 All pipe/bolt threading machines will have a momentary contact, guarded, foot switch.

4.27.3 Spring loaded self-ejecting chuck wrenches be used on all machine tools & power tools that require the use of a chuck wrench or chuck key.

4.28 Woodworking Machinery

4.28.1 Due to the unique requirements of guarding all the different types of Woodworking Machinery, Table saws, Radial Arm Saws, Miter Saws, Sanders, Drill Presses, Jointers, Planers, etc., shall be guarded per the specific ANSI standards for that particular machine.

5. SIGNS & WARNING SIGNALS

5.1 Appropriate signs should be provided that identify the potential hazard, consequence, or injury and the necessary precautions to avoid injury.

5.2 Warnings should be clear, concise, easy to read, and conspicuously located near the "danger zone." When signs are placed in the Danger Zone, the letters should be red on a white or black background to indicate danger. When signs are placed in an area to warn or bring attention to a potential hazard (caution), they should have yellow letters on a black background or black letters on a yellow background. Signs should be located at eye level, and be clear and visible to all personnel. They should be as close as possible to the potential hazard. In high-speed rotation areas, visibility is reduced, so consider adding marking devices (for example, arrows on rollers) to make hazards visible. Signs should be in the local language and include universal symbols.

6. TRAINING

6.1 Employees shall be provided with general awareness instruction in machine guarding principles and requirements.

6.2 Advanced Machine Guarding Principles shall be provided to those employees who install, repair, or fabricate machine guards initially and every three years thereafter.

6.3 Machine operator safety training should be provided when new or altered safeguards are put in service, or when operators are assigned to a new machine or operation. Training should describe the following:

- The hazards associated with specific machines.
- The safeguards for the above hazards, and how they provide protection.
- The use of the safeguards.
- The removal of safeguards, including the procedure, permitted personnel and circumstances.
- The procedure if an operator identifies that a safeguard is damaged, missing, or unable to provide adequate protection.

Every machine operator should be trained when they first begin to work on equipment and whenever there is a change to the safeguarding system (a new or altered guard).

7. INSPECTIONS

7.1 Inspections will fall under two categories:

7.1.1 Daily visual inspections by operations & maintenance personnel.

7.1.2 Frequent inspections (at least monthly) that are incorporated into the facility's routine safety and housekeeping inspection program.

7.1.3 Annual machine guarding compliance verification by maintenance to include documentation of inspection to specific machinery.

8. CONTRACTORS

8.1 All contractors and temporary employees shall adhere to all safety and heath policies required for Mosaic employees.

9. APPENDICES

9.1 Appendix 1A Guard Opening Dimension Requirements

9.2 Appendix 1B Guard Opening Illustrations

9.3 Appendix 2A Barrier Guarding Dimension Requirements

9.4 Appendix 2B Barrier Guarding Dimension Illustrations

9.5 Appendix 3 Electric Motor Guard Opening Probe Dimensions

10. REFERENCES

10.1 MSHA
- 10.1.1 Subpart M, 30 CFR 56.1400 through .14132
- 10.1.2 Guide to Equipment Guarding

10.2 OSHA
- 10.2.1 Subpart O, 29 CFR 1910.211 through .219
- 10.2.2 Publication 3067, Concepts and Techniques of Machine Guarding

10.3 ANSI
- 10.3.1 B 20.1, Conveyors and Related Equipment
- 10.3.2 B11.12, Construction , Care, and Use of Roll-Forming and Roll-Bending Machines
- 10.3.3 B11.15, Construction , Care, and Use of Pipe, Tube and Shape Bending Machines
- 10.3.4 B11.19, Construction , Care, and Use of Machine Tool Safeguards
- 10.3.5 B11.3, Construction , Care, and Use of Power Press Brakes
- 10.3.6 B11.4, Construction , Care, and Use of Shears
- 10.3.7 B11.5, Construction , Care, and Use of Iron Workers
- 10.3.8 B11.6, Construction , Care, and Use of Lathes
- 10.3.9 B15.1 Mechanical Power transmission Apparatus
- 10.3.10 B7.1, Use, Care, and Protection of Abrasive Wheels
- 10.3.11 O1.1, Construction, Care, and Use of Woodworking Machines

10.4 National Safety Council's Accident Prevention Manual, 11th edition

10.5 Underwriters Laboratory Standard 674, Electric Motors

11. REVISION LOG

Revision Log				
Rev. No.	Requested By	Approved By	Revised By	Rev. Date
0	Initial Issue for Mosaic	Safety Dept.	Safety Dept.	5/14/07
	Reformat for ISO;		D. Allen	6/9/2011
1	Review Cycle	Director Phosphate Safety	SME Review	12/7/2015
2	Review date past due	PMO	PMO	6/30/2021
Contact the Subject Matter Expert for additional information on this program.				

Appendix 1A
Guard Opening Dimension Requirements

GRAPHIC FORMAT

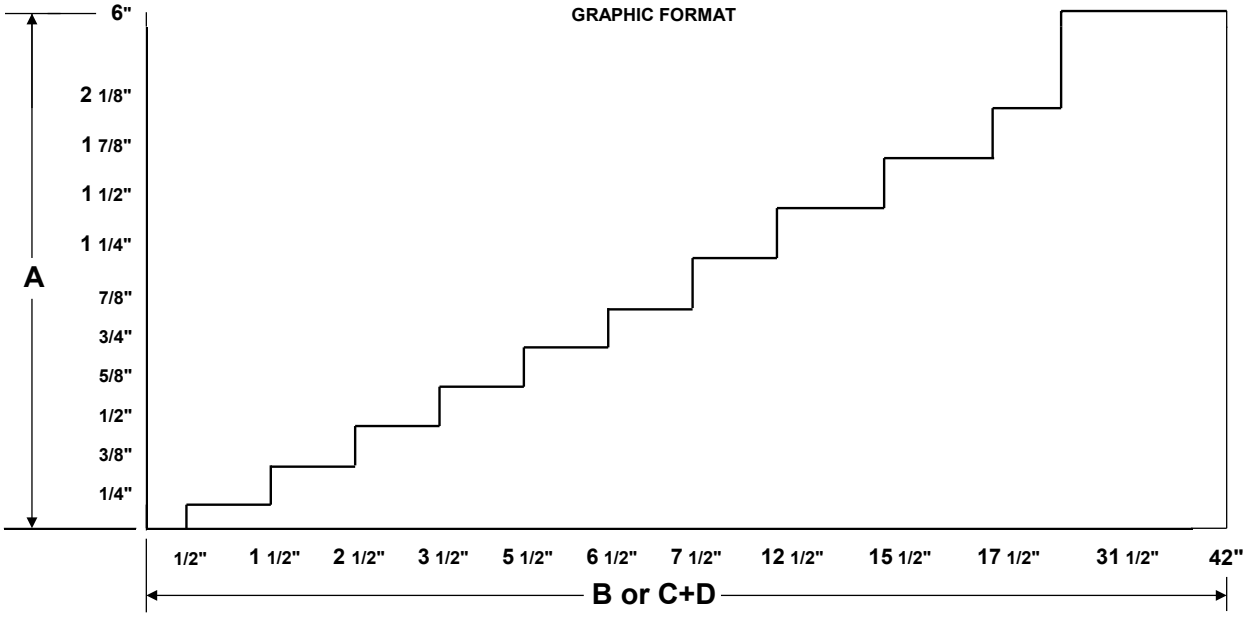
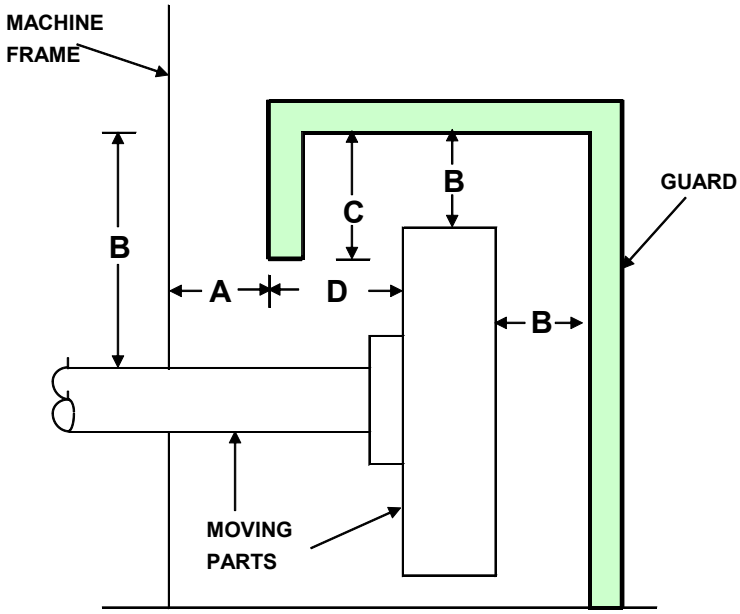


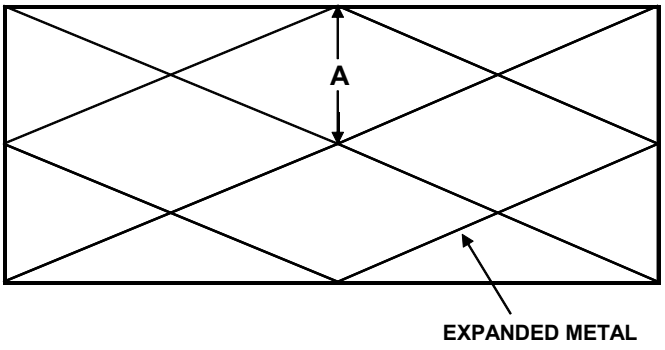
TABLE FORMAT

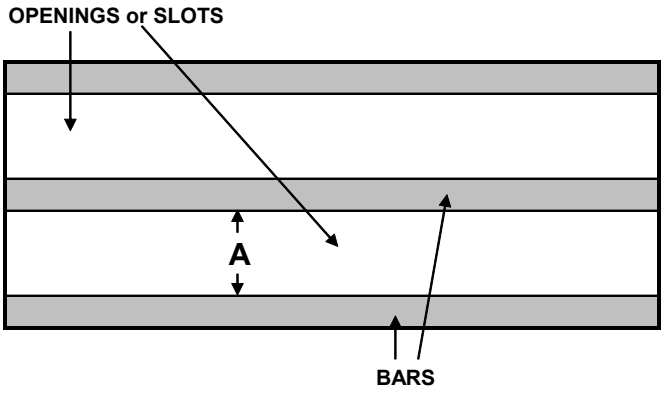
MAXIMUM OPENING WIDTH = A	DISTANCE FROM OPENING TO HAZARD = B or C+D
1/4"	1/2" to 1 1/2"
3/8"	1 1/2" to 2 1/2"
1/2"	2 1/2" to 3 1/2"
5/8"	3 1/2" to 5 1/2"
3/4"	5 1/2" to 6 1/2"
7/8"	6 1/2" to 7 1/2"
1 1/4"	7 1/2" to 12 1/2"
1 1/2"	12 1/2" to 15 1/2"
1 7/8"	15 1/2" to 17 1/2"
2 1/8"	17 1/2" to 31 1/2"
6"	31 1/2" to 42"

Appendix 1B

Guard Opening Illustrations





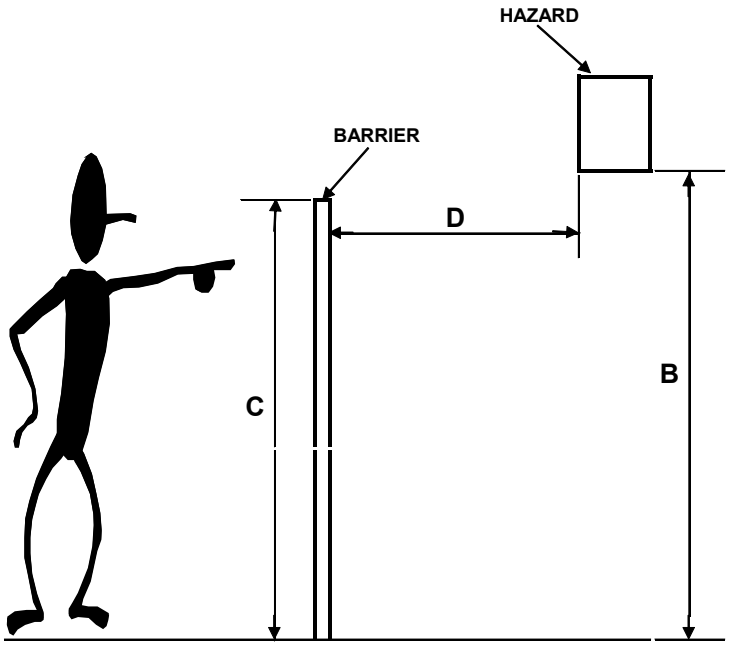


Appendix 2A

Barrier Guarding Dimension Requirements

		BARRIER HEIGHT (inches) = C							
		96	86	78	71	63	55	48	40
HAZARD HEIGHT (inches) = B	96	0	4	4	4	4	4	4	4
	86		10	14	16	20	20	24	24
	78			14	20	24	28	36	43
	71				24	36	36	40	43
	63				20	36	36	40	51
	55				4	32	36	40	51
	48					20	36	40	55
	40		HORIZONTAL			12	36	40	55
	32		DISTANCE to				24	36	51
	24		HAZARD					20	48
	16		(inches) = D					12	48
	8							8	43

Appendix 2B
Barrier Guarding Dimension Illustrations



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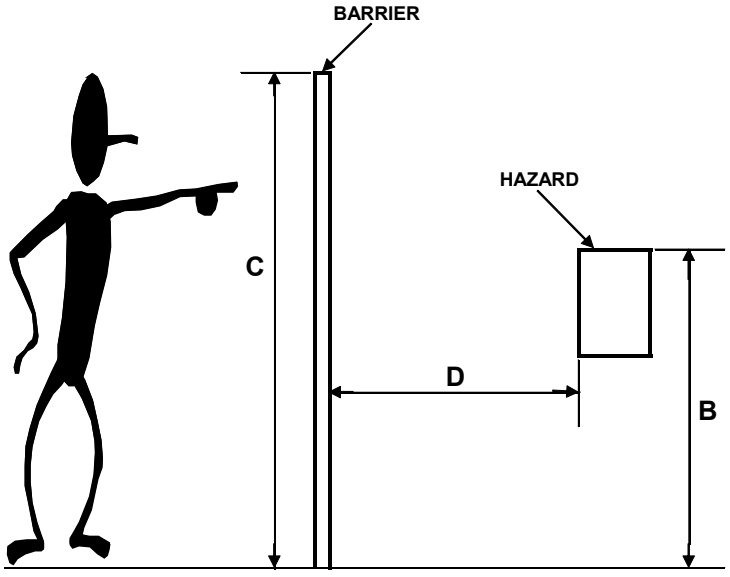

Appendix 3

Electric Motor Guard Opening Probe Dimensions