

TABLE OF CONTENTS

PART 7 - MACHINERY AND MACHINERY GUARDING

	Page
DEFINITIONS	7-1
SAFEGUARDS	7-1
GUARDING	7-2
PULLEYS, BELTS AND BELT-SHIFTERS	7-3
CONTROLS	7-3
FLYWHEELS	7-3
GRINDING WHEELS	7-3
WORK REST	7-4
CONVEYORS	7-4
POWER PRESSES, BRAKE PRESSES AND SHEARS.....	7-5
FEED ROLLS AND METAL FORMING ROLLS.....	7-6
MACHINING TOOLS.....	7-6
WOODWORKING EQUIPMENT	7-7

PART 7 – MACHINERY AND MACHINERY GUARDING

DEFINITIONS

7.01 In this part, the following definitions apply:

“guard”

means a type of safeguard consisting of a physical barrier that prevents a worker from reaching over, under, around or through the barrier to a moving part or point of operation;

“point of operation”

means the danger area in a machine where a part is being formed or work is being done;

“power transmission part”

means any moving part of a machine that transfers power from a power source to a point of operation;

“safeguard”

means the use of a guard, safety device, shield, awareness barrier, warning signs or other appropriate means, either singly or in combination, to provide effective protection to workers from hazards;

“safety device”

means a type of safeguard consisting of an arrangement of operating controls, an active or passive physical restraint, an interlock, or a presence-sensing device that ensures that a worker cannot access or be in a hazardous area while a machine is operating;

“shield”

means a type of safeguard consisting of a physical cover or barrier that restricts but does not prevent access to a hazardous moving part or a point of operation.

SAFEGUARDS

Where required

7.02 Machinery and equipment shall be fitted with proper and adequate safeguards that

- (a) protect a worker from contact with hazardous power transmission parts,
- (b) ensure that a worker cannot access a hazardous point of operation,
- (c) safely contain any material ejected by the work process, which could be hazardous to a worker, and

Standard for guarding

- (d) meet all the requirements of *CSA Standard Z432-04, Safeguarding of Machinery*, or other similar standard acceptable to the director.

Design

7.03 A safeguard provided on machinery or equipment shall

- (a) be capable of performing its intended function,
- (b) be designed, where practicable, to allow lubrication and routine maintenance without the removal of the guard,

Lockout

- (c) be removed or made inoperable only after the machine is locked out as required by Part 3 – Lockout,

Modification

- (d) be modified or readily removable only with the use of tools when it is a fixed guard, and

Openings

- (e) when designed with an opening in the guard, have a reach distance to hazardous parts that meets the requirements of Appendix A of *CSA Standard Z432-04, Safeguarding of Machinery*, or other similar standard acceptable to the director.

Identification of physical hazards Standards for signage **7.04** Any physical hazard shall be marked in a manner that clearly identifies the hazard to any worker, as provided by the following standards:

- (a) *CAN/CSA-Z321-96, Signs and Symbols for the Workplace,*
- (b) *ANSI Z535.1-2002, Safety Color Code,*
- (c) *ANSI Z535.2-2002, Environmental and Facility Safety Signs,*
- (d) *ISO 3864-1:2002, Graphical Symbols – Safety Colours and Safety Signs – Part 1.*

Clutches and pulleys **7.05** A mechanically driven machine, if not coupled directly to a motor, shall have a clutch, loose pulley or other such device that

- (a) allows starting or sudden stopping of the machine,
- (b) has controls immediately accessible to the operator,
- (c) is protected against accidental movement capable of starting the machine, and
- (d) is provided with a mechanism preventing the belt from creeping from the loose pulley to the fast pulley.

GUARDING

Rotating parts **7.06** (1) Effective guards shall be in place wherever workers are exposed to or may contact

- (a) rotating parts on machines or transmission equipment, such as friction drives, shafts, coupling and collars, set screws and bolts, keys and keyways, and projecting shaft ends,
- (b) a crank, connecting rod, tail rod, extension piston rod or other reciprocating or oscillating part, or
- (c) the in-running nip point of a power transmission belt, rope or chain, and any portion of a flywheel or pulley located within 2.5 m (8 ft.) of a floor, walkway or platform.

Gear and chain (2) Every gear and chain sprocket shall be completely enclosed, or where complete enclosure is not practicable, a band-type guard with flanges extending below the root of the teeth shall be provided.

Spokes (3) Where a hazard exists from rotating spokes, the spokes shall be guarded on their sides accessible to workers.

Overhead belts, ropes, chains (4) All power transmission drive belts, ropes or chains located over any area used by workers shall have a guard that effectively protects workers from injury as a result of failure of the belt, rope or chain.

Belts, ropes, chains (5) Every belt, rope or chain used for transmission of power to gears, sprocket, clutches, cranks and connecting rods, except those operated from a cathead or capstan, shall be enclosed, screened or railed off to prevent contact with workers.

Pinch points (6) All pinch points of any machine and the cutting edges of all power driven tools shall be properly guarded or provided with a device to prevent accidental contact with workers.

Pulleys (7) Driven pulleys on line shafts or counter shafts with no bearing between the pulley and the outer end of the shaft shall be equipped with appropriate safeguards to prevent the belt from slipping off the driven pulley.

Location (8) Machinery or equipment shall be located or safeguarded to provide safe passage and working space to workers using normal routes or operating an adjacent machine.

PULLEYS, BELTS AND BELT-SHIFTERS

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| Belt-shifters | 7.07 | (1) All manually controlled loose pulleys shall be equipped with permanent belt-shifters located within easy reach of the operator. |
| | | (2) Belt-shifters shall be equipped with a device to make it impossible for the belt to creep from the loose pulley onto the tight pulley. |
| Cone pulleys | | (3) All belts over 0.1 m (4 in.) in width, running on cone pulleys, shall be equipped with belt-shifters. |
| Dressing | | (4) Where it is necessary to apply dressing to a moving belt, it shall be done only where the belt leaves the pulley. |
| | | (5) When pulleys are 0.2 m (8 in.) or less in diameter, the dressing shall be applied midway between the pulleys, but not within 0.6 m (2 ft.) of an in-running nip-point. |
| Belts hung | | (6) When a belt is not in use it shall be hung clear of shafting and pulleys. |
| Defective pulley or flywheel | | (7) A pulley or flywheel that is defective or has been exposed to excessive heat shall be removed from service and not returned to service until it has been repaired according to the manufacturer's recommendations, or certified safe for use by a professional engineer. |
| | | (8) Belts or cables shall not be engaged manually while the pulleys are in motion. |

CONTROLS

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| Engaging | 7.08 | (1) Powered equipment, other than portable powered tools or mobile equipment, shall have |
| Location Identification | | (a) starting and stopping controls located within easy reach of the operator, |
| | | (b) controls and switches clearly identified to indicate the functions they serve, and |
| Positioning | | (c) controls designed, shielded or positioned to prevent inadvertent activation. |
| Two-hand controls | | (2) Where two-hand controls are installed, the equipment shall have controls that require both controls to be activated and released simultaneously before another machine cycle can be initiated. |

FLYWHEELS

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| Rim velocity | 7.09 | (1) A flywheel or pulley shall be operated at a rim velocity that does not exceed the manufacturer's specification or, in the absence of such specifications, does not exceed 1,800 m per minute (6,000 ft. per minute), or as specified by a professional engineer. |
| | | (2) Cast iron flywheels or pulleys shall not be repaired by welding, brazing, or bolting. |
| Guarding | | (3) Exposed portions of the operating mechanisms of friction-clutch couplings shall be properly guarded and the operating handles placed at a safe distance from the coupling. |

GRINDING WHEELS

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| Specifications | 7.10 | An abrasive wheel or a grinding wheel |
| | | (a) shall be installed, guarded, maintained and operated in accordance with the manufacturer's recommendations and specifications, |

Standards	(b) shall meet the requirements of <i>ANSI Standard B7.1-2000, The Use, Care and Protection of Abrasive Wheels</i> , or other similar standard acceptable to the director,
Guarding	(c) shall have a protective guard capable of containing any fragments that may break loose from the wheel, unless the wheel <ul style="list-style-type: none"> i. is used for work inside the object being ground, ii. is a mounted wheel 0.050 m (2 in.) or less in diameter, iii. is a cone or plug type wheel and the nature of the work provides the required protection, or iv. is on a portable grinder with a protective hood covering at least 120 degrees of the circumference of the wheel, when grinding root passes in welded pipe and the operator wears adequate eye and face protective equipment,
Speed	(d) shall be marked with the maximum speed recommended by the manufacturer and never operated above that speed,
Protection	(e) shall be operated only by workers wearing appropriate eye and face protection, and
Air grinders	(f) on a pneumatic grinder, shall be governed by an automatic speed control governor, which does not allow the wheel speed to exceed the recommended limit.
Ventilation	7.11 A grinding or abrasive wheel shall have a hood or ventilation system to control dust exposure to workers.

WORK REST

Clearance Installation Adjusting	7.12 A work rest used on a grinding wheel shall <ul style="list-style-type: none"> (a) have a maximum clearance of 0.003 m (¹/₈ in.) from the grinding wheel, (b) not be installed below the centre line of the wheel, and (c) not be adjusted by a worker while the wheel is in motion.
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CONVEYORS

Standards	7.13 (1) Conveyors shall meet the requirements of <i>ANSI Standard B20.1-2000, Safety Standards for Conveyors and Related Equipment</i> , or other similar standard acceptable to the director. (2) Openings in mesh and grid guards shall meet the requirements of Appendix A of <i>CSA Standard Z432-04, Safeguarding of Machinery</i> , or other similar standard acceptable to the director.
Sideboards	(3) A conveyor shall have guards or sideboards to prevent material from falling in areas occupied by workers if the falling material poses a hazard.
Removing safety devices	(4) A worker shall not walk in or on a conveyor, or remove a guard or safety device, unless the conveyor has been de-energized and locked out.
Emergency stops	(5) A conveyor shall have an emergency stopping system, unless guarding prevents access to the conveyor and possible contact with the moving parts. (6) A conveyor emergency stopping system as required in subsection (5) shall be designed and installed so the system <ul style="list-style-type: none"> (a) activates if a worker falls onto the conveyor, or if a fallen worker on the conveyor moves an arm or leg off to one side of the conveyor, (b) activates by the pull of the wire or cord in any direction or by a slack cable condition if a pull wire or cord is used as an emergency stopping device, and

- (c) reactivates only after the controls have been manually reset after an emergency stopping.
- Restarting** (7) Conveyors shall only be restarted after an emergency stop if the conveyor has been inspected to determine that it can be operated safely.
- Screw type** (8) The moving part of a screw type conveyor shall be properly guarded to prevent worker contact and the guard secured in place with fasteners that require tools to remove.
- Elevated conveyors** (9) Elevated conveyors shall have walkways with guardrails over them if workers must walk across them.
- Start-up warning** (10) Each time a conveyor is started, an audible warning alarm shall sound prior to movement of the conveyor.

POWER PRESSES, BRAKE PRESSES AND SHEARS

- Standards** 7.14 The design, installation, maintenance, operation, point of operation safeguarding and reliability of operating controls of a power press, brake press, ironworker, shear or cutter shall meet the requirements of the following standards:
 - (a) *CAN/CSA-Z142-02, Code for Power Press Operation: Health, Safety and Guarding Requirements,*
 - (b) *ANSI B11.4.2003, Machine Tools – Safety Requirements for Shears,*
 - (c) *ANSI B11.5-1988, Machine Tools – Ironworkers – Safety Requirements for Construction, Care and Use,* or
 - (d) other similar standards acceptable to the director.
- Control keys** 7.15 (1) When a power press or brake press is being used in a production mode, keys for all control selector switches shall be kept under the control of a supervisor.
- Temporarily removing safeguards** (2) Where the safeguarding of point of operation must be temporarily removed from a brake press as it is used for custom or different bend work
 - (a) safe work procedures shall be developed by the employer and used by the worker, and
 - (b) the safeguarding shall be replaced immediately following the completion of that work.
- Safeguards** 7.16 (1) Appropriate safeguards shall be provided to prevent injury to the operator and other workers from the point of operation of a power press, brake press, shear or cutter, whether operated manually, mechanically or electrically.
- No substitutions** (2) Hand feeding or extraction tools shall not be used as a substitute for point of operation safeguarding.
- Guillotines** (3) Where a guillotine or alligator shear is used, an effective guard or device shall be provided to prevent
 - (a) the hands of the operator from entering the point of operation while the shears are closing, and
 - (b) particles or material from being thrown from the shear's operation.
- Die setting** (4) Following a die setting activity, the guards and feeding system shall be properly arranged before starting the machine.
 - (5) The source of power shall be disconnected when setting dies, except on large presses that cannot be turned by hand.
- Multi-person controls** (6) Every power press operated by more than one person at a time shall be equipped with controls or devices to prevent operation until each operator's controls have been activated.

Multi-controls		(7) Where a power press with more than one control station is operated through only one control station, the unused controls shall be locked out.
Limiting stroke		(8) Where a press is guarded by limiting the stroke of the ram, the stroke shall be such that the clearance between the ram and the die or stripper shall not exceed 0.010 m (³ / ₈ in.).
Ram enclosures	7.17	On a ram-enclosed guard <ul style="list-style-type: none"> (a) the opening between the bottom of the enclosure and the work or working surface shall not exceed 0.010 m (³/₈ in.), (b) the top end of the enclosure shall extend at least as high as the upper limit of the ram, and there shall be no dangerous shear-points between the guard and any moving part, and (c) openings in the guard shall not exceed <ul style="list-style-type: none"> i. 0.013 m (¹/₂ in.) in minor dimension, if within 0.10 m (4 in.) of any moving part, and ii. 0.05 m by 0.05 m (2 in. by 2 in.), if over 0.10 m (4 in.) from any moving part.

FEED ROLLS AND METAL FORMING ROLLS

	7.18	Rotating feed rolls shall be <ul style="list-style-type: none"> (a) installed, maintained and operated in accordance with the manufacturer's recommendations, (b) provided with guards or safety devices to prevent contacts with in-running nip points, (c) equipped with feed-roll guards which <ul style="list-style-type: none"> i. are suitable for the thickness of the material being processed, and ii. have clearance less than 0.009 m (³/₈ in.) between the guard and the material passing through the feed-rolls, (d) equipped with a quick power disconnecting or reversing device within easy reach of either hand or foot of the operator, (e) equipped with a fixed or self-adjusting barrier on the in-running angle of the rolls, (f) equipped with a contact activated emergency stopping device on all exposed sides where a worker may be working and the process on the rolls precludes the use of guards, (g) cleaned manually only after stopping the machine and locking out the power supply, except for large machines which cannot be turned off manually or which are equipped with a slow-motion power control, and (h) provided with splashguards or other effective system to contain the cutting or cooling fluids, metal chips, scarf or turning produced from their operation.
Operation		
Guards		
Power disconnect		
Barriers		
Emergency stop		
Cleaning		
Splashguards		

MACHINING TOOLS

Guards	7.19	(1) All openings in shaper and planer beds shall be covered or guarded to eliminate shearing hazards.
Carriage travel		(2) Safeguards shall be installed at the farthest points of travel of the carriages or tables of shapers, planers, surface grinders or similar equipment, to protect workers against contact with moving parts.
Boring mills		(3) Rims of revolving tables of vertical boring mills shall be guarded to prevent contact by workers.
Lathes		(4) Dogs extending beyond the circumference of a lathe chuck shall be guarded against contact by operator.

- Projections** (5) Stock projecting from a machine tool shall be guarded to prevent contact by workers.
- Polishing lathe stock** (6) The polishing of lathe stock shall be carried out only with the tools designed for the purpose, not with hand-held abrasive cloth.

WOODWORKING EQUIPMENT

- Guards** 7.20 (1) Guards on all saws, planers, and other woodworking equipment shall be kept in place and used in accordance with the manufacturer's specifications.
- Push stick** (2) A push stick shall be readily available and used by workers to keep hands away from the cutting area.
- Kickback fingers** (3) Kickback fingers shall be used on a hand-fed circular saw when ripping lumber.
- Radial arm saws** (4) The cutting table and the saw travel stop on a radial arm saw shall be designed and maintained so that the edge of the saw blade does not travel past the forward edge of the cutting table.
- Band-saws** (5) Band-saw blades shall be enclosed or guarded except for the working side of the blade between the guide rolls and the table.
- Guide rolls** (6) The guide rolls on a band-saw shall be adjusted to a height just above the material being cut.

INDEX

PART 7 - MACHINERY AND MACHINERY GUARDING

	Page
CONTROLS	7-3
Engaging	7-3
Identification	7-3
Location	7-3
Positioning	7-3
Two-hand controls	7-3
CONVEYORS	7-4
Elevated conveyors	7-5
Emergency stops	7-4
Removing safety devices	7-4
Restarting	7-5
Screw type	7-5
Sideboards	7-4
Standards	7-4
Start-up warning	7-5
DEFINITIONS	7-1
FEED ROLLS AND METAL FORMING ROLLS	7-6
Barriers	7-6
Cleaning	7-6
Emergency stop	7-6
Guards	7-6
Operation	7-6
Power disconnect	7-6
Splash guards	7-6
FLYWHEELS	7-3
Guarding	7-3
Rim velocity	7-3
GRINDING WHEELS	7-3
Air grinders	7-4
Guarding	7-4
Protection	7-4
Specifications	7-3
Speed	7-4
Standards	7-4
Ventilation	7-4
GUARDING	7-2
Belts, ropes, chains	7-2
Gear and chain	7-2
Location	7-2
Overhead belts, ropes, chains	7-2
Pinch points	7-2
Pulleys	7-2
Rotating parts	7-2
Spokes	7-2
MACHINING TOOLS	7-6
Boring mills	7-6
Carriage travel	7-6

Guards.....	7-6
Lathes.....	7-6
Polishing lathe stock.....	7-7
Projections.....	7-7
POWER PRESSES, BRAKE PRESSES AND SHEARS.....	7-5
Control keys	7-5
Die setting	7-5
Guillotines.....	7-5
Limiting stroke	7-6
Multi-controls	7-6
Multi-person controls	7-5
No substitutions.....	7-5
Ram enclosures.....	7-6
Safeguards	7-5
Standards	7-5
Temporarily removing safeguards	7-5
PULLEYS, BELTS AND BELT-SHIFTERS	7-3
Belts hung	7-3
Belt-shifters	7-3
Cone pulleys.....	7-3
Defective pulley or flywheel.....	7-3
Dressing	7-3
SAFEGUARDS	7-1
Clutches and pulleys	7-2
Design	7-1
Identification of physical hazards.....	7-2
Lockout.....	7-1
Modification	7-1
Openings	7-1
Standard for guarding design	7-1
Standards for signage	7-2
Where required.....	7-1
WOODWORKING EQUIPMENT.....	7-7
Band-saws.....	7-7
Guards.....	7-7
Guide rolls	7-7
Kickback fingers	7-7
Push stick	7-7
Radial arm saws.....	7-7
WORK REST	7-4
Adjusting.....	7-4
Clearance	7-4
Installation	7-4