

BC GUIDANCE DOCUMENT

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Health, Safety and Reclamation Code for Mines in British Columbia

Safeguarding of Machinery



Ministry of
Energy, Mines and
Low Carbon Innovation

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Purpose of Guidance Document

This Guidance document is intended to provide further information on the changes to the *Health, Safety and Reclamation Code for Mines in British Columbia* (Code) regarding the Safeguarding of Machinery or Equipment for surface and underground mines. Compared with its previous version, the 2024 Code now defines different types of guards, establishes guidelines for guard construction and clarity on servicing, testing, or adjusting energized machinery or equipment while in motion, without removing guards.

The following are additions or modifications to parts of the Code included in this guidance document.

- Guarding Machinery and Equipment with Moving Parts under sections 4.4.2 - 4.4.2.4 and 4.4.2.7& 4.4.2.8
- Designing and constructing guards
- Servicing Energized Machinery or Equipment without removing guard under section 4.4.2.5,
- Testing or Adjusting Energized Machinery or Equipment as per section 4.4.2.6.

Note: Section 4.4.16(6) (guarding conveyor belts) and section 4.13.4 (guards required for raise climbers) of previous versions of the Code have been repealed. The 2024 version of the Code provides all requirements and definitions for safeguarding of machinery or equipment throughout its sections 4.4.2 to 4.4.2.8.

Other requirements specific to conveyor belts and raise climbers continue to be addressed by sections 4.4.16 and 4.13 of the Code.

If you find yourself in a situation where the current requirements are not clear or fail to cover a specific case at your mine site, aim to go beyond them to ensure people are protected from harm. There are several sources outside the Code and this guidance document that can provide extra support and relevant information in this area. CSA has developed and updated a specific standard for safeguarding of machinery – the CSA Z432 which was used as the key reference in developing the new requirements of this version of the Code.

Types of Guards and Definitions

What the Legislation says...

- 4.4.2 (1) In this section and sections 4.4.2.1 to 4.4.2.8, 4.4.16, 4.5.3 and 4.11.6, “guard” means a physical barrier that provides protection from a hazard.
- (2) The manager must ensure that machinery or equipment with moving parts are equipped with guards which are designed, constructed, installed and maintained so that
- (a) no person can reach over, under, around or through the guard and access a hazard including a drive belt, chain, rope or pulley, sprocket, flywheel, geared wheel, any opening through which a belt, pulley or wheel operates, any bolt, key or set screw, every part of any wheel or other moving part that projects unevenly from the surface, or all head, tail, drive and tension pulleys of a conveyor, and
 - (b) all material that may be ejected in the normal course of operating the machinery or equipment, which could be hazardous to a person, is safely contained.
- (3) Subsection (2) of this section, and sections 4.4.2.1 to 4.4.2.8, do not apply to idlers of a conveyor belt except with respect to the return idlers, beneath the conveyor belt, that
- (a) are directly above a regular walkway or work area, and
 - (b) present a risk of harm to a person on the walkway or in the work area, beneath the return idlers, by being vertically reachable or by detaching and falling.

Guidance on section 4.4.2

Guards must be designed and installed to reasonably prevent any part of the body from contacting a hazard. This can be accomplished using physical barriers and/or interlocking devices that stop the movement of specific equipment or machinery to provide effective risk reduction before access is permitted to moving parts of machinery or equipment.

Section 4.4.2(2) established a requirement to have moving parts of machinery or equipment properly guarded. The intent is to create physical barriers to minimize the risk of personnel being exposed to the hazards of moving parts of machinery or equipment. This includes accessing, being caught by those moving parts, or being struck by material ejected from equipment and machinery. To avoid potential misinterpretation of section 4.4.2(2)(b), it is important to emphasize that section 4.4.2.4 – Construction of guards – is applicable to both types of hazards described in this subsection and should be built to be robust but practical to handle.

Examples of guards as described in sections 4.4.2(1) and 4.4.2(2) subsections (a) and (b):



FIGURE 1:EXAMPLE OF A GUARD AROUND A MOTOR DRIVE COUPLING



FIGURE 2:EXAMPLE OF A GUARD PROTECTING THE TAIL PULLEY OF A CONVEYOR

Section 4.4.2(3) is intended to provide protection in specific areas where conveyor rollers create a unique hazard relative to a typical return idler on a conveyor. The intent of this section is to ensure rollers above walkways or work areas are guarded when they create a reachable hazard (someone can reach up to a roller) or when they create a falling object hazard (roller dislodges and strikes an individual below the conveyor).

Examples of guarding return idlers are shown below:



FIGURE 3: GUARD PROTECTING A RETURN IDLER

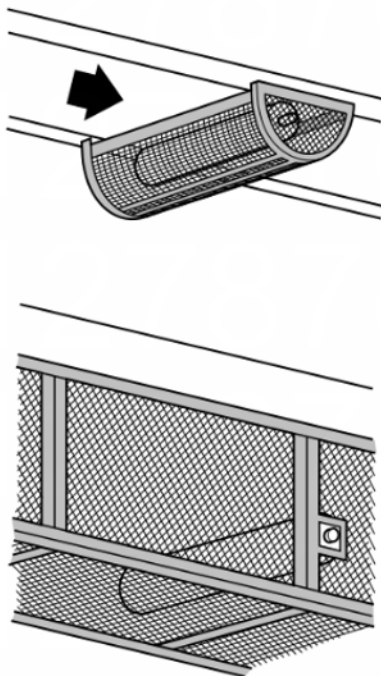


FIGURE 4: EXAMPLES OF RETURN IDLER GUARDING

Note: Other situations involving hazards from conveyor belts continue to be addressed by section 4.4.16 of the Code, which includes requirements for the provision of pullcords in their accessible sections.

Fixed Guards

- 4.4.2.1** (1) In this section, “fixed guard” means a guard that is kept in place with either a permanent attachment system or an attachment system that necessitates the use of tools to remove or open the guard.
- (2) The manager must ensure that, when fixed guards are removed from machinery or equipment, the attachment systems of the fixed guards remain attached to the guards or to the machinery or equipment.

Guidance on section 4.4.2.1

Fixed guards are attached to a machine and are intended to protect workers from localized hazards like rotating components, pinch points, crushing hazards, or ejected material etc. Fixed guards are intended to move with the equipment or machine if it is mobile (alternator belts), transported (conveyor pulley guards), or setup in another location (crushing plant).

Section 4.4.2.1 (1) outlines the requirement for the use of a tool to remove the guard. Examples of a tool include a wrench to remove a bolt, side cutters to cut a zap strap, or a key to open a lock. The intent is that workers are required to follow a separate train of thought (obtaining a tool to remove the guard) before opening a guard and potentially bypassing mandatory lockout procedures.

Section 4.4.2.1 (2) requires the mounting system for the guard to remain permanently attached to either the guard or the machine. For example, if a guard is bolted to a machine, either the nut or the bolt must be welded to the machine. The requirement prevents guards from not being replaced after they have been removed due to missing hardware or leaving a machine unguarded while replacement hardware is obtained.

Examples of fixed guards are shown below:



FIGURE 5: EXAMPLE OF GUARD PROTECTING TAIL PULLEY



Note: The bottom part of the tail pulley would have been exposed if the fixed guard wasn't in place.

FIGURE 6: GUARD PROTECTING A TAIL PULLEY

Below are examples of 4 different applications of fixed guards.

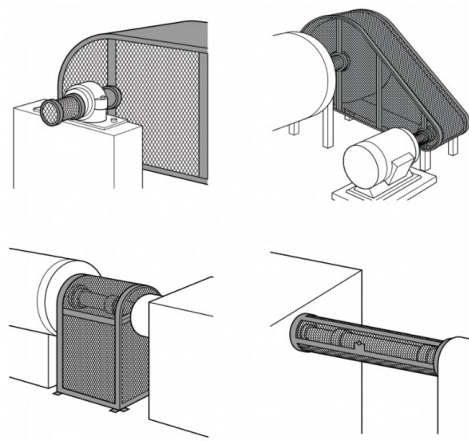


FIGURE 7: EXAMPLES OF ROTATING SHAFT, MOTOR COUPLING AND DRIVE PULLEY GUARDING

Interlocked Guards

4.4.2.2 (1) In this section, “interlocked guard” means a guard that is attached, and interlocked, to the operational controls of machinery or equipment which prevents the operation of hazardous machinery or equipment functions.

(2) The manager must ensure that interlocked guards comply with CSA Z432:23, Chapter 9.5, Guards, interlocked.

Guidance on section 4.4.2.2

Section 4.2.2.2 establishes the requirements for the use of detection systems and automatic devices that interact with the electrical controls of a machine or equipment to stop them or keep them paused if a person is exposed to the hazard of moving parts of that machine or equipment. In the future, despite potential updates to the CSA Safeguarding of Machinery Standard, the CSA Z432:23 version will remain in force for this section of the Code.

Below, an example of interlocked guard:

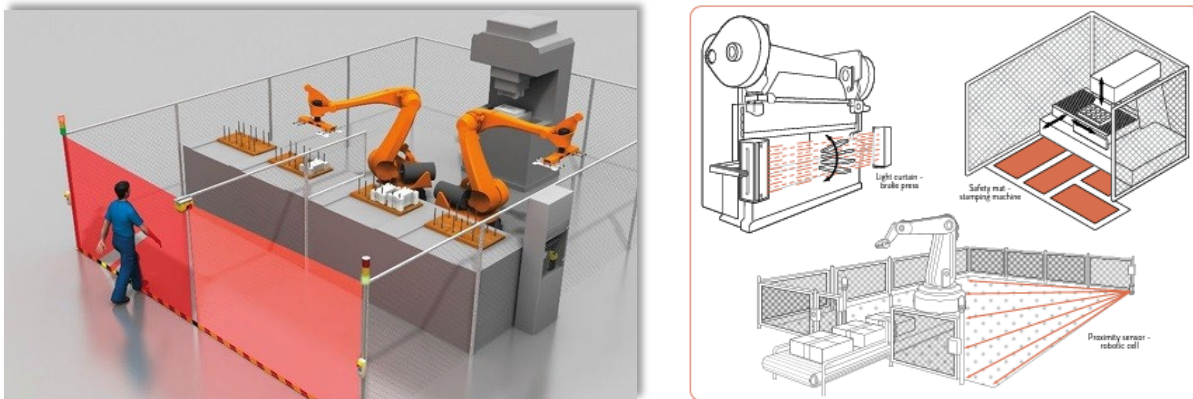


FIGURE 8: EXAMPLE OF AN INTERLOCKED GUARD

The left photo above is an example of a light curtain acting as an interlocked guard. Note that distance guards are also used to prevent access to the hazardous area from other directions not covered by the curtain.

Distance Guards

- 4.4.2.3** (1) In this section, “**distance guard**” means a guard that prevents access to the hazard by its physical dimensions and distance from the hazard.
- (2) The manager must ensure that distance guards
- (a) have no greater than a 0.15 m opening between the adjacent walked surface and the bottom of the distance guard,
 - (b) have a minimum height of at least 1.8 m,
 - (c) open laterally or away from the hazard and cannot close by itself and
 - (d) can only be removed by use of a tool.

Guidance on section 4.4.2.3

The term "distance guard" is introduced in the Code to replace "fencing" to better emphasize protection. "Fencing" has often caused misunderstanding and misconceptions about the necessity of guarding moving parts of machinery. Inspections in mines have revealed instances where mere installation of "fences" without proper design has resulted in unacceptable risks to personnel.

Examples include the use of “snow fence” type of material that can easily get loose, break or be cut; and isolating an area with multiple pulleys (head or tail) and belt drives without guards by the use of chains and signs where people can easily go over/under them and immediately be exposed to the hazards that were supposed to be dealt with. The dimensions defined in 4.4.2.3 (2) (a) and (b) are intended to cover that type of scenario.

It is important to recognize that the requirements of subsection 4.4.2.4 – Construction of guards are also applicable to this subsection. The effectiveness of the distance guards to protect people is directly related to keeping them away from hazards by preventing access to the areas where they are located. It means that no physical access to the hazardous areas from any direction is possible while the distance guards are kept in place. If any section of the distance guards is removed and/or not properly installed, the machine or equipment must not operate, be locked out and tagged out. As demonstrated below, if access gates are part of the installation, they must be provided with a lock at minimum.

The next two pictures show examples of distance guards – the height of the guards is considered to be 1.8 m:



FIGURE 9: DISTANCE GUARD EXAMPLE #1



FIGURE 10: DISTANCE GUARD EXAMPLE #2

Below is an example of UNSAFE distance guarding, which is NOT ACCEPTED by this Code.

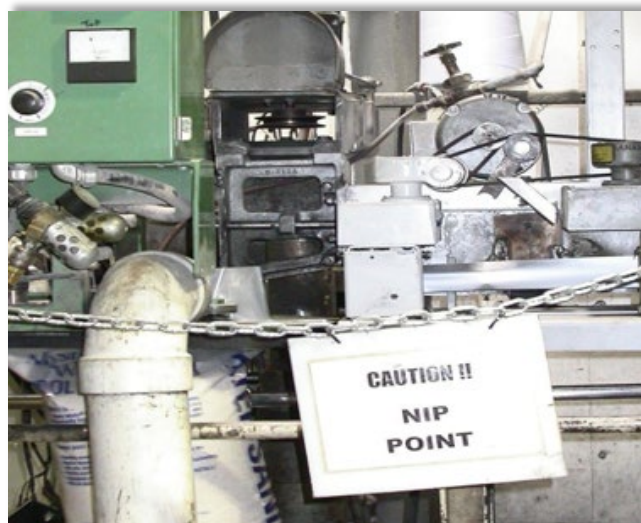


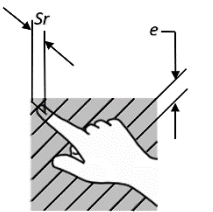
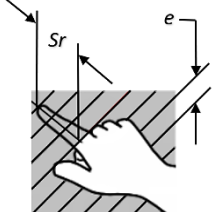
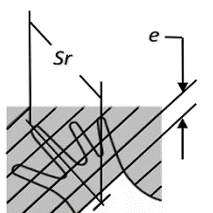
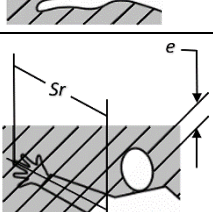
FIGURE 11: EXAMPLE OF UNACCEPTABLE GUARDING

Construction of Guards

4.4.2.4 The manager must ensure that all guards are designed to be of a suitable size and weight to permit ease of handling, are of robust construction and are free of sharp edges, rough surfaces and protruding parts that could cause injury, cause a minimal amount of visual obstruction during the production process, and meet the requirements of Table 4-1 for opening size and distance from a hazard.

TABLE 4-1: REACHING THROUGH REGULAR OPENINGS (IN MM)

Persons 14 yrs. of age and above*

Part of Body	Illustration	Opening	Safety Distance to Hazard zone,		
			Slot	Square	Round
Fingertip		$e \leq 4$	≥ 2	≥ 2	≥ 2
		$4 < e \leq 6$	≥ 10	≥ 5	≥ 5
Finger up to knuckle joint		$6 < e \leq 8$	≥ 20	≥ 15	≥ 5
		$8 < e \leq 10$	≥ 80	≥ 25	≥ 20
Hand		$10 < e \leq 12$	≥ 100	≥ 80	≥ 80
		$12 < e \leq 20$	≥ 120	≥ 120	≥ 120
		$20 < e \leq 30$	$\geq 850^{\dagger}$	≥ 120	≥ 120
Arm up to junction with shoulder		$30 < e \leq 40$	≥ 850	≥ 200	≥ 120
		$40 < e \leq 120$	≥ 850	≥ 850	≥ 850

Guidance on section 4.4.2.4

Section 4.4.2.4 (a) This section establishes a requirement that prevents guards from creating hazards such as muscle strain and lifting injuries. The size and weight of guards must take into consideration ergonomic factors and the ease of their installation, removal, and replacement. People lifting/handling a guard that is too heavy may get hurt or leave the removed guard out of its place due to difficulties with handling the guard safely.

Section 4.4.2.4(b) is intended to ensure that guards are built with adequate materials to withstand operational and environmental forces, ensure that they will not easily break or deform and to protect people who may have to handle or physically contact them. People may accidentally get hurt (cuts, bruises) by contacting sharp edges, rough surfaces, and protruded parts of guards.



FIGURE 12: EXAMPLE OF A GUARD WITH SNAG/PUNCTURE POINTS

Subsection 4.4.2.4(c) This section eliminates the potential for guards to be removed for the purpose of viewing the production process.

Subsection 4.4.2.4(d) This section establishes the minimum dimensions and distances for guard openings, preventing inadvertent contact with the hazard.

As listed in Table 1 above, the maximum dimension of an opening must not exceed 120mm.

Figure 13 illustrates a safety gauge (yellow) that can be used to ensure the dimensions of the opening vs the distance to the hazard comply with table 4.1. The use of a guarding safety gauge is encouraged to ensure compliance with the Code. Guarding safety gauges can be purchased online however, caution must be used to ensure the gauge purchased is compliant with the Code.

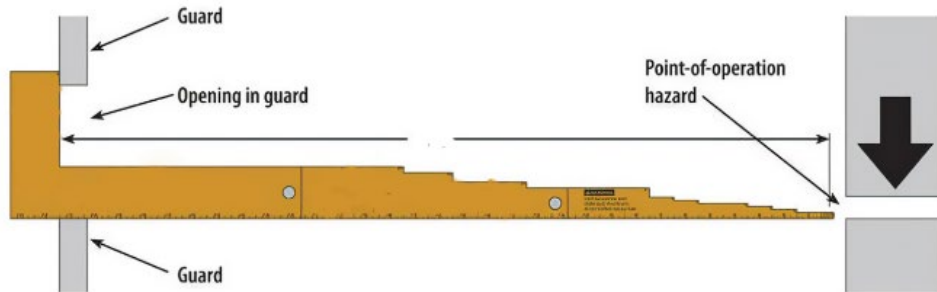


FIGURE 13: GUARDING SAFETY GAUGE

Servicing Energized Equipment without Removing Guard

4.4.2.5 If machinery or equipment with guards can only be serviced while the machinery or equipment is energized, the lockout procedures set out in sections 4.11.1 to 4.11.7 do not apply when servicing the machinery or equipment if the manager ensures that

- (a) the guards remain in place, and
- (b) only the parts of the machinery or equipment that are necessary for servicing it are energized.

Guidance on section 4.4.2.5

This section establishes requirements for maintenance of machinery where guards do not need to be removed.

The picture below shows an example where the guards were properly built to ensure that servicing can be safely performed without removing guards. The position of the grease fittings is extended to the outside of the guarded moving part.



FIGURE 14: PROPER GUARDING

Testing or Adjusting Energized Machinery/Equipment

4.4.2.6 If machinery or equipment with guards can only be tested and adjusted after the guards are removed and while the machinery or equipment is energized, the lockout procedures set out in sections 4.11.1 to 4.11.7 do not apply to the machinery or equipment while it is being tested or adjusted provided the manager

- (a) establishes a safe procedure for testing and adjusting the machinery or equipment in accordance with the manufacturer's recommendations, if any,
- (b) ensures that only qualified persons, or employees under the direct supervision of a qualified person, perform the testing and adjusting, and
- (c) ensures that the safe procedure referred to in paragraph (a) is reviewed by the qualified persons and employees at the frequency determined by the manager.

Guidance on section 4.4.2.6

Section 4.4.2.6 provides requirements for situations where testing and adjustments can ONLY be performed after guards are removed. As examples, this includes tasks such as conveyor belt tracking and vibration analysis. It is critical to emphasize that this section's intent is to address specific cases where there is no other option to perform those tasks. Whenever possible, and in most cases, a machine or equipment should be designed and installed to allow for testing and adjustments to be made with the guards in place. In those specific cases where a guard must be removed from its place for testing or adjustments, subsections 4.4.2.6(a) (b) and (c) must be followed.

Note: If the hazard cannot be controlled while servicing, lockout procedures as established in this Code must be adhered to.

Machinery or Equipment Isolated by Height

4.4.2.7 Despite section 4.4.2, guards are not required for exposed moving parts of machinery or equipment if the exposed moving parts are 3 m or more above the ground, working surface, walkway, stockpiles, or material build up, whichever surface is closest to exposed moving parts.

Guidance on section 4.4.2.7:

Section 4.4.2.7: This section establishes that guards are not required for exposed moving parts in circumstances where people would not be able to reach them under normal operation.

Note in the picture below that no walkways or working platforms are installed on the conveyor and the top of the stockpile has been kept at a distance larger than 3 meters from the head pulley.



FIGURE 15: STOCKPILE BENEATH HEAD PULLEY

Overhead Drive Belts

4.4.2.8 Despite section 4.4.2.7, the manager must ensure that an overhead drive belt has guards if the whipping action caused by the belt breaking may be hazardous to a person.

Guidance on section 4.4.2.8

Whenever hazards to persons working or traveling nearby are created by a drive belt or drive chain failure, a guard must be provided to contain the broken belt or chain. Due to the high tension and speed that drive belts and chains are subject to and their rapid failure mode, a whipping action can occur during failure. This whipping action can strike workers anywhere in the rotational plane of the drive components if not properly guarded.