

September 7th, 2012

Overview

TW Machine Safety Services was contracted to perform a through Machine Safety Audit after the Ministry of Labour issued various *Orders To Comply* on machines located in the various Tech Ed classrooms within the Keewatin-Patricia School Board.

This document is designed to help the district understand OHSA, the MOL orders, how the regulations interact with various other regulations, and how the machine audit questions within the Machine Safety Management software are based on Canadian regulations, along with Employer, Employee obligations OHSA specifically spells out.

To clarify how the OHSA regulations relate to employers and employees we will begin with Quick Faq's excerpts directly from the Ministry of Labour website at:

<http://www.labour.gov.on.ca/english/hs/faqs/rights.php#what4>

Quick Faq's about the Occupational Health and Safety Act (OHSA)

[What Ontario legislation now applies to workplace health and safety?](#)

The [Occupational Health and Safety Act](#) (OHSA) is Ontario's cornerstone legislation for workplace health and safety. Other contributing legislation includes the [Workplace Safety and Insurance Act](#) (WSIA), Part II of which deals with the prevention of occupational injury and disease and the [Human Rights Code](#), which often has to be considered in dealing with OHS issues.

[In general, what does OHSA require?](#)

The main purpose of the Act is to protect workers from health and safety [hazards](#) on the job. It sets out [duties](#) for all workplace parties and rights for workers. It establishes procedures for dealing with workplace hazards and provides for enforcement of the law where compliance has not been achieved voluntarily. Fundamental to the successful working of OHSA is the workplace [Internal Responsibility System](#) (IRS).

Who is covered by OHSA?

[OHSA](#) applies to almost every worker, supervisor, employer and workplace in Ontario, including workplace owners, constructors and suppliers of equipment or materials to workplaces covered by the Act.

How are OHSA and Regulations enforced?

The Ministry's goal is for all workplaces to achieve self-compliance with [OHSA](#) and regulations through a well-functioning Internal Responsibility System (IRS). Where this does not happen, progressive enforcement results. Enforcement begins with the issuing of orders and may proceed to prosecution.

Inspectors are the enforcement arm of the Ministry of Labour; their role includes the following:

- **inspection of workplaces**
- **issuing of orders where there is a contravention of OHSA or its regulations**
- **investigation of accidents and work refusals**
- **resolution of disputes**
- **recommendation of prosecution.**

What are the penalties for not complying with OHSA and its regulations?

The maximum penalties for a contravention of OHSA or its regulations are set out in OHSA Section 66. A successful prosecution could, for each conviction, result in:

- **A fine of up to \$25,000 for an individual person and/or up to 12 months imprisonment;**
- **A fine of up to \$500,000 for a corporation.**

What is the Internal Responsibility System (IRS)?

The IRS gives everyone within an organization direct responsibility for health and safety as an essential part of his or her job. It does not matter who or where the person is in the organization, they achieve health and safety in a way that suits the kind of work they do. Each person takes initiative on health and safety issues and works to solve problems and make improvements on an ongoing basis. They do this both singly and co-operatively with others. Successful implementation of the IRS should result in progressively longer intervals between accidents or work-related illnesses.

Employers Duties

What duties does OHSA place on employers?

OHSA Sections 25 and 26 assign a mixture of general and specific duties to employers and provide for other duties to be prescribed by regulation. The general duties require an employer to;

- **Take all reasonable precautions to protect the health and safety of workers;**
- **Ensure that equipment, materials and protective equipment are maintained in good condition;**
- **Provide information, instruction and supervision to protect worker health and safety; and**
- **Co-operate with the JHSC.**

The specific duties require an employer to:

- **Comply with all regulations made under OHSA;**
- **Develop and implement a health and safety program and policy;**
- **Post a copy of OHSA in the workplace; and**
- **Provide health and safety reports to the JHSC.**

OHSA Section 26 details a number of other areas where additional duties for an employer may be prescribed. "Prescribed" means "required by a regulation." Regulations give specific directions on how to comply with the general requirements of OHSA.

NOTE:

Explanation of the **General Duty Clause** referred to in Section 25 above (Commonly used on MOL orders.

OHSA, 1990, Sec. 25, Sub Section 2, Clause h

“Without limiting the strict duty imposed by subsection (1), an employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.”

(Then the specific violation is noted to repair.)

This clause pulls in all applicable CSA or other applicable standards, not necessarily specifically referenced in OHSA, in addition to any other additional standards or plain “common sense” that may also apply.

This clause is a “Catch-all” for all hazards either directly or not directly addressed in the standards. The General Duty Clause is also worded to address specific hazards found on machines or processes that are not specifically addressed within the current regulations or

standards because they may be: too specialized, too old or machines in the future that are not yet on the market.

Another way to put the General Duty Clause is: “If you can get hurt by it, management is obligated to guard it to protect the worker from getting injured.”

In the unfortunate case of a serious accident to either to a worker (or student), attorneys will bring in all applicable regulations and standards, along with any other standards referenced within the CSA standards.

NOTE:

Common misconception on MOL orders:

Due to time and cost restraints for MOL inspectors, the inspector most likely will come into a business or school district and only site a few specific targeted hazards, site the General duty clause and put the management on notice they are to: **“Without limiting the strict duty imposed by subsection (1), an employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.”**

If the MOL inspector issued a citation for *every* hazard found on *all* equipment and processes, the inspector could be at each business or school district for several weeks or months, in addition, all the paperwork and follow-up required for each citation is very extensive, the one inspector could be tied up for several months in just one school district with several school locations, sometimes with extensive travel distances between schools.

Just because a school district has been issued citations on just a few or multiple machines on a specific hazard, they should consider themselves on notice and correct all hazards according to the General Duty Clause Regulation.

Workers Duties

[Do workers have duties under OHSA?](#)

Workers have a general duty to take responsibility for personal health and safety, which means they should not behave or operate equipment in a way that would endanger themselves or others. Section 28 of OHSA lists additional specific duties:

- **Work in compliance with the Act and regulations;**
- **Use any equipment, protective devices or clothing required by the employer;**
- **Tell the employer or supervisor about any known missing or defective equipment or protective device that may be dangerous;**

- Report any known workplace hazard or violation of the Act to the employer or supervisor;
- Not remove or make ineffective any protective device required by the employer or by the regulations.
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Common terminology used in machine guarding.

To help understand the common terminology used within the machine guarding area (Also used among all other areas as well.) are provided for this discussion direct from OSHA Reg. 851

“Transmission equipment” means any object or objects by which the motion of a prime mover is transmitted to a machine that is capable of utilizing such motion and includes a shaft, pulley, belt, chain, gear, clutch or other device.

“Adequate”, when used in relation to a procedure, plan, material, device, object or thing, means that it is,

(a) sufficient for both its intended and its actual use, and

(b) sufficient to protect a worker from occupational illness or occupational injury.

“Protective element” means a shield, a guard, an operating control acting as a guard, a locking device or any other device preventing access.

How CSA standards often incorporates *other* standards by reference.

[Example:](#)

CSA Z432-04 Safeguarding of machinery

7.17.1.1

The emergency stop shall be fully in accordance with NFPA 79 and ISO 13850, override all other machine controls, cause all moving parts to stop, and remove drive power from the machine actuators.

Note: The emergency stop may be a category 0 or category 1 type stop as required by NFPA 79.

Note: “NFPA” listed above is an acronym for “National Fire Protection Association” another set of American standards.

Often CSA standards also reference the “ANSI” (American National Standards Institute) standards as well. Many other standards are incorporated by reference also.

As demonstrated above, following the trail of a specific regulations or standards to the inexperienced person can be very confusing, frustrating and dangerous. In addition, just because a hazard is not defined in a specific CSA standard you *may think* is the obvious standard to look in, there are other CSA standards that may apply under a different title.

Example:

The CSA Z432-04 Safeguarding of machinery standard you *would think* will have all the standards associated with guarding a table saw, bandsaw, radial arm saw, etc. Actually, you will find additional standards for these machines located in the CSA standard “C22.2 No.71.2-10 Electric bench tools”. The title of the standard would lead most people to believe that this standard is for small electric drills and small bench type equipment. Not the case.

Various Standards used in the Machine Safety Management software

Beginning on the following page is a partial listing of CSA Standards that are specifically referenced in the OHSR Regulations. Depending on the specific machines, lifts, processes, or projects that a school or business has in operation will dictate which regulation, standard or standards apply within the Machine Safety Management Software.

For a more complete listing of any other standards and purchase of any specific standard go to:

<http://ohsviewaccess.csa.ca/viewStandards.asp>

Jurisdiction	Standard	Language	Title
Ontario	B352.0-95 (R2006)	English	Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry, Industrial and Mining Machines - Part 1: General Requirements
Ontario	B352.2-95 (R2006)	English	Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry, Industrial and Mining Machines - Part 3: Testing Requirements for ROPS on Construction, Earthmoving, Forestry, Industrial and Mining Machines
Ontario	B354.1-04 (R2011)	English	Portable Elevating Work Platforms
Ontario	B354.1-M82 (R2003)	English	Elevating Rolling Work Platforms
Ontario	B354.2-01 (R2011)	English	Self-Propelled Elevating Work Platforms
Ontario	B354.2-M82	English	Self-Propelled Elevating Work Platforms for Use on Paved/Slab Surfaces
Ontario	B354.3-M82	English	Self-Propelled Elevating Work Platforms for Use as "Off-Slab" Units
Ontario	B354.4-02 (R2007)	English	Self-Propelled Boom-Supported Elevating Work Platforms

Jurisdiction	Standard	Language	Title
Ontario	B354.4-M82	English	Boom-Type Elevating Work Platforms
Ontario			

Jurisdiction	Standard	Language	Title
Ontario	B44-07	English	Safety Code for Elevators and Escalators
Ontario	B44-1975	English	Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks
Ontario	B44-M90	English	Safety Code for Elevators
Ontario	B44-M94	English	Safety Code for Elevators and Escalators
Ontario	B51-09	English	Boiler, Pressure Vessel, and Pressure Piping Code
Ontario	B51-97	English	Boiler, Pressure Vessel and Pressure Piping Code
Ontario	B52-05	English	Mechanical Refrigeration Code
Ontario	B52-99	English	Mechanical Refrigeration Code

Jurisdiction	Standard	Language	Title
Ontario	C22.1-12	English	Canadian electrical code, part I (22nd edition), safety standard for electrical installations
Ontario	C22.1-1982	English	Canadian Electrical Code, Part I (14th edition), Safety Standards for Electrical Installations

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	M421-93	English	Use of Electricity in Mines
Ontario	M424.2-M90 (R2011)	English	Non-Rail-Bound Diesel-Powered Machines for Use in Non-Gassy Underground Mines
Ontario	M424.3-M90 (R2007)	English	Braking Performance - Rubber-Tired, Self-Propelled Underground Mining Machines
Ontario	086-01 (R2006)	English	Engineering Design in Wood
Ontario	086-09	English	Engineering design in wood
Ontario	086.1-94	English	Engineering Design in Wood (Limit States Design)
Ontario	S269.1-1975 (R2003)	English	Falsework for Construction Purposes - Structures (Design)
Ontario	S269.3-M92 (R2008)	English	Concrete Formwork
Ontario	W117.2-06 (R2011)	English	Safety in Welding, Cutting, and Allied Processes

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	W117.2-94	English	Safety in Welding, Cutting and Allied Processes
Ontario	W117.2-M87	English	Safety in Welding, Cutting, and Allied Processes
Ontario	W178.1-08	English	Certification of Welding Inspection Organizations
Ontario	W178.1-1990	English	Certification of Welding Inspection Organizations
Ontario	W178.2-08	English	Certification of Welding Inspectors
Ontario	W178.2-1990	English	Certification of Welding Inspectors
Ontario	W47.1-09	English	Certification of Companies for Fusion Welding of Steel
Ontario	W59-03 (R2008)	English	Welded Steel Construction (Metal Arc Welding)
Ontario	W59-M1989	English	Welded Steel Construction (Metal Arc Welding) (Metric version)
Ontario	Z107.1-1973	English	Methods for the Measurement of Sound Pressure Levels
Ontario	Z11-M81 (R2011)	English	Portable Ladders

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	Z142-10	English	Code for power press operation: Health, safety, and safeguarding requirements
Ontario	Z142-M90 (R2000)	English	Code for Punch Press and Brake Press Operation: Health, Safety and Guarding Requirements
Ontario	Z150-11	English	Safety code on mobile cranes
Ontario	Z150-1974	English	Safety Code for Mobile Cranes
Ontario	Z150-98 (R2008)	English	Safety Code on Mobile Cranes
Ontario	Z180.1-00 (R2010)	English	Compressed Breathing Air and Systems
Ontario	Z180.1-M85	English	Compressed Breathing Air and Systems
Ontario	Z195-09	English	Protective Footwear
Ontario	Z195-M92	English	Protective Footwear
Ontario	Z204-94 (R1999)	English	Guideline for Managing Indoor Air Quality in Office Buildings
Ontario	Z248-04 (R2009)	English	Code for Tower Cranes

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	Z248-1975 (R2003)	English	Code for Tower Cranes
Ontario	Z259.1-05 (R2010)	English	Body Belts and Saddles for Work Positioning and Travel Restraint
Ontario	Z259.1-95 (R2004)	English	Safety Belts and Lanyards
Ontario	Z259.10-06 (R2011)	English	Full Body Harnesses
Ontario	Z259.10-M90 (R2003)	English	Full Body Harnesses
Ontario	Z259.11-05 (R2010)	English	Energy Absorbers and Lanyards
Ontario	Z259.11-M92 (R2003)	English	Shock Absorbers for Personal Fall-Arrest Systems
Ontario	Z259.2.1-98 (R2011)	English	Fall Arresters, Vertical Lifelines and Rails
Ontario	Z259.2.2-98 (R2009)	English	Self-Retracting Devices for Personal Fall-Arrest Systems
Ontario	Z259.2.3-99 (R2010)	English	Descent Control Devices
Ontario	Z271-10	English	Safety code for suspended platforms

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	Z271-98 (R2004)	English	Safety Code for Suspended Elevating Platforms
Ontario	Z275.1-05	English	Hyperbaric Facilities
Ontario	Z275.1-93 (R2004)	English	Hyperbaric Facilities
Ontario	Z275.2-11	English	Occupational safety code for diving operations
Ontario	Z275.2-92 (R2004)	English	Occupational Safety Code for Diving Operations
Ontario	Z275.3-09	English	Occupational safety code for work in compressed air environments
Ontario	Z275.3-M86 (R2009)	English	Occupational Safety Code for Construction Work in Compressed Air
Ontario	Z275.4-02 (R2008)	English	Competency Standard for Diving Operations
Ontario	Z412-00 (R2011)	English	Guideline on Office Ergonomics
Ontario	Z432-04 (R2009)	English	Safeguarding of Machinery
Ontario	Z432-94 (R1999)	English	Safeguarding of Machinery

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	Z434-03 (R2008)	English	Industrial Robots and Robot Systems - General Safety Requirements
Ontario	Z434-94 (R2000)	English	Industrial Robots and Robot Systems - General Safety Requirements
Ontario	Z460-05 (R2010)	English	Control of Hazardous Energy - Lockout and Other Methods
Ontario	Z615-87 (R2006)	English	Code for Hot Forging Producers, Health and Safety Requirements
Ontario	Z62.1-11	English	Chain saws
Ontario	Z62.1-95	English	Chain Saws
Ontario	Z91-02 (R2008)	English	Health and Safety Code for Suspended Equipment Operations
Ontario	Z462	English	Workplace Electrical Safety
Ontario	Z94.2-02 (R2011)	English	Hearing Protection Devices - Performance, Selection, Care, and Use
Ontario	Z94.2-94	English	Hearing Protectors
Ontario	Z94.3-07	English	Eye and Face Protectors

Jurisdiction ↕	Standard ↕	Language	Title
Ontario	Z94.3-92	English	Industrial Eye and Face Protectors
Ontario	Z94.3-M88	English	Industrial Eye and Face Protectors
Ontario	Z94.4-02 (R2007)	English	Selection, Use, and Care of Respirators
Ontario	Z94.4-11	English	Selection, Use, and Care of Respirators
Ontario	Z94.4-93 (R1997)	English	Selection, Use and Care of Respirators
Ontario	C22.2 No 71.2	English	Electric bench tools

Machine Safety Management Software

Common Machine Questions

The following is a partial list of sample common specific questions found within the Machine Safety Management Software along with a list of regulations and or standards the questions are based upon.

Question 1: Is there a red emergency-stop switch with a yellow background at each operator's position?

CSA Standard Z434-04 Safeguarding of Machinery

7.17 Emergency stop

7.17.1 General

7.17.1.1

The emergency stop shall be fully in accordance with NFPA 79 and ISO 13850, override all other machine controls, cause all moving parts to stop, and remove drive power from the machine actuators.

Note: The emergency stop may be a category 0 or category 1 type stop as required by NFPA 79

7.17.1.2

Each operator control station, including pendants, capable of initiating machine motion shall have a manually initiated emergency stop device.

7.17.2 Emergency stop device design

Push-buttons that activate an emergency stop circuit shall be

- (a) red in colour with a yellow background;
- (b) unguarded;
- (c) palm or mushroom head type;
- (d) the type requiring manual resetting; and
- (e) installed such that resetting the button shall not initiate a restart

CSA Standard Z434-04 Safeguarding of Machinery

6.2.1.8 Applying intrinsic design measures to control systems

6.2.1.8.1

Insufficient attention to the design of machine control systems can lead to unforeseen and potentially hazardous machine behavior.

6.2.1.8.1.2

Typical causes of hazardous machine behavior are

- (d) a wrong design or location of controls.

Industrial Regulations 851

27. An emergency stop control on a power-driven machine shall,

(a) be conspicuously identified; and

(b) be located within easy reach of the operator. R.R.O. 1990, Reg. 851, s. 272.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker

Question 2: Is there power outage protection to prevent automatic restart of the machine after a power failure?

Canadian Electrical Code, Part I

Section 14 — Protection and control

Scope

14-000 Scope

This Section covers the protection and control of electrical circuits and apparatus installed in accordance with the requirements of this Section and other Sections of this Code.

14-010 Protective and control devices required

(c) devices that, when necessary, will open the electrical circuit thereto in the event of failure of voltage in such a circuit.

Definition - Low-voltage protection — a device that operates on the reduction or failure of voltage to cause and maintain the interruption of power to the main circuit.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker

Question 3. If hardwired, does the machine have a lockable disconnect or means to properly be locked out?

Canadian Electrical Code, Part I

2-304 Disconnection (see Appendix B)

(1) No repairs or alterations shall be carried out on any live equipment except where complete disconnection of the equipment is not feasible.

- (2) Three-way or four-way switches shall not be considered as disconnecting means.
- (3) Adequate precautions, such as locks on circuit breakers or switches, warning notices, sentries, or other equally effective means, shall be taken to prevent electrical equipment from being electrically charged when work is being done.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker

Question 4. Are all electrical components in good repair? (Plug, cord, connections, etc. Removable plastic or cardboard inserts on plugs are not compliant.)

CSA Standard Z434-04 Safeguarding of Machinery

7.7 Electrical systems

Electrical equipment shall comply with the requirements of the *Canadian Electrical Code, Part I* and *Part II*, as applicable, as well as pertinent regulations of the authority having jurisdiction.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.

Question 5. Is the machine securely anchored to prevent walking or moving? (Permanently anchored to floor/bench, clamped to bench, on a locking portable stand, on a cart with locking casters.)

CSA Standard Z434-04 Safeguarding of Machinery

6.2.2.4 Protective measures for stability

If stability cannot be obtained adequately by intrinsic design measures (e.g., by stable weight distribution), then stability shall be obtained by special protective measures. For example,

- (a) movements of parts of the machine may be restricted;
- (b) instability indicators or alarms to warn if stability is endangered or interlocks to prevent tipping may be provided; or
- (c) the machine may be securely anchored to a foundation.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.

Question 6. Is there a high friction coating on the floor at each operator's position?

OHSA Regulation 851

11. A floor or other surface used by any worker shall,

(a) be kept free of,

(i) obstructions,

(ii) hazards, and

(iii) accumulations of refuse, snow or ice; and

(b) not have any finish or protective material used on it that is likely to make the surface slippery. R.R.O. 1990, Reg. 851, s. 11.

CSA Standard Z434-04 Safeguarding of Machinery

7.14.1

Where work platforms are used, they shall have been so designed as to prevent hazards and provide a level standing space of adequate size (and strength) with a firm foothold. The stepping areas shall be made from materials that remain as slip-resistant as practicable under working conditions, and guard rails, posts, and toe boards shall be provided as required by the authority having jurisdiction.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.

Question 7. Are all OEM parts in place and operational?

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.

Question 8. Are the work lights, if installed, protected from impact and breakage from all angles?

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker.

Question 9. Is the shatterproof glass or polycarbonate in the lathe guard or chip shield intact and clean?

CSA Standard Z434-04 Safeguarding of Machinery

13.1.4

Materials used for safeguards shall be non-toxic, non-absorbent, shatterproof, readily cleanable, and unaffected by the material being processed or by any cleaning or sterilizing agent. Welds used in the fabrication of guards shall not form surfaces

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker

Question 10. Are all pinch point areas guarded?

Industrial Regulations 851

25. An in-running nip hazard or any part of a machine, device or thing that may endanger the safety of any worker shall be equipped with and guarded by a guard or other device that prevents access to the pinch point. R.R.O. 1990, Reg. 851, s. 25.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker

(The following four questions use the same regulations listed below the questions)

Question 11. Is the power transmission area of the machine fully guarded? (Belts, pulleys, sprockets, shafts, gears, chains, etc.)

Question 12. Is a guard installed that covers the chuck and the rotating shaft of the workplace the entire length of the bedway to protect the operator from rotating parts and flying chips? Note specifically Table A.7 (a)

Question 13. Is the shaft on the left side of the headstock guarded with a hand wheel or other type of guard?

CSA Standard Z434-04 Safeguarding of Machinery

6.1.3 Mechanical hazards

6.1.3.1 General

Mechanical hazard is a general designation for all physical factors that can give rise to injury deriving from the mechanical action of a machine, machine parts, tools, workplaces, and loads, or from projected solid or fluid materials.

6.1.3.2 Elementary forms of mechanical hazards.

The elementary forms of mechanical hazard are notably (see descriptions in Table A.7):

(a) entanglement: Entanglement occurs as a result of bodily contact with one of the following features:

- (i) a single rotating surface;
- (ii) projections or gaps;
- (iii) counter-rotating parts;
- (iv) rotating and tangentially moving parts;
- (v) rotating and moving parts;
- (vi) rotating and fixed parts; and
- (vii) material in motion.

(b) friction and abrasion: Friction and abrasion occur as the result of bodily contact with relatively smooth parts operating at high speeds (e.g., the rim of a centrifuge) or abrasive hazards (e.g., abrasive wheels or belt sanders).

(c) cutting or severing: Cutting occurs as a result of bodily contact with such items as cutting tools, saws, routers, knives, or moving sheet metal.

(d) shearing: Parts of the body may be sheared between two machine parts or between a machine part and a workpiece.

(e) stabbing or puncturing: The body may be penetrated by flying objects or by rapidly moving parts.

(f) impact: Impact occurs as the result of bodily contact with objects acting against the inertia of the body but not penetrating it.

(g) crushing: Crushing occurs as the result of bodily contact between one part of machinery moving against another part.

(h) drawing-in or trapping: Drawing-in occurs as the result of bodily contact with one of the following mechanisms:

- (i) in-running nips between two counter-rotating parts; and
- (ii) in-running nips between a rotating surface and a tangentially moving surface; and
- (i) pressurized liquids or gases injection or ejection: Compressed air or high-pressure fluid injection occurs as the result of skin exposure to high-pressure streams such as compressed air jets, paint sprayers, or hydraulic systems.

6.1.3.3 Factors in the generation of mechanical hazards

The mechanical hazard that can be generated by a machine, machine parts (including work material holding mechanisms), work pieces, or loads is conditioned, among other factors, by:

- (a) shape (cutting elements, sharp edges, angular parts, even if they are motionless);
- (b) relative location, which can create crushing, shearing, and entanglement zones when they are moving;
- (c) stability against overturning (considering kinetic energy);
- (d) mass and stability (potential energy of elements that can move under the effect of gravity);
- (e) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion);
- (f) acceleration/deceleration;
- (g) inadequate mechanical strength, which can generate hazardous breakages or bursts;
- (h) potential energy of elastic elements (springs), or high pressure injection or rejection hazard; and
- (i) conditions of use (e.g., environment varying operational fields).

7.5 Rotating shafts, spindles, and couplings

Setscrews, bolts, or keys on any exposed revolving part of machinery shall be sunk, shrouded, or otherwise guarded. Guarding of the rotating shafts may be accomplished by means of:

- (a) fixed guards of solid construction;
- (b) bellow-type guards; or
- (c) telescopic-type guards

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Table A.7
Mechanical hazards and controls
(See *Clause 6.1.3.2*.)

Name	Description	Control
(a) Entanglement	<p>Bodily contact with the following features may lead to entanglement.</p> <p>(a) Contact with a single rotating surface, e.g., couplings, spindles, chucks, leadscrews, mandrels, bars, or rotating workpieces. These, even when rotating slowly, are a source of danger.</p> <p>(b) Catching on projections or in gaps, e.g., fan blades, spoked pulleys, chain wheels, gear wheels and flywheels, mixer and beater arms, spiked cylinders, belt fasteners, projecting keys, set screws, cotter pins on shafts or slat conveyors.</p> <p>(c) By catching between two parts (see <i>Clause 6.1.3.2</i>):</p> <p>(i) Between counter-rotating parts, e.g., gear wheels, rolling mills, mixing rolls and calendars, or material being drawn between two rolls.</p> <p>(ii) Between rotating and tangentially moving parts, e.g., a power transmission belt and its pulley, a chain and chain wheel, a rack and pinion, metal, paper, rope, etc. and a reeling drum or shaft, batch-up, reel-up, etc., or a conveyor belt and its driving pulley or any bend pulley.</p> <p>Some mechanisms contain a combination of sliding and turning movement such as those used in certain cam gear designs, e.g., the mechanism on the side of some flatbed printing machines, or baling machines.</p> <p>(iii) Between rotating and fixed parts, e.g., spoked hand-wheels or flywheels and the machinery bed, screw or worm conveyors and their easing, revolving mixer and mincing mechanisms in casings having unprotected openings, Z-blade and ribbon-blade mixers, extruder scroll and barrel, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.</p>	<p>Entanglement hazards may be reduced by reducing speed or distance of movement, by avoiding projections and recesses, by restricting force, torque and inertia, and by aiming for smooth polished surfaces. These measures apply both to machinery and process material. It helps also if the process material and any by-product is discrete rather than continuous. Every projection such as a setscrew, bolt or key on any exposed revolving part of machinery should be sunk, shrouded, or otherwise effectively guarded. Guards for rotating shafts should preferably be fixed guards of solid construction. However, guards of the loose tube type or of bellows construction may also be used satisfactorily in some applications (see also <i>Clause 6.2.2</i>).</p> <p>The ergonomic criteria given in <i>Clause 12.4</i> and <i>Annex C</i> should not be regarded as giving complete protection against entanglement.</p> <p>Note: For additional illustration of controls, see <i>Annex B</i>.</p>

(Continued)

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Table A.7 (Continued)

Name	Description	Control
(a) Entanglement (Continued)	<p>(d) Catching in materials in motion, e.g., in centrifuges, tumble driers, dough mixers, or swarf from machining operations. The risk of entanglement is increased by loose clothing, gloves, neck-ties, jewellery, hair, cleaning brushes or rags, medical dressings, or materials being handled.</p>	
(b) Friction and abrasion	<p>The distinction between abrasion and cutting by a saw, for example, is one of degree. Friction burns can be caused by relatively smooth parts operating at high speed, e.g., the rim of a centrifuge basket at the edge of the easing opening. Other examples of friction or abrasion hazards include the periphery of an abrasive wheel, belt sanding machines, material running on to a reel or shaft, a conveyor belt, and its drums or pulleys (see Clause 6.1.3.2), and fast moving ropes or belts.</p>	<p>Friction and abrasion hazards are reduced by reducing speed or distance of movement, force, torque, and inertia, and by use of surfaces that are as smooth as possible. Damage due to any particular moving surface can be aggravated by abutting surfaces preventing removal of the hand, etc. from the danger zone, e.g., a badly adjusted work rest on an abrasive wheel.</p>

(Continued)

Industrial Regulations 851

24. Where a machine or prime mover or transmission equipment has an exposed moving part that may endanger the safety of any worker, the machine or prime mover or transmission equipment shall be equipped with and guarded by a guard or other device that prevents access to the moving part. R.R.O. 1990, Reg. 851, s. 24.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker

The following two questions use the same standards listed after the questions.

Note: It is more cost effective to use inexpensive labels rather than actually colour coat parts.

Question 14. Are all machine guards color-coded yellow?

Question 15. Are the edges of pulleys, sprockets, gears and other moving parts color-coded orange?

Question 16. Are all pinch point areas color-coded orange?

CSA Standard Z434-04 Safeguarding of Machinery

7.12 Safety colours and symbols

7.12.1

Where practicable, colours should be used to draw attention to a hazard. For example, certain parts of machines should be painted a distinguishing colour that will only be visible when a hazardous situation is present. Such finishes are required to be non-toxic when used in the food processing and pharmaceutical industries.

7.12.2

If it is not practicable to apply a distinguishing colour to an element of the machine structure, then the hazardous items themselves should be coloured; for example, where the machine structure adjacent to the hazardous element is completely hidden by it. It is not necessary that the whole of the hazardous part be coloured; it is sufficient to colour the ends of shafts, rims of pulleys, edges of blades, or other relevant machine members.

7.12.3

Where safety colours and symbols are used, they shall adopt a bold, recognizable, consistent pattern or symbol using standardized colours and should comply, where applicable, with CAN/CSA-Z321 and CAN/CSA-Z431.

17.2 Instruction placards and warning labels

Designers and manufacturers shall have provided warning labels on the machinery that may be appropriate for

- (a) commissioning and installation, e.g., to indicate lifting procedures or the exposure of hazardous parts prior to the fixing of safeguards during the commissioning phase; or
- (b) operation of the machine, e.g., to indicate hazardous parts of machinery behind a guard, such as drive systems or electrical control equipment, or to inform about safe working procedures, e.g., the need to wear eye or ear protection.

Warning labels should be clear and concise and use, where practicable, standard symbols and colours as specified in CAN/CSA-Z321.

Instruction placards may be used in the area adjacent to the machinery to explain the legal requirements, e.g., statutory notice, outlining the dangers associated with abrasive wheels, or to carry reference information on machinery operation.

OHSA Section 25 Sub Sec 2 Clause (h)

Without limiting the strict duty imposed by subsection (1), and employer shall, (h) take every precaution reasonable in the circumstances for the protection of a worker