



OCCUPATIONAL HEALTH AND SAFETY CODE 2018 EXPLANATION GUIDE



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*For the purpose of retaining the section numbers of this Code,
those sections which are no longer required and which have
been removed are indicated as "repealed."*

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Introduction

Purpose of the OHS Code Explanation Guide

This is the fourth edition of the Occupational Health and Safety (OHS) Code Explanation Guide. Its purpose is to explain the requirements of the Occupational Health and Safety Code 2018 in plain, easy-to-understand language.

The OHS Code Explanation Guide does not provide “interpretations” of the requirements—interpretations are provided by the courts. Readers making use of this explanation guide are reminded that it has no legislative sanction. The OHS Code should be consulted for all purposes of interpreting and applying the law.

The OHS Code Explanation Guide presents information that helps clarify the intent or application of each “rule” or “section” of the OHS Code. In some cases, extensive background information is presented so that readers have a better appreciation of the subject material. Where appropriate, readers are directed to Safety Bulletins published by Alberta Labour, to Web sites for documents dealing with specific topics, and to reference materials such as books and standards.

When a section in this second edition is shown as having been “repealed,” the section is no longer required and has been removed. The original section number has been retained so that the entire OHS Code does not need to be renumbered.

The Explanation Guide includes hundreds of illustrations. The illustrations are intended to help readers understand the requirements of the OHS Code and the accompanying explanations. The illustrations are not intended to be used as compliance guidelines, nor are they intended to reflect all the applicable requirements of the OHS Code.

Like the OHS Code, the OHS Code Explanation Guide is divided into three broad subject areas, and subdivided into 41 Parts or chapters as follows:

Core Requirements Applicable to All Industries (3 Parts)

- Part 1—Definitions and general application
- Part 2—Hazard assessment, elimination and control
- Part 3—Specifications and certifications

Requirements Applicable to All Industries (26 Parts)

- Part 4—Chemical hazards, biological hazards and harmful substances
 - Part 5—Confined spaces
 - Part 6—Cranes, hoists and lifting devices
 - Part 7—Emergency preparedness and response
 - Part 8—Entrances, walkways, stairways and ladders
 - Part 9—Fall protection
-

- Part 10—Fire and explosion hazards
- Part 11—First aid
- Part 12—General safety precautions
- Part 13—Health and safety committees and representatives
- Part 14—Lifting and handling loads
- Part 15—Managing the control of hazardous energy
- Part 16—Noise exposure
- Part 17—Overhead power lines
- Part 18—Personal protective equipment
- Part 19—Powered mobile equipment
- Part 20—Radiation exposure
- Part 21—Rigging
- Part 22—Safeguards
- Part 23—Scaffolds and temporary work platforms
- Part 24—Toilets and washing facilities
- Part 25—Tools, equipment and machinery
- Part 26—Ventilation systems
- Part 27—Violence and harassment
- Part 28—Working alone
- Part 29—Workplace hazardous materials information system (WHMIS)

Requirements Applicable to Specific Industries and Activities (12 Parts)

- Part 30—Demolition
 - Part 31—Diving operations
 - Part 32—Excavating and tunnelling
 - Part 33—Explosives
 - Part 34—Forestry
 - Part 35—Health care and industries with biological hazards
 - Part 36—Mining
 - Part 37—Oil and gas wells
 - Part 38—Residential roofing—Expired
 - Part 39—Tree care operations
 - Part 40—Utility workers—Electrical
 - Part 41—Work requiring rope access
-

Need more information? Call the Contact Centre

The explanations presented in this explanation guide apply to most workplaces and work situations. However, not all situations can be foreseen and therefore are not discussed in this explanation guide. Readers having questions about a particular topic or issue should call the OHS Contact Centre at:

1-866-415-8690
(780-415-8690 in the Edmonton area)



Deaf or hard of hearing

- Edmonton 780-427-9999
- Other locations 1-800-232-7215

Readers can also contact the Contact Centre through the Occupational Health and Safety website at:



<https://www.alberta.ca/ohs-complaints-incidents.aspx>

Part 1 Definitions and General Application

Section 1 Definitions

A number of words and terms are used in the *Occupational Health and Safety Code (OHS Code)* and are defined in this section. Understanding these words and terms is key to being able to use the *OHS Code*. Only those definitions that appear to require additional explanation are shown below.

“abnormal audiogram”

An audiogram is considered abnormal when a worker experiences significant hearing loss. Hearing loss is considered significant if the hearing threshold level in either ear is more than 25 dB at 500, 1000, 2000, 3000, 4000 or 6000 Hz.

“abnormal shift”

An audiogram is considered to be an abnormal threshold shift if there is a change of 15dB or more in either ear at two consecutive test frequencies at 1000, 2000, 3000, 4000 or 6000 Hz when it is compared with the worker’s baseline test.

“Act”

“Act” refers to Alberta’s *Occupational Health and Safety Act*. The *OHS Act* describes obligations and duties that serve to protect and promote the occupational health and safety of workers throughout Alberta. It describes the rights and responsibilities of employers, workers, and others connected with the work site. The *OHS Code* derives its authority from the *OHS Act* and together with the *OHS Regulation (AR 62/2003)*, states the rules applicable to occupational health and safety at Alberta workplaces.

For more information



The complete text of the OHS Act, OHS Regulations, and OHS Code

“asbestos waste”

Materials considered to be asbestos waste are those having a high probability of releasing airborne asbestos fibres when handled. This includes asbestos-containing materials discarded from asbestos abatement projects and the disposable protective clothing worn by workers during those projects.

“audiometer”

An audiometer is an instrument used to test hearing. The American National Standards Institute (ANSI) standard mentioned in the definition covers instruments that are designed primarily for the testing of hearing. The purpose of the standard is to ensure that tests of hearing ability, performed with different instruments complying with the standard, give essentially the same results under comparable conditions. The results must represent a good comparison between the hearing in the ear tested and the reference threshold of hearing. The standard applies to six types of instruments that are classified according to the type of test signal they generate (pure tone, speech or both), their mode of operation, and the complexity or range of auditory functions they test.

“audiometric technician”

The *OHS Code* requires an audiometric technician to pass an approved audiometric technical course. Audiometric technician courses may only be provided by an agency that has entered into an agreement with the Director of Medical Services. A Director of Medical Services is a member of the staff of Alberta Labour, appointed by the Minister under section 5 of the *OHS Act*.

The audiometric technician administers occupational hearing tests, classifies audiometric data and conducts post-test counseling of workers who have had an audiogram. Audiometric technicians must pass an approved audiometric technician course and are required to pass a requalification examination every five years.

“biohazardous material”

According to the *Human Pathogens and Toxins Act* (Canada), biohazardous materials are classified into the following Risk Groups:

Risk Group 1 (low individual and community risk)

Any biological agent that is unlikely to cause disease in healthy workers or animals.

Risk Group 2 (moderate individual risk, limited community risk)

Any pathogen that can cause human disease but, under normal circumstances, is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures rarely cause infection leading to serious disease; effective treatment and preventive measures are available and the risk of spread is limited. Examples of Risk Group 2 pathogens include the Hepatitis B and C viruses, salmonella, and E. Coli bacteria.

Risk Group 3 (high individual risk, low community risk)


Any pathogen that usually causes serious human disease or can result in serious economic consequences but does not ordinarily spread by casual contact from one

individual to another, or that causes disease treatable by antimicrobial or antiparasitic agents. Examples of Risk Group 3 pathogens include hantavirus, tuberculosis, human immunodeficiency virus (HIV), and the virus causing Creutzfeldt-Jakob disease (CJD).

Risk Group 4 (high individual risk, high community risk)

Any pathogen that usually produces very serious human disease, often untreatable, and may be readily transmitted from one individual to another, or from animal to human or vice-versa directly or indirectly, or by casual contact. Examples of Risk Group 4 pathogens include the hemorrhagic fevers such as Ebola, Marburg and Lassa.

For more information

 *Laboratory Biosafety Guidelines*

“blasting area”

The blasting area defines the area for which the blaster has been assigned direct control.

“blasting machine”

A typical blasting machine produces electric current as a lever is moved through a magnetic coil. The electric current passes through the detonator, exploding the explosive charge. Capacitor-discharge-type blasting machines are also available. These machines store electrical energy and discharge it on demand.

“bootleg”

A bootleg is usually recognizable as the remnant of a drill hole where an explosive was detonated. It is treated as though it may still contain explosive materials in its cracks or fissures. Precautions are taken to prevent drilling in or near a bootleg to avoid possible detonation of any remaining explosives.

“CANMET”

CANMET sets standards and provides approvals for testing and blasting equipment used in mines.

“combined ventilation system”

A combined ventilation system in a mining operation has two fans, one forcing air towards one side of the face and the other fan helping the air return. This increases the

volume of air as well as its turbulence by injecting fresh air to the headings where dust and methane levels could create hazards for workers.

In large underground mining operations, a combination of forcing fans and exhausting fans is used to supply air throughout the mine at a relatively reduced pressure differential. This offers an economical way of ventilating the mine. Also, the reduction in pressure improves equipment performance and is more comfortable for workers.

“dBA”

A decibel, abbreviated as “dB,” is the unit of measurement of sound intensity. It is a dimensionless unit calculated using the equation:

$$L = K \times \log_{10} \left(\frac{A}{B} \right),$$

where:

L is the noise level in dB,

A and B are quantities having the same units (either measures of energy or pressure), and

K is a multiplier, either 10 or 20, depending on whether A and B are measures of energy or pressure, respectively.

The A-weighted sound level, abbreviated as “dBA,” is used to measure noise exposure and is obtained from a sound level meter that uses an A-weighting network. The A-weighting network or filter derives its characteristics from certain properties of human hearing. The A-weighting curve is used most frequently since various studies have concluded that it provides a better estimate of the threat to human hearing by a given noise compared to other weighting curves.

“detonator”

A detonator is a relatively small explosive contained in a convenient cylindrical cap that is ignited by a flame (fuse type) or electric current. Ignition of the detonator causes the explosive attached to it to detonate. Electric or non-electric type cap detonators are equipped with a delaying device that allows the sequence of blasts.

“flash point”

Flammable and combustible liquids do not burn. Liquid gasoline for example, does not burn. The vapours given off by the liquid form an ignitable mixture with air. A liquid’s flash point is the lowest temperature at which the liquid evaporates quickly enough to produce enough vapours to ignite.

The flash point of gasoline for example, is approximately -40°C ; the exact flash point varies with the grade of gasoline. This means that at temperatures as cold as -40°C , gasoline can still evaporate quickly enough to have its vapours create an explosive atmosphere under the right circumstances.

“gob”

A gob is an area of an underground mine from which the coal and support pillars have been removed, allowing the roof to cave in.

“heavy duty scaffold”

A heavy duty scaffold is capable of supporting both workers and stored materials. The phrase “evenly distributed load” means that all similar parts of the scaffold are “loaded” equally. A concentrated load, depending on its location on the scaffold, may unevenly load one or more parts of the scaffold with resulting structural failure.

A heavy duty scaffold is designed to support loads ranging from 122 kilograms/square metre (25 pounds/square foot) to 367 kilograms/square metre (75 pounds/square foot). Scaffolds intended to exceed the design load of 367 kilograms/square metre must be certified by a professional engineer.

“light duty scaffold”

A light duty scaffold is intended for workers only. Materials other than tools should not be stored on this type of scaffold. The phrase “evenly distributed” means that all similar parts of the scaffold are “loaded” equally up to the maximum limit of 122 kilograms/square metre (25 pounds/square foot). A concentrated load, depending on its location on the scaffold, may unevenly load one or more parts of the scaffold with resulting structural failure.

“magazine”

Explosive magazines are designed and constructed to safely store explosives, detonators and blasting agents. The size, structure and construction details of a magazine are based on the amount and type of explosives stored. Various classes of magazines are designed to address different concerns as indicated in *Storage Standards for Industrial Explosives* (M81-7/2001E), published by Natural Resources Canada.

“mine level”

This definition of level applies to all drivages (tunnels) having a slope within 5 degrees of horizontal. In coal mines, the level is driven generally along the strike, which is

perpendicular to the dip of the coal formation. A moderate slope is usually incorporated in the level to help drain any water or other liquid from the level to a sump.

“mine shaft”

In mining operations, any opening in the ground made at an angle of 45 degrees or more from the horizontal is called a shaft. Shafts are generally used for transporting workers and materials. They also accommodate various services such as ventilation, power cables, water lines, communication cables and other utilities.

“misfire”

For a misfire to occur, either the detonation energy was too weak, a cut-off occurred, or the explosion did not propagate through the entire explosive column. A minimum amount of detonation energy is needed for most explosives to explode, and some degree of insensitivity is designed into the explosive as a safety measure to permit its handling.

Misfires must be treated as explosives not yet detonated. The following options may be considered when disposing of a misfire:

- (a) a fresh charge with appropriate detonation can be exploded close enough to the misfire to detonate it;
- (b) water can be used to wash it out; or
- (c) other alternatives prescribed by the explosive’s manufacturer.

The area must be controlled to keep people and equipment away until the misfire has been appropriately disposed of.

“occupational exposure limit”

An occupational exposure limit (OEL) is the airborne concentration of substance for which it is believed that nearly all workers may be repeatedly exposed on a day-to-day basis without suffering adverse health effects. The OEL refers to the concentration of the substance to which the worker is exposed, not the concentration of the substance in the workplace.

OELs are based on review of data from experimental animal and human studies and from industrial experience from clinical and epidemiological (comprehensive statistical studies of disease patterns among known groups of people) studies of workers.

While animal and human experimental data are the most useful when determining how the body responds when exposed to single substances or specific mixtures of substances, the studies do not usually represent workplace conditions of exposure. Personal habits such as smoking, drinking alcoholic beverages and using drugs or medications may also affect a worker’s health profile. The substances involved in these personal habits may

have an additive or synergistic action on exposures at the workplace. Well-designed epidemiologic studies can help distinguish between the effects of work-related and non-work-related variables.

Exposure limits have been developed by a number of organizations. The OELs are, for the most part, based on Threshold Limit Values (TLVs) developed by the American Conference of Governmental Industrial Hygienists (ACGIH). The basis on which the values are established differs from substance to substance. Protection against health impairment may be a factor for some, reasonable freedom from irritation, narcosis, nuisance or other forms of stress may form the basis for others. Health impairments that are considered include those that reduce life expectancy, compromise physical function of the body, impair the capability for resisting other toxic substances or diseases or adversely affect reproductive capability or the developmental process.

In some cases, Alberta's OELs differ from the ACGIH values. Data associated with exposure to the substances in question was extensively reviewed in these cases. The primary criterion for deviating from the ACGIH values was the health and safety of workers based on available documentation and scientific rationale. The applicability of the rationale to circumstances in Alberta was considered as well (i.e., conditions of exposure or special exposure for Alberta workers, safety margin of the ACGIH values, social expectations and technical feasibility of meeting the standards).

Substances for which the OELs differ from the TLVs recommended by ACGIH are listed below.

- Acetic anhydride, ceiling limit used instead of an 8-hour exposure limit
- Formaldehyde
- Hydrogen sulphide, ceiling limit used instead of a 15-minute short term exposure
- Particulate Not Otherwise Regulated (no ACGIH TLV)
- Polymethylene polyphenyl isocyanate (no ACGIH TLV)
- Sulphur (no ACGIH TLV)
- Sulphuric acid
- Ozone
- 1,1,1-Trifluoro-2,2-dichloroethane (no ACGIH TLV)

Inhalable limits for which the numerical value in the 2006 TLV is the same as the current OEL will remain the same, (i.e., the total value will be used). This applies to the following substances:

- Calcium sulphate
- Captan
- Diquat
- EPN
- Glass fibres
- Molybdenum
- Nickel
- Silicon carbide, nonfibrous

In some cases, inhalable limits were recommended by ACGIH but the TLV documentation supported total limits (which may or may not be the same as the inhalable limits). In these cases, total limits were adopted consistent with the documentation. This applies to the following substances:

- Flour dust (numerically the same)
- Natural rubber latex (numerically the same)
- Borates (half the inhalable limit)

For seven substances, agreement could not be reached on whether or not the ACGIH TLVs should be adopted. These substances will be reviewed further at a later date to determine the most appropriate value to be adopted as the OEL. This applies to the following substances:

- Asphalt
- 2,2-dichloropropionic acid
- Magnesium oxide
- Methane
- p,p-oxybis
- Trichlorophon
- Wood dust

The OELs presented in Table 2 of Schedule 1 are given in units of ppm (parts per million) and mg/m³ (milligrams per cubic metre). Where the OEL has the units of mg/m³, unless otherwise specified (e.g., “respirable”), the OEL is the total amount of substance measured in air at the workplace.

“permitted explosive”

This means an explosive was put through a very strict review and laboratory testing schedule by the Chief Inspector of Explosives, Natural Resources Canada. The explosive must meet certain criteria that allow it to be used in hazardous conditions such as gassy coal mines. One of the most important characteristics is the length of time the explosive “flames” during explosion. This duration must be very short for explosives used in coal mines because of the mine’s potentially explosive atmosphere.

“pipeline”

According to the *Pipeline Act*, “pipeline” means a pipe used to convey a substance or combination of substances, including installations associated with the pipe, but does not include

- (i) a pipe used to convey water other than water used in connection with a facility, scheme or other matter authorized under the *Oil and Gas Conservation Act* or the *Oil Sands Conservation Act*,
- (ii) a pipe used to convey gas, if the pipe is operated at a maximum pressure of 700 kilopascals or less, and is not used to convey gas in connection with a facility,

scheme or other matter authorized under the *Oil and Gas Conservation Act* or the *Oil Sands Conservation Act*,
(iii) a pipe used to convey sewage.

“restricted area”

A work area is considered “restricted” if it is likely that its airborne concentration of asbestos will exceed the occupational exposure limit (OEL) for that substance.

“restricted space”

For the sake of simplicity, a restricted space can be thought of as a work area in which the only hazard is the difficulty of getting into and out of the space—all other hazards are either non-existent or have been eliminated or controlled as required by Part 2. Restricted spaces are therefore not subject to the permitting, atmospheric testing and tending worker requirements of a confined space. Workers and employers sometimes refer to restricted spaces as non-permitted confined spaces.

Examples of restricted spaces may include building attics, below-ground vaults used for electrical and telecommunications cables, some ventilation system passages and crawlspaces in buildings and the interior inspection spaces of wind turbine blades. Trenches can also often be considered to be restricted spaces if all hazards have been eliminated or controlled prior to workers entering the trench.

Despite being classified as a restricted space, the following requirements of Part 5 Confined Spaces, continue to apply to workers entering a restricted space:

- a hazard assessment must be performed prior to entry—section 45;
- workers assigned duties related to the entry must be trained to recognize hazards and how to perform their duties in a safe and healthy manner—section 46;
- general safety requirements involving the use and availability of safety, personal protective, and emergency equipment, as well as a communication system—section 48;
- prevention of unauthorized persons entering a restricted space—section 50;
- protection of workers from hazards created by traffic in the area of the restricted space—section 51;
- workers cannot enter or remain in a restricted space unless an effective rescue can be carried out—section 55;
- a competent worker, designated by the employer, must be in communication with the worker(s) inside a restricted space—section 56; and
- a safe means of entry and exit must be available to all workers required to work in the restricted space—section 57.

Employers and workers must be mindful that a restricted space can become a confined space if conditions or work practices change.

“split”

In a split ventilation circuit, a portion of fresh air from a main intake airway is split away to provide clean, uncontaminated air to a working place. The remainder of the main intake air continues on into the mining operation to meet additional needs. The contaminated air coming from this “split” is then directed back into the main return airway and out of the mine.

“ventilation stopping”

A stopping is used to direct and control ventilation air in a mine. Built to be sturdy and leakproof, stoppings prevent unnecessary leakage of ventilation air. In a gassy mine, stoppings are coated with fire-resistant chemicals to prevent the spread of fire and are made leakproof to prevent recirculation of contaminated air. When a stopping is used to regulate ventilation, the quantity of air flow is controlled by the size of the opening in the stopping. As a barrier, a stopping does not require any openings except where holes are needed to monitor the atmosphere behind the stoppings. Figures 1.1 and 1.2 illustrate a permanent stopping and a stopping used to regulate ventilation.

Figure 1.1 Permanent stopping

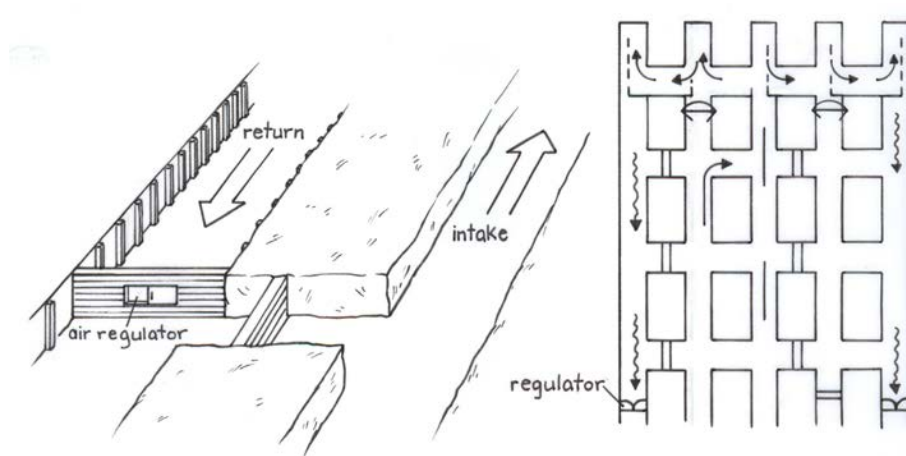
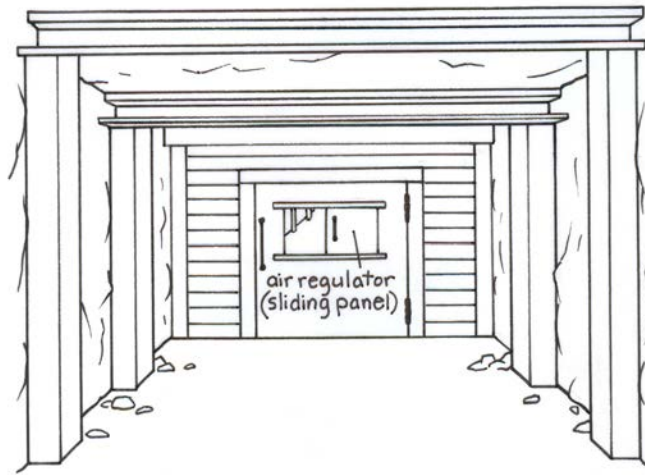


Figure 1.2 Stopping for ventilation regulation



“work area”

Subsection 1(n) of the *OHS Act* defines a work site as a location where a worker is, or is likely to be engaged in any occupation. For workers who work out of their vehicle, any vehicle or mobile equipment used by the worker as part of the job is also considered a work site. The *OHS Act* clearly indicates that a work site is any location where there is, or is likely to be, a worker doing work as part of their occupation.

A work area is considered to be the place at a work site where a worker actually is or may be during work, or during a work break. At a large warehouse operation for example, the office in which a worker performs work is the worker’s work area. The warehouse operation is considered to be the work site.

Situations may arise in which work is performed at two or more locations within a large work site. In such situations, an employer may wish to partition or divide the large work site into two or more smaller work sites. The reasons for doing so may include better access control of persons and vehicles, restricting certain activities to a specific area, and optimizing the type and quantity of first aid supplies, equipment and services required.

Ideally, the areas will be physically separated. For example,

- (a) smaller work sites would function independently of one another (i.e., there is no work-related interaction between the workers of the smaller work sites);
- (b) the perimeter of each of the smaller work sites would be defined by an effective physical barrier such as a fence, wall, etc. This controls vehicular and foot traffic between work sites; and
- (c) if two or more employers work at a smaller work site at the same time, then the smaller work site requires its own prime contractor.

For example, a fenced-off construction site within the land occupied by a refinery can be treated as a separate “work site within a work site.” A fenced-off construction site within a retail complex can also be treated as a “work site within a work site.” By meeting the three conditions listed above, each work site within a work site can be treated as a separate work site for the purposes of complying with the *OHS Act*, *OHS Regulation* and *OHS Code*.

There may also be instances in which work sites can be partitioned administratively (e.g., a work area with office functions may be separated by distance or time-of-day activities by a production or packaging work area). When this approach is used, care must be taken to ensure that the “work sites” function independently of one another, that workers understand and respect the administrative limits that separate the sites, and that the potential need for a prime contractor in the partitioned work site is acknowledged.

Section 1.1 Farming and ranching operations

As of December 1, 2018, farming and ranching operations must comply with the *OHS Code* pursuant to the *Occupational Health and Safety Code (Farm and Ranch) Amendment Regulation*.

Farming and ranching operations are limited to

- (a) the production of crops, including fruits and vegetables, through the cultivation of land;
- (b) the raising and maintenance of animals or birds;
- (c) the keeping of bees.

Furthermore, the following are not considered farming and ranching operations:

- (a) the processing of food or other products from the operations referred to above;
- (b) the operations of greenhouses, mushroom farms, nurseries or sod farms;
- (c) landscaping;
- (d) the raising or boarding of pets.

Section 1.2 Domestic Workers

The *OHS Code* does not apply to domestic workers, as defined in section 1.2. Generally, domestic workers include child care workers, maids, housekeepers, personal care workers and gardeners who do not work for another employer (such as an agency) and are hired directly by the homeowner. Domestic workers include full- or part-time employees. Some live in their employers’ residence, others in their own homes. Employers of domestic workers are still required to comply with the *OHS Act* and *OHS Regulation*.

Other Exempted Workers

In the *OHS Act*, a “worker” means a person engaged in an occupation. It includes

- persons who perform or supply services for no monetary compensation for an employer or organization (volunteers) and
- self-employed persons.

A worker does not include a student in learning activities conducted by or within an educational institution for which the student is not paid compensation, a non-waged worker or a family member employed on a farm or ranch.

Further, the *OHS Act*, *OHS Regulation* and *OHS Code* do not apply to federal government workers, or workers in federally-regulated industries such as banking, telecommunications, television and radio broadcasting, and interprovincial transportation. As an example, construction falls under provincial jurisdiction. Grain elevators are deemed to be for “the general advantage of Canada” and fall under federal jurisdiction. What happens when the grain elevator company hires a construction firm to build a new grain elevator? During the construction phase, construction workers are under provincial jurisdiction because construction falls under provincial jurisdiction.

Once the building is erected and grain personnel move in, the grain elevator is a federally regulated site and the employer must comply with the *Canada Labour Code*, Part II.

Table 1.1 provides an overview of workers under federal and provincial jurisdiction.

Table 1.1 Summary of industry sectors under federal and provincial jurisdiction

Federal Jurisdiction	Provincial Jurisdiction
<ul style="list-style-type: none"> ▪ Aeronautics Passenger/cargo airlines, aircraft maintenance companies, most airside operations such as baggage handlers and refuelers, security services for pre-board screening, e.g., Hudson General, PLH Aviation Services and Field Aviation ▪ Airside operations Air traffic control, e.g., NavCan 	<ul style="list-style-type: none"> ▪ Aircraft component manufacturers, retailers and restaurants at the airport Sky Chef, Canadian Turbine and United Technologies etc., food kiosks
<ul style="list-style-type: none"> ▪ Oil and Gas Pipelines Only pipelines that cross provincial or international boundaries are under federal jurisdiction (administered by the National Energy Board) 	
<ul style="list-style-type: none"> ▪ Pipeline Head Offices and Pipeline Employees and Compressor Stations ▪ Off shore drilling/production Falls within an aspect of shipping in Canadian waters (National Energy Board) 	<ul style="list-style-type: none"> ▪ Pipeline Construction & Maintenance Construction workers constructing the pipeline
<ul style="list-style-type: none"> ▪ Grain All grain elevators and most feed mills, flour mills, feed warehouses and seed cleaning mills are for the general advantage of Canada ▪ Martin Pet Foods, Landmark Feeds, Masterfeeds, etc. <ul style="list-style-type: none"> • Cargill – feed mill • Agricore elevators etc. 	<p>Retail service is separated from the elevator operations.</p> <ul style="list-style-type: none"> • Cargill meat processing • Agricore fertilizer operations, etc.
<ul style="list-style-type: none"> ▪ Federal Public Service and Government of Canada Crown Corporations i.e., HRSDC, Labour, Canada Post or CMHC etc. 	<ul style="list-style-type: none"> ▪ Provincial Public Service
<ul style="list-style-type: none"> ▪ A railway, canal, telegraph or other work or undertaking connecting any province with any other province, or extending beyond the limits of a province 	
<ul style="list-style-type: none"> ▪ Railroads CN, CP Rail, etc. 	<ul style="list-style-type: none"> ▪ Railroads ProCor, PDS Railcar Service, Central Western Railway, Stettler Short Line, etc.

Federal Jurisdiction	Provincial Jurisdiction
<ul style="list-style-type: none"> ▪ Road Transport, interprovincial trucking companies (common carriers) and their facilities (warehouse, maintenance garages) This includes bus/courier/moving companies and oilfield haulers that are common carriers or interprovincial trucking. ▪ Trucking Canadian Freightways, Tri-Line, SLH Transport, Jo-Ann Trucking (oilfield hauler), etc. 	<ul style="list-style-type: none"> ▪ Trucking Safeway – (Safeway and The Brick haul exclusively their own product unlike Tri-Line) etc.
<ul style="list-style-type: none"> ▪ Buses, Couriers Greyhound, Brewster, UPS, Purolator, etc. 	<ul style="list-style-type: none"> ▪ Buses, Couriers School buses and city buses, local couriers, bicycle couriers, etc.
<ul style="list-style-type: none"> ▪ Banks All chartered banks ▪ Bank of Canada, HSBC, Bank of Montreal, etc. 	<ul style="list-style-type: none"> ▪ Trust and Credit Union operations All trust companies and credit unions ▪ Alberta Treasury Branch, Calgary First, etc.
<ul style="list-style-type: none"> ▪ Telecommunications Telephone companies and most national paging companies ▪ Telus, Bell Canada, etc. 	<ul style="list-style-type: none"> ▪ Telecommunications Companies selling cellular devices, e.g., TAC Mobility, etc.
<ul style="list-style-type: none"> ▪ Broadcasting – jurisdiction determined respecting hertzian waves All radio, television and cable operations ▪ Shaw, Cogeco, City Cable, WIC Communications, etc. 	
<ul style="list-style-type: none"> ▪ First Nations Band employees and industries which benefit the band. 	<ul style="list-style-type: none"> ▪ First Nations Industries which do not benefit the band itself
<ul style="list-style-type: none"> ▪ Mining Uranium 	<ul style="list-style-type: none"> ▪ Mining All materials other than uranium

Section 2.2 Designated person to prepare plan

Where the *OHS Code* requires a “plan” to be prepared, this section requires that the plan be prepared by a person designated by the employer. This person must be competent in the principles and practices of the work described in the plan. The following is a list of the plans required by the *OHS Code*:

- health and safety plan (if required by Minister)—section 11;
- lead exposure control plan—section 41;
- emergency response plan for confined spaces—section 55;
- emergency response plan—sections 115, 116, 117, 118;
- fall protection plan—section 140;

- hot tap plan—section 170;
- training plan for noise management—section 221;
- various mine plans—sections 533, 556, 681, 682, 700, 745, 746, 747, 749.1, 752; and
- rope access safe work plan—sections 808, 809, 810, 812.

Section 3 Adoption of standards

This section lists all the standards referenced in the *OHS Code*. Doing so ensures that the requirements of the referenced standards can be enforced.

Section 3.1 Previous editions of referenced standards

Section 3.1 was created to eliminate the need to list all previous applicable editions of a standard referenced in the 2017 edition of the *OHS Code*. This section allows older equipment to have been approved to, or have met the requirements of, an earlier edition of a referenced standard. For example:

Full body harness

142(1) An employer must ensure that

- (a) a full body harness manufactured on or after Jan 1, 2017 is approved to
 - (i) CSA Standard CAN/CSA Z259.10-12, *Full Body Harnesses*,
 - (ii) ANSI/ASSE Standard Z359.1-2007, *Safety requirements for personal fall arrest systems, subsystems and components*, or
 - (iii) CEN Standard EN 361:2002, *Personal protective equipment against falls from a height—Full body harnesses*, and...

If it is still in good working condition, a full body harness approved to the 2006 edition of the CSA standard, the 1992 edition of the ANSI standard or the 1993 edition of the EN standard can remain in service. The full body harness does not need to be replaced with a full body harness approved to the newest edition of one of the standards listed in the example shown above.

Section 4 Transitional

Repealed

Section 5 Repeal

Repealed

Section 6 Coming into force

This section states the date on which the *OHS Code* comes into force (i.e., the effective date on which the requirements of the *OHS Code* must be met and as of which they can be enforced).

Part 2 Hazard Assessment, Elimination and Control

Highlights

- Section 7 requires employers to assess a work site and identify existing or potential hazards before work begins. Employers must prepare a report that provides the results of the assessment and specifies the methods that will be used to control or eliminate the hazards.
- Section 8 requires employers to involve workers in assessing, controlling and eliminating potential hazards.
- Section 9 requires employers to eliminate hazards whenever it is reasonably practicable to do so. If elimination is not reasonably practicable, hazards must be controlled
 - first by using engineering controls,
 - then administrative controls, and
 - as a last option, by using personal protective equipment.

Requirements

Section 7 Hazard assessment

Subsection 7(1) Identifying existing or potential hazards

A hazard is any situation, condition or thing that may be dangerous to the safety or health of workers. A hazard has the potential to cause an injury, illness or loss. Some people think of a hazard as “an accident waiting to happen.”

The purpose of the hazard assessment is to identify and evaluate those conditions that could lead to workers getting hurt or becoming ill. Injuries and ill health can ruin lives and affect an employer’s business if production is lost, machinery and equipment are damaged, insurance costs increase, or the employer is prosecuted.

Assessing hazards involves looking at what could harm workers at a workplace. The typical question to ask is “What could go wrong?” A hazard assessment takes into account the hazards specific to the work task being done. It also takes into account the potential for hazards at the work site to affect the worker performing the task, e.g., movement of vehicles, upset of stored materials, collapse of unsecured structures, collapse of earthen piles, etc.

The important things an employer needs to decide when assessing a worksite is whether a hazard is significant and whether satisfactory precautions have been taken so that the chances of worker injury are eliminated or made extremely unlikely.

Hazards specific to a particular job or worksite that are not explicitly addressed by the OHS Code should also be assessed by the employer if the hazards are relevant to the employer's operations. Examples include working at extreme temperatures and work-related fatigue.

Subsection 7(2) Written assessment

Putting the hazard assessment in writing moves it from a "what could go wrong?" walk-around-the-worksite approach to one that is more thorough and rigorous. Having the assessment in writing also proves it has been done.

When assessing hazards, an employer should keep the process simple. To comply with this subsection, the employer must be able to produce a written hazard assessment that applies to the worksite or work activities being reviewed. The assessment must indicate the methods used to eliminate or control the hazards identified.

Recommendations should be made to eliminate or control each of the hazardous conditions identified. The recommendations should include the specific actions required to correct the problem.

Completeness of assessment

An employer must be able to demonstrate that all existing and potential hazards have been identified. The hazard assessment need only include those hazards that apply, or are reasonably likely to apply, to the employer's operations. If confined space entry is never done, or respiratory protective equipment is never required because respiratory hazards are not present at the work site, then neither of these hazards is required as part of the employer's hazard assessment.

The size and scope of the written hazard assessment will vary based on the complexity of the employer's operations and the extent to which those operations present hazards to workers. The assessment may be only one page long or take up several binders. A single-page assessment is acceptable if it identifies all the existing or potential hazards at the employer's work site and describes how the hazards will be eliminated or controlled.

One hazard assessment for multiple work sites

A unique hazard assessment is not required for each work site. If an employer faces the same hazards at multiple work sites, and the safe work practices to be followed are identical at each work site, then a single hazard assessment applicable to all the work sites is acceptable.

The employer must ensure that the circumstances at a new work site do not differ significantly from those encountered at other work sites for which the hazard assessment was done. Doing so, perhaps through a walkabout and visual inspection, ensures that the results of the hazard assessment are valid for the new work site. If unexpected differences are discovered, then the employer is required to perform a hazard assessment that takes these new findings into account.

Hazard assessment tools

The employer's hazard assessment can be in any written format the employer chooses. The assessment must, however, identify the workplace hazards and indicate how those hazards will be eliminated or controlled. Figures 2.1 and 2.2 show examples of completed hazard assessment forms applicable to work sites that change very little over time. These examples meet the minimum requirements of the legislation. Employers and workers are encouraged to exceed this baseline level of hazard assessment where possible. Figure 2.1 applies to a small retail operation with limited hazards. Figure 2.2 considers the more complex example of a grocery store.

Figure 2.1 Example of completed hazard assessment for a small retail operation

		Date prepared:
Task	Hazards	Plans to eliminate or control the hazards
Restocking shelves and product displays	<ul style="list-style-type: none"> Products falling down Damaged shelves breaking 	<ul style="list-style-type: none"> Train workers Safety footwear worn by staff Inspect and repair/replace damaged shelves
Frequently lifting and carrying products	<ul style="list-style-type: none"> Back injuries, overuse injuries of the arms and shoulders 	<ul style="list-style-type: none"> Provide workers with carts, dollies, or hand trucks
Cleaning floors, washrooms, public areas	<ul style="list-style-type: none"> Working with unknown chemicals Chemicals contacting the skin, eyes 	<ul style="list-style-type: none"> Have safe use information [Material Safety Data Sheet (MSDS)] about each cleaning solution available at the workplace If necessary, have gloves and eyewear available for workers
Restocking storage rooms, moving around the workplace	<ul style="list-style-type: none"> Slipping and tripping 	<ul style="list-style-type: none"> Remove clutter and waste materials from walking areas Clean up spills that can make the floor slippery for walking
Working alone	<ul style="list-style-type: none"> Not having anyone to help in case of an emergency 	<ul style="list-style-type: none"> Employer will provide a telephone with which to contact the employer or emergency services
Other		
Other		

Figure 2.2 Example of completed hazard assessment for a grocery store

		Date prepared:
Task	Hazards	Plans to eliminate or control the hazards
Restocking shelves and product displays	<ul style="list-style-type: none"> Products falling down Damaged shelves breaking 	<ul style="list-style-type: none"> Train workers Safety footwear worn by staff Inspect and repair/replace damaged shelves
Frequently lifting and carrying products	<ul style="list-style-type: none"> Back injuries, overuse injuries of the arms and shoulders 	<ul style="list-style-type: none"> Provide workers with carts, dollies, or hand trucks
Cleaning floors, washrooms, public areas	<ul style="list-style-type: none"> Working with unknown chemicals Chemicals contacting the skin, eyes 	<ul style="list-style-type: none"> Have safe use information [Material Safety Data Sheet (MSDS)] about each cleaning solution available at the workplace If necessary, have gloves and eyewear available for workers Workers will be trained in WHMIS
Restocking storage rooms, moving around the workplace	<ul style="list-style-type: none"> Slipping and tripping 	<ul style="list-style-type: none"> Remove clutter and waste materials from walking areas Clean up spills that can make the floor slippery for walking
Working alone	<ul style="list-style-type: none"> Not having anyone to help in case of an emergency 	<ul style="list-style-type: none"> Employer will provide a telephone with which to contact the employer or emergency services
Using electrically powered equipment	<ul style="list-style-type: none"> Unsafe operation by worker Damaged cord or broken ground pin 	<ul style="list-style-type: none"> Train worker and closely supervise until competent Repair cords, inspect all equipment for damage

		Date prepared:
Task	Hazards	Plans to eliminate or control the hazards
Working in walk-in freezer	<ul style="list-style-type: none"> ▪ Getting locked inside ▪ Getting cold 	<ul style="list-style-type: none"> ▪ Check that door handle works perfectly before entering ▪ Ensure that workers wear proper gloves, apron, other clothing; limit time worked inside
Operating forklift truck	<ul style="list-style-type: none"> ▪ Unsafe operation by worker ▪ Forklift doesn't function properly 	<ul style="list-style-type: none"> ▪ Train worker and closely supervise until competent ▪ Maintain the forklift according to the manufacturer's instructions
Collecting shopping carts in the parking lot	<ul style="list-style-type: none"> ▪ Being struck by a motor vehicle 	<ul style="list-style-type: none"> ▪ Workers must wear high visibility vest
Working around equipment with rotating parts	<ul style="list-style-type: none"> ▪ Long hair and loose clothing getting caught in the rotating parts ▪ Fingers, hands or arms getting entangled in the rotating parts 	<ul style="list-style-type: none"> ▪ Workers should confine their hair and wear clothing that fits closely to the body ▪ Rotating parts should be enclosed by guards provided by the manufacturer
Meat-cutting operations	<ul style="list-style-type: none"> ▪ Cuts ▪ Heavy items falling on the feet ▪ Foreign objects in the eyes 	<ul style="list-style-type: none"> ▪ Workers could wear chain mail gloves, knives could be sharper ▪ Workers should wear shoes/boots with protective toe caps ▪ Workers may need to wear protective eyewear

		Date prepared:
Task	Hazards	Plans to eliminate or control the hazards
Cashiers at check-out	<ul style="list-style-type: none"> ▪ Cashiers experiencing leg, back and arm pain ▪ Chance of debilitating musculoskeletal injuries 	<ul style="list-style-type: none"> ▪ Install anti-fatigue matting at each check-out area ▪ Provide sit/stand work stools ▪ Rotate cashiers to other jobs in the store so that they can perform other duties ▪ Provide cashiers with more frequent, shorter breaks
Frequently lifting and carrying products	<ul style="list-style-type: none"> ▪ Back injuries, overuse injuries of the arms and shoulders 	<ul style="list-style-type: none"> ▪ Provide workers with carts, dollies, or hand trucks
Other		
Other		
Other		

Field level hazard assessment

At work locations where the activities and conditions change, employers and workers often rely on field level hazard assessments that are done on-the-spot frequently, e.g., construction sites, road building activities, brush control activities, outdoor work activities affected by weather conditions, etc. This form of hazard assessment is usually done at the beginning of a work day or when a new job is started. It should also be done when site conditions change.

Figure 2.3 shows a typical field level hazard assessment form (courtesy of the Construction Owners Association of Alberta [COAA]). Figure 2.4 serves as an example of how the form could be filled out for a business involved in the delivery of building supply materials to a work site.

Safe work permits

A safe work permit (see Figure 2.5) can also function as a site-specific, task-specific hazard assessment form. All hazards relevant to the task being performed, and hazards relevant to the work area in which the work is being performed, must be identified on the work permit. Because all potential hazards can rarely be anticipated when the work permit is printed, the work permit should include a blank area where a worker can include “other” hazards that need to be eliminated or controlled.

Checklists

Checklists are a popular tool often used when performing hazard assessments. A checklist serves as a memory cue, directing the person or team performing the assessment to look at specific hazards. On the negative side, checklists are sometimes too easy. An assessor may simply check off each box without actually considering each of the listed hazards and determining realistic ways of eliminating or controlling the hazards.

The notes and comments prepared by the assessor need to be as specific as possible, especially when referring to a particular hazard. If a guard has been removed from a machine, the exact machine must be identified so that there is no confusion about what must be done to which machine.

Because all potential hazards can rarely be anticipated when the checklist is printed, the checklist should include a blank area where a worker can include “other” hazards that need to be eliminated or controlled.

Figure 2.3 Example of field level hazard assessment form

FIELD LEVEL HAZARD ASSESSMENT		Company Name:	
Work to be done:			Date:
Task location:	Emergency meeting location:	Permit Job #:	

Identify and Prioritize the task and hazards below, then identify the plans to eliminate/control the hazards

Tasks	Hazards	Plans to Eliminate/Control
Require Gloves to be Removed Yes <input type="checkbox"/> No <input type="checkbox"/>		Warning ribbon needed? Yes <input type="checkbox"/> No <input type="checkbox"/>
Is the worker working alone? Yes <input type="checkbox"/> No <input type="checkbox"/>	If Yes, explain	
Job Completion		
Are all Permit(s) closed out? Yes <input type="checkbox"/> No <input type="checkbox"/>	Are there Hazards remaining: Yes <input type="checkbox"/> No <input type="checkbox"/> (if Yes, explain)	
Was the area cleaned up at end of job/shift? Yes <input type="checkbox"/> No <input type="checkbox"/>		
Were there any incident/injuries? Yes <input type="checkbox"/> No <input type="checkbox"/>	If Yes, explain	

Please print and sign below (all members of the crew) prior to commencing work and initial when task is completed or at the end of the shift

Worker Name and Signature (below)

Foreperson's Name & Signature: _____
(sign upon reviewing completed card)

All Names and Signatures should be legible

Reviewed by Name & Signature: _____

Figure 2.4 Example of completed field level hazard assessment form

FIELD LEVEL HAZARD ASSESSMENT		Company Name: <i>Tim's Building Supply Company</i>
Work to be done: <i>Deliver new doors to home</i>		Date: <i>date assessment completed</i>
Task location: <i>24 Foxglove Avenue</i>	Emergency meeting location: <i>front of house</i>	Permit Job #: <i>Order 245</i>

Identify and Prioritize the task and hazards below, then identify the plans to eliminate/control the hazards

Tasks	Hazards	Plans to Eliminate/Control
<i>Deliver new doors to main door of house</i>	<i>1. getting from sidewalk to house – no walkway</i>	▪ <i>Clear route or ask for wooden walkway</i>
	<i>2. getting up ramp – ramp made of scrap wood, doesn't have any cross braces</i>	▪ <i>Ask framers to widen ramp and add cross braces</i>
	<i>3. possible opening in floor</i>	▪ <i>Make sure that openings are covered or guarded</i>
	<i>4. trench in yard</i>	▪ <i>Make sure that route to the house avoids going near the trench</i>
		<i>If site crew unwilling to help, call supervisor for help</i>
Require Gloves to be Removed Yes <input type="checkbox"/> No <input type="checkbox"/> <i>NA</i>	Warning ribbon needed? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>Beside trench</i>	
Is the worker working alone? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	If Yes, explain	
Job Completion		
Are all Permit(s) closed out? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>NA</i>	Are there Hazards remaining: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (if Yes, explain)	
Was the area cleaned up at end of job/shift? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>NA</i>		
Were there any incident/injuries? Yes <input type="checkbox"/> No <input type="checkbox"/>	If Yes, explain	

Please print and sign below (all members of the crew) prior to commencing work and initial when task is completed or at the end of the shift

Worker Name and Signature (below)

Foreperson's Name & Signature: *Lyle Moffat*
(sign upon reviewing completed card)

Corona Richards

All Names and Signatures should be legible

Reviewed by Name & Signature: *Lyle Moffat*

Figure 2.5 Example of safe work permit

SAFE WORK PERMIT										Work Order No. _____		
Persons issuing or receiving plant Safe Work Permits must understand the procedures for issuing and receiving permits and must fully realize their responsibilities in this phase of plant operations.												
Date Issued:		Time Issued:		GOOD ONLY FOR DATE OF ISSUE								
Department:		Building:										
Description of Work To Be Done:												
Department or Contractor Doing Work:												
Person in Charge of Work:												
(Note: In the following, check Yes, No, or Not Applicable [N/A])										YES	NO	N/A
1. Have process materials (liquid, gas) been removed from the equipment?												
2. Has the equipment been cleaned by:												
(a) Steaming?												
(b) Flushing with water?												
(c) Inert gas purging?												
(d) Air ventilation?												
3. Has the necessary equipment been adequately protected by:												
(a) Blanking/Blinding off?												
(b) Double Block and Bleed?												
(c) Disconnecting?												
(d) Draining and venting?												
4. Have all electrical switches been locked out?												
5. Is there an adequate supply of fresh air?												
6. Is it permissible to use:												
(a) Open flame/welding equipment?												
(b) Electrical equipment/tools?												
(c) Gasoline, propane or diesel driven equipment?												
7. Can sparks ignite material around or below this level?												
8. What fire protection is necessary?												
(a) Fire extinguisher Dry Chem <input type="checkbox"/> CO ₂ <input type="checkbox"/> H ₂ O <input type="checkbox"/>												
(b) Firewatch												
(c) Other (Specify)												
9. Have precautions been taken against radioactivity?												
10. Do atmospheric conditions and wind direction permit safe work near vents?												
11. Does this work involve asbestos?												
12. Has the confined space or vessel been prepared for safe entry?												
13. Is a gas test necessary?												
Frequency: Per Shift <input type="checkbox"/> Per Hour <input type="checkbox"/> Continuous <input type="checkbox"/> Type of Gas Testing Equipment										MX-241 <input type="checkbox"/> Gas Techtor <input type="checkbox"/>		
Time	Explo Gas %	O ₂ %	CO ppm	CO ₂ %	H ₂ S ppm	NH ₃ ppm	SO ₂ ppm	Other (Specify)	Gas Tester's Signature			
14. Identify materials normally in equipment												
(a) Toxic: (b) Flammable: (c) Corrosive: (d) Other (describe):												
15. What personal protective equipment is required? (Specify)												
(a) Type of eye protection:												
(b) Type of protective clothing:												
(c) Type of respiratory protection:												
(d) Type of ear protection:												
Other (Specify):												
Other hazards or special instructions:												
THE PERMIT RECEIVER ACKNOWLEDGES THAT HE WILL INFORM ALL PERSONNEL WORKING UNDER THE AUTHORITY OF THIS PERMIT OF ALL INFORMATION CONTAINED HEREIN.												
Permit issued by:				Job Title:				Time:				
Permit received by:				Job Title:				Time:				
Work Completed by:				Job Title:				Time:				
Process Completed by:				Job Title:				Time:				
The following person(s) acknowledges that this job is in progress during shift change and has checked both the permit and the nature of the job and understands the precautions to be followed:												
Supervisor Signature:				Time:				Shift:				
Supervisor Signature:				Time:				Shift:				
DISPLAY AT WORKPLACE – MAINTENANCE COPY										Permit NO:		

Subsection 7(3) Date of hazard assessment

The hazard assessment report must be dated to confirm when it was completed and how current it is.

Subsection 7(4) Assessment intervals

This subsection requires that after the initial assessment, further assessments are performed as follows.

- (a) *At reasonably practicable intervals to prevent the development of unsafe and unhealthy working conditions.*

Hazard assessments should be performed periodically, even when nothing has changed. Doing so confirms that workers are continuing to follow correct procedures and that equipment is in proper working condition. Assessments should be done at intervals that anticipate problems before the safety and health of workers is affected.

- (b) *When a new work process is introduced.*

A new work process may involve the use of new materials, chemicals, equipment, etc., with which workers are unfamiliar. A change of work process may introduce new and unexpected hazards. These must be identified and controlled in addition to those initially addressed.

- (c) *When a work process or operation changes.*

The introduction of a new process, operation or piece of equipment could influence the results of a previous hazard assessment or make it meaningless. Removing the automatic feeder to a table saw for example, may increase worker exposure to the hazard of the spinning blade, affecting the outcome of the hazard assessment.

- (d) *Before the construction of significant additions or alterations to the work site.*

Assessing hazards in this case tries to anticipate potential problems and prevent those problems from being built into the work site. It is often far less expensive to eliminate problems at the design stage than to modify the work site later to eliminate or control a hazard.

Once new controls are implemented, the job or work should be reviewed to make sure that the hazard(s) has been eliminated or controlled. This is a check to make sure that the controls work as they should and that the controls do not create additional new hazards.

In the case of an employer whose operations change very little over time, the findings of the initial hazard assessment may not change for an extended period of time.

Nonetheless, as stated in (a) above, a re-assessment should be performed at some time, even if it is after an extended period of time.

Section 8 Worker participation

Subsection 8(1) Worker involvement

The purpose of this requirement is to encourage employers to involve workers in hazard assessment, elimination, and control activities. Workers are often very knowledgeable about the tasks or processes being assessed, and can be directly affected by the hazard elimination and control activities. Workers often have more insight into a task or process than persons who only observe the completed work.

To demonstrate compliance with this requirement, the employer should be able to indicate which workers were meaningfully involved and to what extent. Workers should be able to confirm their involvement in the assessment, elimination, and control activities.

Involving workers can

- (a) increase the number of persons available to perform assessments, spreading out the work into manageable pieces,
- (b) teach them how to recognize hazards, increasing the likelihood that the hazards will be quickly corrected, and
- (c) increase their awareness of, and involvement in, health and safety issues at the work site.

To be successful, workers must know ahead of time what is expected of them and be given the training they will need to do the job effectively.

Section 9 Hazard elimination and control

Subsection 9(1) Eliminate or control

Whenever possible, hazards should be eliminated or controlled at their source—as close to where the problem is created as possible—using engineering solutions. If this is not possible, controls should be placed between the source and workers. The closer a control is to the source of the hazard the better. If this is not possible, hazards must be controlled at the worker level.

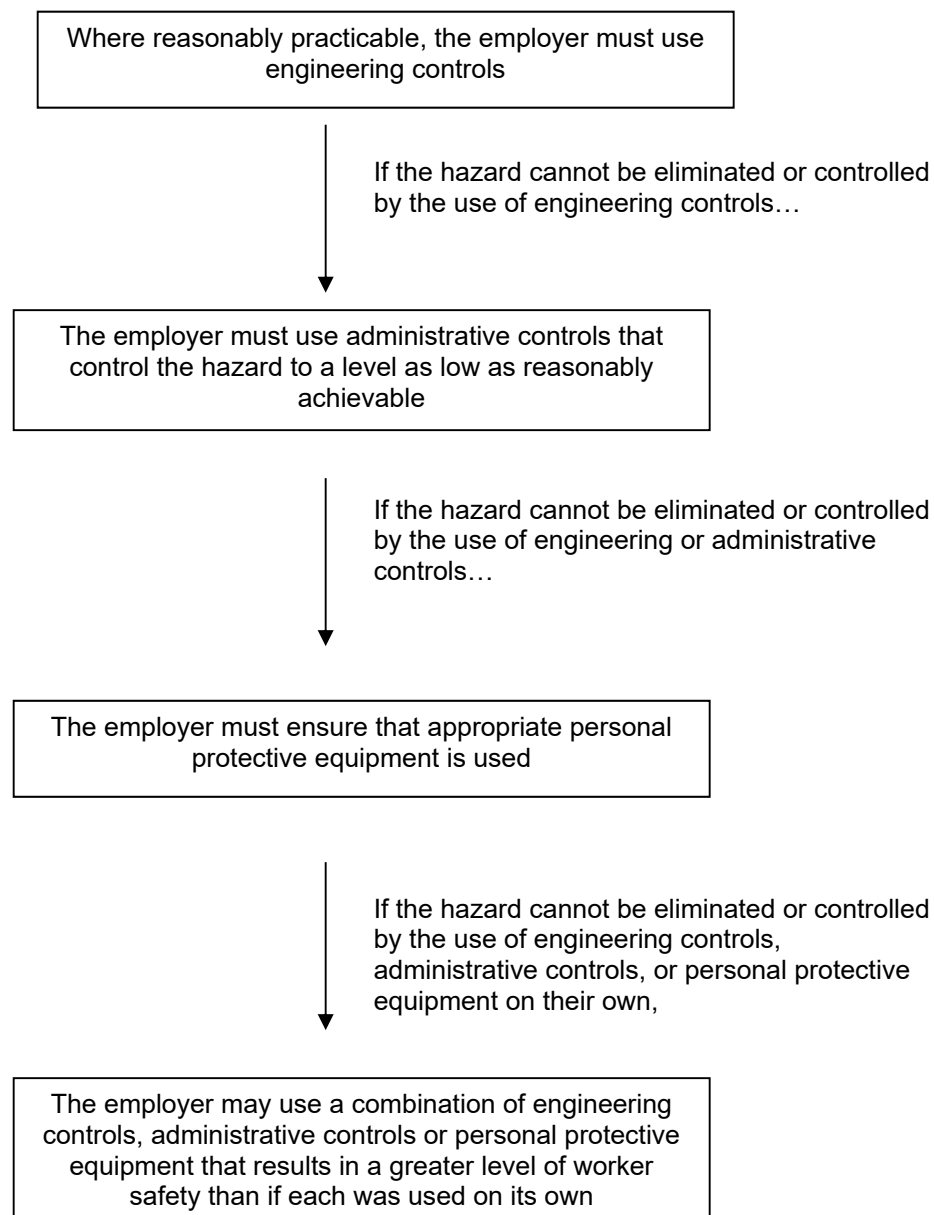
Administrative controls and personal protective equipment (PPE) control hazards at the level of the worker. These control methods reduce the likelihood and severity of worker injury but do not eliminate the hazard. A combination of several hazard control approaches may be necessary in some situations (see Figure 2.6).

Whatever control method is used, it should attack the source of the hazard, not the outward signs that it produces, e.g., the noise, vibration, fumes, exhaust, etc. For example, it is better to replace, redesign, isolate or quiet a noisy machine than it is to provide workers with hearing protection.

In complying with this subsection, the employer should be able to describe which hazards identified by the hazard assessment have been eliminated or controlled. The employer should be able to justify the appropriateness of the hazard controls used. All reasonably practicable steps should have been taken to first eliminate the hazard.

For the remaining hazards, particularly those being controlled by the use of personal protective equipment, the employer should be able to explain why those hazards could not practicably be eliminated.

Figure 2.6 Hazard elimination or control flow chart



Subsection 9(2) Engineering controls

Engineering controls provide the highest degree of worker protection because they eliminate or control the hazard at its source. Engineering controls are the preferred method of eliminating or controlling hazards.

Engineering controls include the following.

Elimination—getting rid of a hazardous job, tool, process, machine or substance may be the best way of protecting workers. Examples include:

- using material handling equipment rather than have workers lift, lower, carry, etc. materials manually;
- eliminating the need to elevate persons or objects above ground level.

Substitution—if elimination is not practical, try substituting or replacing one substance or process with another. Examples include:

- substituting a safer substance for a more hazardous one;
- replacing hazardous operations with less hazardous operations.

Redesign—hazards can sometimes be “engineered out” through redesign of the work site, workstations, work processes and jobs. Examples include:

- providing fail-safe interlocks on equipment, doors, valves, etc.;
- installing guardrails around elevated work areas;
- providing non-slip working surfaces;
- controlling traffic to avoid collisions.

Isolation—hazards can sometimes be isolated through containment or enclosure.

Examples include:

- negative-pressure fume hoods in laboratory settings;
- sound reducing enclosures for noisy equipment.

Automation—some processes can be automated or mechanized. Examples include:

- spot welding by industrial robots;
- assembly line operations that require repetitive manual handling by workers.

Subsection 9(3) Administrative controls

If engineering controls cannot eliminate or control a hazard, administrative controls can be used to control the hazard to a level that is as low as reasonably achievable.

Administrative controls are less effective than engineering controls since they do not eliminate the hazards. Examples include:

- safe work practices, job procedures, policies, rules—safe work procedures describe how to correctly perform a job from start to finish;
- work/rest schedules to reduce worker exposure to hazardous substances or conditions;
- limiting hours of work;

- scheduling hazardous work during times when exposure of other workers is limited;
- wet methods as opposed to dry sanding or sweeping.

Subsection 9(4) Personal protective equipment

As a last resort, workers may need to use personal protective equipment (PPE) to reduce the potentially harmful effects of exposure to a known hazard. PPE is much less effective than engineering controls because it does not eliminate the hazards.

PPE must be used properly and consistently to be effective. Awkward or bulky PPE may prevent a worker from working safely. In some cases, PPE can increase the likelihood of hazards such as heat stress and tripping and falling.

Examples of PPE commonly used include:

- safety eyewear, hard hats and safety boots;
- hearing protection if workers are exposed to noise that exceeds allowable levels;
- respiratory protective equipment to protect the lungs against harmful dusts and vapours.

Subsection 9(5) Combination of control methods

The control of some hazards requires the combined use of all three control methods to reduce the hazard to the lowest level practicable or achievable. Employers are not restricted to a single approach if using a combination achieves a greater level of worker safety than if only one approach was used.

Section 10 Emergency control of hazard

Subsection 10(1) Competent workers, minimize number

This section applies in situations where emergency action is required to control or eliminate a hazard that is dangerous to the safety or health of workers. Only those workers competent in correcting the hazardous condition may be exposed to the hazard. The number of these exposed workers must be kept to a minimum—as few as is necessary to correct the condition. The employer must make every possible effort to control the hazard while this is being done.

As an example, a piping system in a building fails, releasing a toxic gas. Twelve workers are at the work site, six of whom are trained in the use of self-contained breathing apparatus and are capable of initiating a repair or shutdown. Of these six competent workers, only three are required to actually perform the repair or shutdown. As a result, only three of the 12 workers are allowed to enter the building and be exposed to the hazard. Prior to and during the entry, every possible effort must be made to reduce the flow or production of gas before it reaches the building, and to limit exposure to other workers in the vicinity of the building.

Subsection 10(2) Emergency response

This subsection reflects the practical reality that during an emergency response, it is impractical (and may be impossible) to prepare a written hazard assessment report. The subsection waives an employer's obligation to comply with subsections 7(2) and 7(3) during the period that emergency action is required.

For more information



Formal Hazard Assessment Template—Alberta Labour

<https://ohs-pubstore.labour.alberta.ca/formal-hazard-assessment-and-control-template>



Prevention and Control of Hazards—Canadian Centre for Occupational Health and Safety

www.ccohs.ca/oshanswers/prevention/



Hazard Assessment and Control: a handbook for Alberta employers and workers

<https://ohs-pubstore.labour.alberta.ca/greyscale-version-hazard-assessment-and-control-a-handbook-for-alberta-employers-and-workers>



Five steps to risk assessment

www.hse.gov.uk/pubns/indg163.pdf

Part 3 Specifications and Certifications

Highlights

Part 3 establishes the importance of manufacturer's specifications and of specifications certified by a professional engineer.

Requirements

Section 12 Following specifications

The employer must ensure that equipment is adequate for the job. The equipment must be of sufficient size, strength, design and made of material that can withstand the stresses created during work. Whenever there is a question about how equipment is to be used, maintained, operated, etc., the answer should be found in the manufacturer's specifications or specifications certified by a professional engineer.

The term "manufacturer's specifications" is defined in the *OHS Act* and refers to written specifications, instructions or recommendations that describe how the equipment is to be used, maintained, operated, etc. Equally effective are specifications certified by a professional engineer, meaning that the specifications are signed and stamped by a professional engineer recognized by the Association of Professional Engineers and Geoscientists of Alberta (APEGA). The author of the specifications, be it the manufacturer or a professional engineer, is considered to know the equipment best.

If an Occupational Health and Safety Officer is in doubt as to whether an employer is in compliance regarding the adequacy, performance or activity of an item of equipment, the officer may request a copy of the manufacturer's specifications or specifications of a professional engineer. After reviewing the specifications, the officer should be able to reasonably judge whether the employer is in compliance with this section.

Section 12.1 Following specifications on a farm and ranch

The employer of farm and ranch operations must ensure that equipment is adequate for the job. The equipment must be of sufficient size, strength, design and made of material that can withstand the stresses created during work. Whenever there is a question about how equipment is to be used, maintained, operated, etc., the answer should be found in the manufacturer's specifications.

The term "manufacturer's specifications" is defined in the *OHS Code* and refers to written specifications, instructions or recommendations that describe how the equipment is to be used, maintained, operated, etc. Where manufacturer's specifications are not available, the employer of farming and ranching operations may have a person

that is competent or a service provider that is competent provide written specifications for the purposes of sections 12(b), (c) and (d) of the *OHS Code*.

If an Occupational Health and Safety Officer is in doubt as to whether an employer is in compliance regarding the adequacy, performance or activity of an item of equipment, the officer may request a copy of the manufacturer's specifications or written specifications of the person that is competent or service provider that is competent. After reviewing the specifications, the officer should be able to reasonably judge whether the employer is in compliance with this section.

Section 13 Manufacturer's and professional engineer's specifications

Subsection 13(1)

Although the employer is required to comply with the manufacturer's specifications, this subsection provides the employer with the flexibility to modify those specifications. This may result in the equipment being used in applications other than those originally intended by the manufacturer. A large power drill for example, may be fitted with a gear reduction mechanism and used as a hoisting mechanism on a swingstage.

A professional engineer must certify such modifications. The engineer providing the certification is responsible for ensuring that the equipment continues to be safe to use, maintain, operate, etc., according to the modified specifications. The subject matter of the specifications must be within the engineer's scope of practice.

Subsection 13(2)

In some instances, the employer will not be able to follow the manufacturer's specifications as required in the *OHS Code* because the manufacturer's specifications are not available or do not exist. The employer is offered two alternatives:

- (a) have written procedures certified by a professional engineer. The procedures must be specific to the equipment and ensure the equipment will be safe for use. The procedures must also include all the essential ingredients of a typical manufacturer's specifications, such as limitations and controls to be applied by the operator. The employer must comply with these procedures, or
- (b) have the equipment certified as safe to operate by a professional engineer at least every 12 calendar months.

Subsection 13(3)

In some instances, the employer will not be able to follow the manufacturer's specifications as required in the *OHS Code* because the manufacturer's specifications are not available or do not exist. The employer of farming and ranching operations is

offered three alternatives instead of providing the certification required by Section 13(1) and 13(2):

- (a) have a person that is competent or a service provider that is competent provide modified written specifications;
- (b) have a person that is competent or a service provider that is competent provide written safe work procedures. The procedures must be specific to the equipment and ensure the equipment will be safe for use. The procedures must also include all the essential ingredients of a typical manufacturer's specifications, such as limitations and controls to be applied by the operator; or
- (c) have a person that is competent or a service provider that is competent state in writing that the equipment is safe to operate. The employer must ensure that the equipment is reevaluated where modifications, deterioration or damages to the equipment could affect the safe use of the equipment.

Section 14 Certification by a professional engineer

This section describes what is meant by the phrase "certified by a professional engineer." The certification must be in writing, be signed and stamped, and ensure the safety of workers who may be affected by it.

This section only applies where a section of the *OHS Code* requires that procedures or specifications be certified by a professional engineer.

Section 15 Approved equipment

Equipment requiring approval from a standards setting, certifying or approving organization normally has the organization's seal, stamp, logo or identifying mark affixed to the equipment. The presence of one of these markings indicates the equipment has been certified or approved by the organization. The marking can then be used as evidence of compliance with the applicable standard referenced in the *OHS Code*. Readers are referred to section 3.1 for additional information.

Because some types of equipment are used and operated under harsh conditions, the markings can fade, chip, wear off or otherwise become illegible. Recognizing this, and the fact that the organizations listed above do not provide markings except at the time of equipment certification or approval, employers are required to use their "best efforts" to retain equipment markings. Markings should be protected to remain legible for as long as possible. Where this is not possible, original documentation referring to the equipment's certification or approval may be accepted.

Part 4 Chemical Hazards, Biological Hazards and Harmful Substances

Highlights

- Occupational exposure limits (OELs) are based largely on the 2006 American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for Chemical Substances.
- Section 16 prohibits a worker being exposed to a chemical substance at a concentration exceeding its ceiling limit at any time and to a concentration that is immediately dangerous to life and health.
- Section 18 requires employers to ensure that OELs are adjusted for work shifts longer than eight hours.
- Section 20 recognizes alternate analytical methods for the measurement of exposure concentrations.
- Sections 21 and 22 require employers to assess worker exposure to harmful substances and sets monitoring requirements.
- Section 26 requires employers to prepare a code of practice governing the storage, handling, use and disposal of any substance present at a work site that is listed in Table 1 of Schedule 1. (Section 8 of the *OHS Regulation* requires that procedures specified by a code of practice be in writing and available to workers).
- Sections 28 through 43 provide rules regarding asbestos, silica and coal dust.
- Section 37 requires that employers ensure asbestos workers working in restricted areas have successfully completed an approved asbestos course.
- Section 39 allows employers to use crystalline silica for abrasive blasting. However, the employer must, if reasonably practicable, ensure that crystalline silica is replaced with a less harmful substance.

Requirements

Section 16 Worker exposure to harmful substances

This section requires an employer to ensure that worker exposure to a harmful substance is kept as low as reasonably practicable/reasonably achievable and does not exceed the substance's OELs. This is based on the principle that for each substance there

is a safe or tolerable level of exposure below which no significant adverse health effects are likely to occur. Many factors affect total exposure, including

- (a) the potential for absorption into the body by inhalation, ingestion or skin absorption,
- (b) the duration of exposure, and
- (c) the effect of simultaneous exposure to multiple substances.

The *OHS Act* requires that employers ensure, as far as it is reasonably practicable to do so, the health and safety of workers at their work site. In this section, the term “reasonably achievable” is used. Understanding of the term reasonably achievable comes from the *Canadian Nuclear Safety Commission Regulatory Guide* (2004, for “*Keeping Radiation Exposures and Doses as Low as Reasonably Achievable* [ALARA]).” Though the term reasonably achievable has not been given definite meaning by the Canadian court system, it is generally accepted in industry and by regulators to encompass the same considerations as the concept of “reasonably practicable.”

Reasonably practicable is a concept used by the courts and is assessed using the “reasonable person test.” This test asks what a dozen of your peers, e.g., twelve workers with equal qualifications and experience, would consider reasonable in a similar set of circumstances. The persons would likely review what happened and compare it against what they do in their own operations. Some of them might do more, others less. The result would be a balanced and wise judgment that could be defended to others. Reasonably practicable is a term that has been tested in the courts and supports a high standard of effective workplace protection for workers.

Factors that might be considered when evaluating exposure to a harmful substance include

- What is common practice in other workplaces that use the substance or process? Are exposure levels at the workplace similar to those at other workplaces that use the substance or process?
- Has the employer assessed whether exposure can be eliminated by substitution with a less toxic substance or other control measures? If these measures have not been implemented, what is the rationale for not doing so?
- Are workers exposed to multiple substances at the workplace that may have synergistic, potentiating or additive effects?
- Are workers experiencing adverse health effects even though exposure may be at or below the OELs?

The *OHS Code* requires that exposure be kept as low as reasonably practicable or reasonably achievable where there are harmful substances used in the workplace for which there are currently no OELs. Employers determining safe levels of exposure in such circumstances should consult other jurisdictions and organizations as well as the product manufacturer to obtain guidance on safe exposure limits. For example, the American Industrial Hygiene Association publishes Workplace Environmental Exposure Levels (WEELs) for a wide variety of substances. Section 60 of the *OHS Act* allows an

occupational health and safety officer to enforce an exposure limit from another jurisdiction or organization if there is no OEL.

The three main routes of entry of a substance into the body are

- (1) inhalation—by being inhaled;
- (2) dermal—by being absorbed through the skin; and
- (3) oral—by being swallowed.

Inhalation is the most common route of entry. Most exposure standards, including the OELs, are based on exposure resulting from the inhalation of substances suspended in air, either as a gas, vapour or aerosol such as dust, mist or fume.

Another way substances enter the body is absorption through the skin. The amount of chemical absorbed through the skin depends on the chemical and it is important to take this into consideration when determining exposure. Substances for which exposure via skin absorption is a potentially significant route of exposure have the designation “2” in the substance interaction column in Schedule 1, Table 2.

Oral exposure or ingestion usually occurs by accident through the contamination and subsequent ingestion of food or materials that come into contact with the mouth. Contaminants can also be ingested through hand-to-mouth contact such as nail biting or hand contamination of food or smoking materials.

Individual susceptibility to adverse effects from exposure to substances varies widely. A small percentage of workers may feel discomfort at or below the OEL. The OEL should not be used as a fine line between safe and unsafe conditions or as an index of relative toxicity. Some workers may be affected more seriously due to aggravation of a pre-existing condition or by development of an occupational illness. In addition, some individuals are extremely sensitive to certain industrial chemicals due to genetic factors, personal habits such as smoking or alcohol use, the use of drugs or medications, pre-existing health conditions or previous exposure. These workers may not be adequately protected from adverse health effects resulting from exposure to substances that are at concentrations at or below their OEL. The extent to which these workers need more protection should be evaluated by an occupational physician.

Compliance in cases of short-term excursions

Short term exposure limits are concentrations of a substance to which it is believed that most workers may be exposed for a short period of time without suffering from adverse health effects such as irritation and chronic or irreversible tissue damage. The worker also should not be physically impaired to a degree that could increase the likelihood of accidental injury, impair self-rescue or reduce work efficiency. It is not a separate exposure limit. It supplements the 8-hour OEL.

Employers must comply with the following rules on short-term excursion limits:

- (a) worker exposure measured over any 15-minute period must not exceed the 15-minute OEL. Worker exposure to a substance measured over successive 15-minute periods, at a concentration above its 8-hour OEL, but at or below its 15-minute OEL, must not happen more than four times per day. There must be at least 60 minutes between successive exposure periods in this concentration range and the 8-hour OEL may not be exceeded for the work shift;
- (b) worker exposure must never exceed ceiling levels which are denoted in Table 2 of Schedule 1 by a "c." Ceiling limits can be measured using a direct reading instrument such as a colorimetric detector tube or an instrument with a diffusion controlled sensor which effectively averages measurements over approximately 1 minute; and
- (c) if there is no 15-minute or ceiling OEL listed for a substance, the 8-hour OEL may not be exceeded and the "3X and 5X" rule applies. A worker must not be exposed to 3 times the 8-hour OEL for more than a total of 30 minutes during a continuous 24-hour period and 5 times the 8-hour OEL at any time. However, in no case can the immediately dangerous to life and health (IDLH) concentration be exceeded.

As defined in Part 1 of the *OHS Code*, IDLH means "circumstances in which the atmosphere is deficient in oxygen, or the concentration of a harmful substance in the atmosphere

- (i) is an immediate threat to life,
- (ii) may affect health irreversibly,
- (iii) may have future adverse effects on health, or
- (iv) may interfere with a worker's ability to escape from a dangerous atmosphere."

Some materials, e.g., hydrogen fluoride gas and cadmium vapour, may produce immediate transient effects that, if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12 to 72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately dangerous to life and health."

IDLH concentrations are described in NIOSH publication NTIS Publication No. PB-94-195047: *Documentation for Immediately Dangerous to Life or Health Concentrations (IDLH)*, May 1994. This publication documents the criteria and information sources that have been used by NIOSH to determine immediately dangerous to life or health concentrations.

Section 17 Exposure to multiple substances

Workers are often exposed to a mixture of chemicals rather than a single substance. However, exposure standards or limits are usually based on information, testing or experience from exposure to a single chemical rather than a mixture of chemicals. The resulting biological effects of exposure to multiple chemicals is rarely known.

The combined effects of chemicals are commonly described as follows:

- (a) *Independent*—the toxicity of each substance is produced by independent mechanisms and/or the substances act on separate organs or systems within the body. Independent substances create their own toxic effects without influence or interference from one another.
- (b) *Additive*—substances with similar toxicity produce a response that is equal to the sum of the effects produced by each of the individual substances acting alone.
- (c) *Antagonistic*—the toxicity of one chemical is reduced by exposure to another chemical.
- (d) *Potentiating*—a substance does not have a toxic effect on a certain organ but when combined with exposure to another substance, the first substance becomes much more toxic.
- (e) *Synergistic*—two substances act together to produce toxic effects that are greater than the effects produced by either substance alone.

In evaluating the impact of exposure to more than one chemical at a time, materials acting independently can be evaluated independently. Where the potential for synergistic or potentiating effects are suspected, this enhancement of toxic effect must be reflected in the allowable exposure. There is no model for adjustment of exposure limits to account for synergistic or potentiating effects. The easiest solution is to avoid the effect by finding a substitute for one or more of the chemicals involved. In occupational settings, antagonistic effects are not used as a basis for decreasing exposure limits.

Where chemicals are known to have additive effects, the equation provided in this section allows the employer to determine whether the OEL is being exceeded. To prevent overexposure, the sum of the standardized exposures must not exceed the value "1." A mixture of xylene and toluene is an example of two substances that produce additive effects; a mixture of xylene and asbestos is an example of two substances that produce independent effects. The equation can be used in the first example, not in the second.

Section 18 Exposure during shifts longer than 8 hours

The amount of time a worker is exposed to a substance has a large effect on the total amount of material absorbed by the body. Non-traditional work schedules have become more common in the workplace. There is an increasing trend towards longer workdays with more days off between shifts. Many continuous process operations such as chemical manufacturing, oil refining, steel processing, oil and gas exploration and paper processing require two or three shifts in a 24-hour period to accommodate continuous production. Workers may routinely work overtime during periods of heavy demand. A second job may also result in workers being exposed to chemicals for extended periods.

OELs are based on the assumption that exposure occurs over an 8-hour period, following which the body is no longer exposed, but allowed to recover for the next 16 hours. When work shifts exceed 8 hours, these assumptions no longer hold true and the worker could be at increased risk of exposure. Although limits can be adjusted downward to accommodate longer periods of exposure, limits cannot be adjusted upwards to accommodate shorter periods of exposure. Numerous substances listed in Table 2 of Schedule 1 appear with the number “3” in the “Substance Interaction” column. For these substances, occupational exposure limits do not need to be adjusted to compensate for unusual work schedules.

The risk of an increased exposure to certain chemicals (body burden) has been recognized and several models have been proposed to modify the 8 hours per day, 40 hours per week standard to a “non-standard” workday. The intent of the models is to maintain the same overall body burden yet preserve the same margin of safety as the original standard. The Brief and Scala model used in this section is the simplest and most conservative model. It compensates for unusual work schedules by reducing the permissible concentration in proportion to both the increase in exposure time and the reduction in recovery time.

The employer may use other models to adjust exposure time as long as the models have been developed using recognized scientific principles approved by a Director of Occupational Hygiene. A Director of Occupational Hygiene is a staff member, of the Government of Alberta, appointed by the Minister under section 42 of the *OHS Act*. It is recommended that a competent person be consulted to ensure that the adjustment method is appropriate and applicable since many models are theoretical and contain assumptions that may not apply to every chemical and work environment.

An understanding of the chemical is required and caution must be taken when limited toxicity data is available, the toxic effect is serious, or the chemical accumulates in the body following repeated exposure. The Director of Occupational Hygiene may accept alternate methods through the acceptance process. To obtain an acceptance from the Director, the employer must show that

- (a) the method is appropriate for the substance(s) used at the workplace; the employer will need to provide justification and a rationale for use of the particular method, and
- (b) if the exposure is to more than one substance, possible potentiating and synergistic effects have been taken into account when applying the method.

Section 19 Review of exposure limits

Requests to review a specific occupational exposure limit should be sent to a Director of Occupational Hygiene at the following address:

Director of Occupational Hygiene
Labour Building
8th Floor, 10808-99 Avenue
Edmonton, AB T5K 0G5
e-mail address: lbr.ohsaccept@gov.ab.ca

Section 20 Airborne concentration measurements

NIOSH and alternate methods

The measurement of exposure concentrations at the workplace is important since compliance with the OELs is based on comparing measured levels with those specified in the *OHS Code*. The adoption of OELs by the *OHS Code* reflects the fact that there are valid, tested and reproducible methods for the collection and analysis of the substances involved. Small errors or departures from accepted methods can have a large impact on worker exposures and the costs of compliance.

Revisions to this section of the *OHS Code* allow for the use of methods developed by seven agencies:

- (1) National Institute of Occupational Safety and Health—NIOSH
- (2) Occupational Safety and Health Administration (United States)—OSHA
- (3) Health and Safety Executive (Great Britain)—HSE
- (4) Environmental Protection Agency (United States)—EPA
- (5) Institut de Recherche Robert-Sauvé en Santé et en Sécurité du Travail (Quebec)—IRRSST
- (6) International Organization for Standardization (Technical Committee TC146)—ISO
- (7) Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (Germany)—Deutsche Forschungsgemeinschaft

More information, and in some cases the actual methods, can be found at the following:



NIOSH Manual of Analytical Methods

<https://www.cdc.gov/niosh/docs/2003-154/default.html>



OSHA Sampling and Analytical Methods

<https://www.osha.gov/dts/sltc/methods/index.html>



HSE Methods for the Determination of Hazardous Substances Guidance

<http://www.hse.gov.uk/pubns/mdhs/>



US EPA Test Methods

<https://www.epa.gov/measurements-modeling/index-epa-test-methods>



IRRSST Sampling Guide for Air Contaminants in the Workplace, 8th edition

<http://www.irsst.qc.ca/en/publications-tools/publication/i/384/n/guide-d-echantillonnage-des-contaminants-de-l-air-en-milieu-de-travail/redirected/1>



ISO

<https://www.iso.org/committee/52702/x/catalogue/p/0/u/1/w/0/d/0>



Deutsche Forschungsgemeinschaft

<https://onlinelibrary.wiley.com/doi/book/10.1002/3527600418>

If there is no specific method for a particular substance, or if the employer wishes to use an alternative analytical method, the employer will need to apply for an acceptance. To obtain an acceptance from a Director, the employer must show

- (a) the precision and accuracy of the method;
- (b) who has previously developed and evaluated the method, i.e., has the method been developed by a recognized independent source;
- (c) the quality assurance and quality control measures that will be used;
- (d) interferences with the method, i.e., other substances that could affect the results; and
- (e) biases with the method, i.e., will the method tend to give higher or lower values, false positives or false negatives.

Users of the analytical methods must be sure to look at the detection limits and limits of quantification of the methods. When reporting results, these limits must be used and values reported with the correct number of significant digits.

When measurements are made, conditions at the workplace on the day the measurements were taken should be recorded. This will include

- (a) environmental conditions such as temperature, pressure and humidity;
- (b) time and date;
- (c) production levels;
- (d) ventilation levels and air circulation;
- (e) location of the sample and a description of the area around the sample; and
- (f) type of sample such as area or personal.

In addition, the person collecting the samples should state the reasons for the number and location of samples collected.

Use of a direct reading instrument

In some cases, a direct reading instrument may be more appropriate for monitoring worker exposure, but there are no specified methods. An example of such a compound is hydrogen sulphide.

If an employer uses a direct-reading instrument to measure exposure to a substance, the employer must ensure that the instrument is used, calibrated and maintained according to the manufacturer's specifications. This means that the employer must ensure that

- (a) factory calibrations are done according to the manufacturer's recommendations;
- (b) the instrument should be field calibrated on a daily basis;
- (c) workers need to be trained in the proper operation and field calibration of the instrument;
- (d) the instrument is used properly; and
- (e) someone is responsible for tracking the instrument and making sure that it is properly maintained.

The *OHS Code* requires that the person who conducts airborne exposure measurements be competent to do so. This means that the person must have specific training and experience in this area. Examples of persons who may have suitable qualifications include Certified Industrial Hygienists and Registered Occupational Hygienists, as well as other professionals with training in the areas of occupational health and safety

NIOSH Method 7400

NIOSH Method 7400 (Asbestos and Other Fibres by PCM) provides rules for counting fibres to determine the fibre concentration in a sample. Only fibres meeting the criteria specified in the definition of "fibre" may be counted (see Part 1).

When using NIOSH Method 7400 (Asbestos and Other Fibres by PCM), the limit of detection is approximately 2,700 fibres per filter and the range is 100 to 1,300 fibres per square millimetre of filter area. Results from this method, in fibres per cubic centimetre, must be reported to two decimal places and take significant digits into account, e.g., 0.01, not 0.014.

Section 21 Potential worker exposure

The purpose of the hazard assessment is to determine the exposure, or potential for exposure, of workers to a harmful substance at their work site. An exposure hazard cannot be controlled without knowing the identity of the harmful substance and the extent to which workers are exposed to it. The toxicity of the substance—type of action,

route of exposure and target organs—must be known, as well as the duration of exposure. Other factors that may contribute to the degree of hazard include

- (a) the nature of the process in which the material is used or generated;
- (b) the possibility of reaction with other physical or chemical agents;
- (c) the degree to which controls such as ventilation and enclosure are effective; and
- (d) the type and degree of toxic response in both the “average” and highly susceptible worker.

Almost every work environment has potential or actual hazards that need to be recognized, measured and monitored. An initial assessment should be performed in any work area where there is a potential for exposure, or there have been complaints of health effects experienced by workers. The assessment should include a walk-around survey of the operation, identification of all the chemicals used at the work site, talking to workers about past experiences and safety concerns and measurement of contaminants in air.

Consider the raw materials being used, how they are modified and the finished product. Each process step from raw material to finished product must be evaluated under normal and anticipated emergency conditions. Re-assessments should be conducted on an annual basis and when

- (a) new equipment or work processes that could affect worker exposure are introduced to the work site;
- (b) work practices or procedures change; or
- (c) workers complain of adverse effects during or after work shifts.

The hazard assessment must be performed by a competent individual. The work site health and safety committee or health and safety representative should participate in the identification of hazards where they are required. In all other cases, the affected workers should be permitted and encouraged to observe and participate in monitoring activities as long as doing so does not interfere with the activities. Workers frequently have the experience to identify sources of exposure, indicate when exposure may differ from “normal” and identify conditions that are routine or not routine.

Once hazards at the workplace have been identified, the employer must take steps to eliminate, or if this is not possible, control the hazards. To eliminate the hazard, the employer may substitute a less hazardous substance or modify equipment or processes to eliminate emissions. If elimination of the hazard is not possible, various control strategies can be used.

The employer should always investigate engineering controls first, then administrative controls, and finally the use of appropriate personal protective equipment. Engineering controls minimize or eliminate exposure by altering or removing the source. Administrative controls influence exposure by modifying the circumstances of the

worker's exposure. Personal protective equipment should only be considered when other control measures are not practicable or do not sufficiently reduce the hazard.

Workers who may be exposed to a harmful substance must receive training in the procedures that minimize their exposure to the substance. The training must, at a minimum, include

- (a) information describing the health hazards associated with exposure to the substance; and
- (b) training in the procedures to be used to reduce exposure.

If the hazard assessment indicates that there is a potential for a worker to be exposed to a substance in excess of its OEL, the employer must measure the airborne concentrations of the substance. The resulting measurement will be important when establishing effective control measures to minimize worker exposure.

Informing the worker and records

Once measurements have been made, section 21 requires that any worker who may be affected by the harmful substance be informed of the measurement and the results. A hard copy of the measurement report must be available at the work site. Section 8 of the *OHS Regulation* requires the report to be in writing and available to affected workers. Both the employer and the prime contractor, if there is one, are responsible for ensuring this is done. Further, a record of the results must be maintained for at least three years from the date the measurement was taken. The results should be readily available for review by an OHS officer or a Director.

Section 22 Worker overexposure

This section describes what needs to be done in the event that a worker is exposed to a substance in excess of its OEL. Steps must be taken immediately to prevent further exposure of the affected worker to airborne concentrations in excess of the OEL. The employer must also inform the affected worker of the nature and extent of the exposure. This information should include the identity of the substance, its concentration, the duration of the exposure, the toxicological properties of the substance and its potential health effects. The source of emission causing the excessive exposure must be identified and controlled before work can resume.

If the work site is required to have a joint work site health and safety committee or a health and safety representative, the employer must inform the committee or representative of the incident and the steps taken to control the excess exposure. If there is no committee, the employer should provide this information to workers at the work site.

Section 23 Worker decontamination

Workers, their clothing, and equipment may become contaminated during work activities through exposure to harmful substances including chemical or biological hazards. The employer is responsible for providing suitable means to allow workers to remove the contamination before leaving the work site.

The type of decontamination facility required depends on the harmful substance and the operation. Workers should be able to leave the work site without carrying away any amount of harmful substance that could adversely affect their health or the health of other persons with whom they have contact. For example, a worker doing lead soldering in a shop where lead particulate is produced must be provided with a suitable facility to change clothes and shower. The facility should have enough space for lockers so clean clothes can be kept separate from contaminated work clothes. As it relates to lead, there is significant potential for take-home lead exposure from lead contamination on a worker's skin, clothing and respirators. It is important that lead contamination be removed prior to the worker leaving the work site.

As the presence of a harmful substance on articles and clothing could adversely affect the worker's health, the employer must ensure that only properly decontaminated or cleaned articles and clothing are taken from the work site by the worker. The employer can determine whether to provide laundry facilities or some other means of cleaning the clothing. Articles may be wiped, washed or hosed down.

As it relates to biohazardous materials, it is recommended that employers develop and implement procedures that describe methods to clean, disinfect, or dispose of contaminated articles or clothing.

Section 24 Emergency baths, showers, eye wash equipment

Matching facilities to the hazard

The requirements of this section apply to any work site where chemicals harmful to the eyes or skin are used, not just chemical plants or laboratories. The employer is required to provide facilities so that chemicals splashed into the eyes or onto the body can be immediately diluted and washed away. Quick dilution and removal helps to minimize potential damage to the eyes, skin and body parts exposed to the chemical.

The facilities selected must be appropriate to the hazard and the extent to which workers are exposed to that hazard. For example, in a chemical processing plant where the potential exists for a worker to receive a chemical splash to the entire body, shower and eye wash stations must be provided. At another workplace where the hazard is limited to exposure of the eyes and face, an eye wash station may be sufficient.

Maintaining facilities

To be effective when needed, emergency baths, showers, eye wash and other similar equipment must be inspected and maintained according to the manufacturer's specifications.

Emergency baths, showers, eye wash stations and similar equipment should be

- (a) located on the same floor level and area as the work process that creates the hazard;
- (b) unobstructed at all times for quick access; and
- (c) marked with clear signage to indicate their location.

Recommended practices

The following recommended practices are not a mandatory part of the *OHS Code*; however, meeting the requirements of the ANSI Standard described in the next paragraph are acceptable practices.

Employers and workers looking for additional information about emergency eyewash and shower equipment should refer to ISEA/ANSI Standard Z358.1-2004, *American National Standard for Emergency Eyewash and Shower Equipment*. The Standard establishes minimum performance requirements for eyewash and shower equipment for the emergency treatment of the eyes or body of a person who has been exposed to injurious materials. It covers the following types of equipment: emergency showers, eyewash equipment, eye and face wash equipment, handheld drench hoses and combination shower and eyewash or eye and face wash equipment. The Standard is intended to provide uniform minimum requirements for equipment performance, installation, test procedures, maintenance and training in order to assure the worker of a minimum level of first aid.

Section 25 Prohibited activities

An employer must not allow workers to eat, drink or smoke at the work site in an area contaminated by a harmful substance. Allowing such activities may result in the workers' health or safety being adversely affected.

If workers are allowed to eat, drink or smoke at a work site, a clean and hygienic area should be provided and maintained for these purposes. Even if workers eat, drink or smoke outside the work site, the employer must provide appropriate means for workers to decontaminate themselves to ensure they are not ingesting the harmful substance (see section 23).

Section 26 Codes of practice

General

A code of practice is intended to provide practical guidance, present safe work procedures and address issues specific to the hazard to which the code applies.

As required by section 62 of the *OHS Act*, the employer must ensure that

- (a) a copy of the code of practice is readily available to workers and other persons at the work site; and
- (b) all workers to whom the code of practice applies receive appropriate education, instruction or training regarding the content of the code of practice. Doing so helps workers comply with it.

Section 200 of the *OHS Code* also requires the employer, contractor or prime contractor (if there is one) to consult and cooperate with the joint work site health and safety committee or health and safety representative, as applicable, to develop codes of practice.

Table 1 of Schedule 1 lists substances with high toxicity and a significant presence in Alberta. Where these substances are present at a work site in either a “significant” quantity or concentration, the employer is required to have a code of practice describing the storage, handling, use and disposal of the substance. The criteria defining “significant” are presented in subsections (1)(a) and (b) of section 26 of the *OHS Code*.

A code of practice should specify the following:

- (a) safe work practices for working with or near the substances;
- (b) preventative measures to be taken to prevent releases of the substance;
- (c) action to be taken in the event of a release;
- (d) protective equipment to be used by workers who work with the substance or in areas of the workplace where they may be exposed to the substance;
- (e) emergency procedures;
- (f) site contacts and emergency contacts;
- (g) decontamination procedures;
- (h) waste handling procedures; and
- (i) work site monitoring requirements.

Processes involving substance

If a process listed in Table 1 of Schedule 1 is used at a work site, regardless of the quantity or concentration of the identified substance used in the process, the employer must establish a code of practice governing the operation of the process.

Uncontrolled release

If there is a possibility of uncontrolled release associated with a substance or a process identified in Table 1 of Schedule 1, the employer must include the measures to be taken to prevent the uncontrolled release and the procedures to follow in the event of such a release in the code of practice.

Section 27 Storage of harmful substances

Although the labelling requirements for controlled products are discussed in Part 29 of the *OHS Code*, Workplace Hazardous Materials Information System (WHMIS), the term “harmful substance” has a broader definition than that of a “hazardous product.”

Subsection (a) requires an employer to clearly identify harmful substance at a work site even if they are not hazardous products. For example, gasoline purchased from a gas station is considered a consumer product exempt from WHMIS information requirements. However, when the gasoline is taken to a work site, its container must be clearly identified.

Subsection (b) requires the employer to provide their workers with training on how to safely handle hazardous waste. This information can be found in Safety Data Sheets (SDSs) or will be provided by the manufacturer.

Requirements specific to asbestos, silica, coal dust and lead

Section 28 General provisions for asbestos, silica, coal dust and lead

This section lists an employer’s general obligations in cases where asbestos, silica, coal dust or lead are present at a work site. The requirements of sections 28 to 43 do not override or replace the more general requirements presented in sections 16 to 27.

An employer must minimize potential worker exposure to the substances by

- (a) minimizing their release to the air;
- (b) removing unnecessary accumulations of the substances; and
- (c) using proper decontamination methods to prevent the generation of airborne dust.

These requirements are intended to apply to all situations in which asbestos, silica, coal dust or lead are released into the air at a work site, regardless of airborne concentration. The requirements are not limited to “restricted areas” as defined in section 1 of the *OHS Code*.

Asbestos, silica and lead are substances for which a code of practice must be prepared under section 26 of the *OHS Code*. The use of the code of practice at the work site will allow the employer to meet the requirements of this section.

Section 29 Restricted area

This section lists requirements applicable only to restricted areas. By definition, these are areas where there is a reasonable likelihood that airborne concentrations of asbestos, silica, coal dust or lead will exceed their OELs. Restricted areas are therefore subject to additional conditions.

The employer is responsible for ensuring that the release of particulate is kept at a minimum by using ventilation, wetting to suppress dust, or other methods. An employer must provide workers in the restricted area with protective clothing that prevents contamination of the other clothing they are wearing. The employer must ensure workers use the clothing provided.

It is also the employer's responsibility to ensure that workers do not take fibrogenic dust or lead particulate with them when leaving the restricted area. Section 23 already requires an employer to provide the facilities, including showers, that workers need to remove the contamination before workers leave the work site. Both the employer and worker have a duty to ensure that the worker is decontaminated prior to leaving the restricted area.

Section 30 Protective clothing used in restricted areas containing asbestos or lead

An employer is responsible for laundering clothing used by workers in a restricted area that contains asbestos or lead. This includes towels that are used for worker decontamination. The intent of the requirement is to centralize the laundering of contaminated clothing and prevent cross-contamination of street clothes with asbestos or lead. If re-usable protective clothing is to be worn in a restricted area containing asbestos or lead, it must be properly laundered before it is removed from the work site. Workers should be able to leave a work site without carrying away any amount of harmful substance that could adversely affect their health or the health of other persons with whom they have contact.

The handling of contaminated protective clothing during laundering could be harmful to workers if it is not done properly. During storage and transportation, all contaminated protective clothing must be in sealed containers that are clearly labelled to identify the contaminants. Workers must be warned not to inhale the dust during handling.

Section 31 Release of asbestos

The release of airborne asbestos poses a serious health risk. For this reason, the employer or prime contractor must take all necessary action to correct a condition in which there is a potential for releasing asbestos fibres.

For more information



Alberta Asbestos Abatement Manual

Section 32 Prohibitions related to asbestos

Crocidolite asbestos may not be used in existing and new buildings. Where crocidolite is found in an existing building, it must be removed unless removal poses a greater hazard to workers. If removal is not possible or reasonably practicable and workers will not be exposed to crocidolite in the course of their usual work procedures, the implementation of a management plan may be acceptable. The employer must document the conditions and rationale to explain why the crocidolite cannot be removed. The management plan should include the elements outlined in Chapter 4 of the *Alberta Asbestos Abatement Manual*. If the building is to be renovated or demolished at a later date, the crocidolite will have to be removed at that time.

To prevent asbestos fibres from becoming airborne and then being inhaled by workers or contaminating a work site, the spray application of materials containing asbestos is prohibited. This is because of the hazards associated with spray application of asbestos products and also because these types of products tend to be friable, i.e., easily crumbled with hand pressure. Friable asbestos poses a greater hazard since there is a greater potential of the product releasing fibres.

Section 33 Asbestos in air distribution systems

The purpose of this requirement is to limit the possibility of airborne asbestos entering air distribution systems or equipment and then posing a hazard to workers and other persons.

Section 34 Asbestos in building to be demolished

The purpose of this requirement is to prevent the release of asbestos fibres into the air during building demolition. More information on work practices related to asbestos removal prior to building demolition is provided in the *Alberta Asbestos Abatement Manual*.

For more information



Alberta Asbestos Abatement Manual



Asbestos-Containing Materials in Buildings to be Demolished

Section 35 Encapsulation, enclosure or removal of asbestos

When a structure with asbestos-containing materials is being altered or renovated, the disturbance of the asbestos may result in the uncontrolled release of airborne fibres. To prevent this, the employer must ensure that the asbestos-containing materials are removed, encapsulated or enclosed. When deciding which of the corrective actions is most appropriate, consideration should be given to the condition of the asbestos, its location, function and the cost of the proposed method of controlling exposure.

Removal, encapsulation and enclosure are corrective measures that can be used separately or in combination. Removal completely eliminates the source of exposure and, as a result, offers a permanent solution. Enclosure and encapsulation are containment methods that do not remove the potential source of asbestos exposure. If asbestos-containing materials remain in place, a management plan will be required for the building.

Removal

Asbestos-containing materials are removed from the underlying surface and collected and placed in containers for disposal at an approved waste disposal site. This process is the most expensive control method in the short term and may require an interruption of building activities. Removal is a prerequisite for demolition of a structure containing asbestos-containing material.

Encapsulation

During encapsulation, asbestos-containing materials are coated with a bonding agent called a sealant. Sealants penetrate and harden the material and/or cover the surface of the material with a protective coating, i.e., bridging sealants. Sealants are applied over the surface of the material using airless spray equipment at a low pressure setting. If a penetrating sealant is used, the person applying the product must ensure that it penetrates through the material to the underlying support. Bridging sealants must form a tough skin that can withstand moderate impact, be flexible and flame retardant, resist deterioration over time and be non-toxic. The encapsulant should meet the requirements of Canadian General Standards Board Standard CAN/CGSB-1-205-94, *Sealer for Application to Asbestos Fibre Releasing Materials*, or an equivalent standard.

Enclosure

Enclosure is the placement of a physical barrier between the asbestos-containing materials and the building environment. Drywall covering is an example of a type of acceptable enclosure. Since the asbestos is not removed, fibres will continue to be released and will accumulate behind the barrier. If the enclosure is damaged or entered for maintenance, these fibres may be released into the building environment.

Management plan

When asbestos-containing materials remain in place in a building, a management plan is needed. The plan should address the following:

- (a) amount and type of asbestos-containing materials in the building;
- (b) inspection frequency and procedures;
- (c) training requirements for maintenance workers and others who may come into contact with the materials or work near them;
- (d) procedures to be followed if the materials are damaged or in other emergency situations;
- (e) procedures to be followed if the condition of the materials change or work routines are altered;
- (f) notification procedures for building occupants; and
- (g) labelling of asbestos-containing materials.

Additional information about these methods and asbestos abatement in general can be found in the *Alberta Asbestos Abatement Manual*.

For more information



Alberta Asbestos Abatement Manual

Section 36 Notification of a project

Notification must be given to the Government of Alberta at least 72 hours before beginning the activities that may release asbestos fibres.

For more information



Asbestos Project Notification Form

Notification is required for all high, moderate and low risk projects. Projects requiring notification normally involve operations having the potential to release fibres from asbestos-containing materials. Although the Government of Alberta requires notification of all asbestos abatement projects, the 72-hour notification requirement is flexible where it can be demonstrated that there is a need to carry out the work immediately.

An example of this type of situation would be the immediate removal of asbestos cladding on a ruptured pipe. Immediate action would be justified to prevent damage to the building. However, delays in construction schedules resulting from the discovery of asbestos would not be considered sufficient reason to reduce the notification period.

Types of projects that do not require notification include

- (a) inspection of asbestos-containing materials as part of a management plan or asbestos assessment project;
- (b) sampling of asbestos-containing materials or potential asbestos-containing materials as part of an asbestos assessment project. Sampling must be done by trained personnel and in a manner that minimizes disturbance and damage to the asbestos-containing materials;
- (c) removal and replacement of small (30 square centimetres or less), manufactured asbestos products such as gaskets or valve packing;
- (d) short-term work in areas that contain non-friable asbestos-containing materials, but do not involve disturbing the asbestos-containing materials; and
- (e) transportation of asbestos-containing materials in a sealed container unless the materials are part of an asbestos abatement project.

In the above cases, employers must take precautions to ensure that asbestos fibres are not released. Moreover, these types of projects must only be carried out by competent workers and in accordance with the requirements of this Part. Work procedures must be developed and followed to prevent potential asbestos exposure.

For pre-planned routine maintenance work involving low risk activities, projects may be granted “extended project notification status” as long as an asbestos survey had been completed and adequately trained workers follow established safe work procedures. Extended notifications may be granted for up to one year, depending on the employer’s ability to plan in advance. It is expected that the work will be carried out in a manner that reflects the principles described in the *Alberta Asbestos Abatement Manual*.

Section 37 Asbestos worker course

This section requires all workers who work with asbestos, including the removal or abatement of asbestos, to receive training. Workers who will be working in a restricted area, i.e., high risk asbestos abatement projects, must successfully complete an asbestos abatement course of at least two days’ duration. The course must be one that is approved by the Government of Alberta.

Approved courses require participants to become familiar with OHS legislation and understand their responsibilities and the responsibilities of their fellow workers, supervisors and regulatory agencies. Practical sessions focus on worker protection, set-up of the work area and safe work practices. Each course concludes with an examination requiring an 80 percent passing grade. Workers who pass the examination receive an

Asbestos Worker card (course certificate). A list of training agencies accredited to provide asbestos worker training and issue Asbestos Worker cards is available on the Occupational Health and Safety website.

Asbestos Worker cards remain the property of the Government of Alberta and as such, can be revoked if a worker is found to not be competent or if the card is misused. Workers must have their original cards available at the work site at which they are working. An OHS officer may ask a worker to produce their original card plus appropriate identification.

Workers involved in moderate and low risk abatement projects are not required to complete a two-day asbestos abatement course and do not need an Asbestos Worker card. The training these workers receive must be appropriate to their level of involvement in the project and at least cover all the information presented in sections 5.2 or 5.3 of the *Alberta Asbestos Abatement Manual*. Training programs that include this information are considered to have met the requirements of this section. Training can be provided by a training agency or in-house by persons knowledgeable in the procedures and hazards associated with asbestos abatement.

For more information



Alberta Asbestos Abatement Manual



List of Training Agencies Accredited to Provide Asbestos Worker Training and Issue Asbestos Worker Cards

Section 38 Containment and labelling of asbestos waste

Asbestos waste must be stored, transported and disposed of in sealed containers. Containment prevents asbestos fibres from becoming airborne and presenting a hazard to workers. Containers of asbestos waste, as well as containers of asbestos products, must be labelled to indicate the presence of asbestos and its hazardous nature. Containers must bear a warning that the dust should not be inhaled. Typical labelling reads:

“Carcinogenic—Asbestos Waste—Do Not Inhale Dust”

Additional information about asbestos waste and safe work procedures involving asbestos abatement is presented in the *Alberta Asbestos Abatement Manual*. Alberta Environment has published guidelines for asbestos waste disposal which provide information regarding the transportation and disposal of asbestos waste.

For more information



Alberta Asbestos Abatement Manual

Section 39 Use of crystalline silica in abrasive blasting

This section requires employers to make a conscientious effort to examine the use of less harmful abrasives when abrasive blasting. Employers must take into account technical, economic and availability factors. This section does not ban the use of crystalline silica in abrasive blasting.

The following are legitimate considerations in accepting or rejecting a less harmful substitute:

- (a) *technical*—Can the substitute perform the same work and produce the same results as silica sand?
- (b) *economic*—Is the cost going to be a prohibitive financial burden to the employer?
- (c) *availability*—Is a sufficient supply of the substitute readily available?

Employers are expected to document their assessment of alternatives when deciding whether or not a silica substitute is reasonably practicable for a specific abrasive blasting job. The Government of Alberta is not looking for a detailed study for every situation where silica sand is used, but will be expecting an honest assessment and justification if silica is used.

In highlighting the use of crystalline silica in abrasive blasting, the Government of Alberta recognizes:

- (1) the hazardous nature of crystalline silica in its respirable particulate form;
- (2) that abrasive blasting breaks silica sand down to respirable sizes; and
- (3) process emissions are difficult to control.

The message to employers is this: use silica substitutes whenever you can. If you must use crystalline silica, understand your responsibilities and meet all regulatory requirements.

Employers are reminded of the stringent regulatory requirements involving the handling of respirable crystalline silica in the workplace. Because of the low OEL for crystalline silica—respirable particulate: 0.025 milligrams per cubic metre vs. 3 milligrams per cubic metre for particulate not otherwise regulated—the *OHS Code's* comprehensive “restricted area” requirements apply, as does the need to have all workers wear respirators. Employers using crystalline silica for abrasive blasting are required to

- (a) establish a code of practice for their operations;
- (b) ensure workers undergo required health assessments, paid for by the employer;
- (c) establish a respiratory protection program for the proper selection and use of respirators;
- (d) provide workers with and ensure they wear protective clothing and respirators;
- (e) minimize the release of crystalline silica particulate into the air, keeping worker exposure as low as reasonably practicable, and never exceeding the OEL;

- (f) keep the work site clear of any unnecessary accumulation of crystalline silica particulate and materials containing crystalline silica;
- (g) ensure that decontamination of workers and materials does not result in the release of airborne crystalline silica particulate;
- (h) provide a means of preventing contamination of workers' street clothes;
- (i) ensure only authorized persons enter a restricted area;
- (j) post signs around restricted areas warning of hazards and ensure signs remain posted until the area is no longer restricted; and
- (k) ensure workers decontaminate themselves prior to leaving a restricted area.

Section 40 Health assessment for workers exposed to asbestos, silica or coal dust

A worker exposed to asbestos, silica, coal or lead must have a health assessment within 30 days of becoming an "exposed worker" as defined in section 1. When hiring a worker to perform work involving exposure to these substances, the employer is responsible for knowing if the worker has received a health assessment in the last two years and it is the worker's responsibility to inform the employer of the date of that assessment. The employer should get verification that the health assessment was performed by checking documents the worker has.

Health assessments must be done every two years after the first assessment as long as the worker continues to be an "exposed worker." If at any time during the preceding two years a worker performed work that qualified them to be an exposed worker, an employer must ensure that the worker undergoes a health assessment. It is the worker's employer at the time the worker becomes an exposed worker who is responsible for ensuring that the health assessment is done.

Should an employer hire a third party to conduct worker health assessments, that service provider is required to meet their service provider obligations under the *OHS Act*.

Health assessment

The purpose of the initial health assessment is to provide the worker with a baseline health evaluation, providing an opportunity to detect early changes to lung health on subsequent evaluations. Periodic health assessments serve as a means of documenting changes that, compared to the baseline evaluation, may have occurred over time. This provides an opportunity to investigate the cause of the changes.

The health assessment for exposure to asbestos, coal and silica consists of health history information, a chest x-ray, a radiologist's report, spirometry and a copy of the physician's interpretation and explanation of the health assessment. The history includes identifying the worker, employer, the worker's previous work and non-work exposures

to coal dust, silica, asbestos, or other dusts, indications of any respiratory disease, smoking history and the date on which the worker had their most recent chest x-ray and spirogram.

The chest x-ray consists of a single back to front (postero-anterior) view of the chest and needs to be interpreted by a radiologist and the report sent to a physician. Where diagnostic imaging facilities no longer maintain x-ray film, the digital imaging format of x-rays is allowed provided the imaging facility can print to film when requested. As well, the employer must have this included in the procedure for health assessments.

Spirometry, conducted by a pulmonary function technician, consists of forced vital capacity (FVC) and forced expiratory volume in the first second (FEV₁) test. Spirometry done as part of a health assessment under Section 40 of the *OHS Code* is different than spirometry or pulmonary function testing done for diagnostic purposes within the health care system. The physician reviewing the health assessment must give a written interpretation of the results to the worker within 60 days of the health assessment. Physicians must keep the health assessment records for 30 years.

The information obtained during a health assessment is confidential. Only the worker and the health professionals who conducted the assessment have access to the information. If others require the information, including the worker's family physician, the worker must give written consent indicating to whom the information is to be given and the specific information that can be provided. Some larger employers have developed a Release of Information form for this purpose.

For the purposes of evaluating programs, assessment information can be released in grouped data provided that an individual cannot be identified. For example, if a job category has one worker, that worker's data should be included in a category with more workers. The purpose of evaluating programs is to determine if the control program is effective.

The worker has the right to refuse all or part of the health assessment. However, the employer must not coerce, threaten or force a worker into refusing part or all of a health assessment.

The employer is responsible for paying for the health assessment and interpretation of the results. Every effort should be made to have the health assessment conducted during normal work hours. The worker must be paid his/her wages, salary and benefits for the time it takes to have the health assessment and any travel time to or from the health assessment. Other mutually agreeable arrangements can be made to have the health assessment done.

Section 41 Lead exposure control plan

The content of the Explanation Guide related to Sections 41–43 is currently being revised. Please refer to the OHS Bulletin, *Lead at the Work Site* for additional information.

Section 42 Lead—air monitoring



Occupational Health and Safety Bulletin—Lead at the Work Site

Section 43 Medical monitoring for lead



Occupational Health and Safety Bulletin—Lead at the Work Site

Section 43.1 Controlling mould exposure

Mould is found almost everywhere in our environment. Mould needs the right combination of water, nutrients and a suitable temperature to grow. Moulds are often relatively harmless, e.g., *Cladosporium* or common leaf mould. Moulds can also be useful, as in the preparation of foods and medications. In other circumstances however, they may pose a health hazard.

The presence of mould at the work site does not mean that it is a hazard to workers. The first step in determining whether or not mould poses a hazard to workers is to conduct a hazard assessment as required by section 7. This may include a thorough assessment of the work space where the issue is or may be a concern. A request for a mould assessment is usually prompted by indoor air quality complaints, an uncontrolled water intrusion event or observed visible mould growth.

The requirement to control mould in accordance with section 9 is based on the results of the hazard assessment. Employers will need to control mould exposure when

- (a) visible uncontrolled mould growth or elevated airborne mould concentrations (compared to a control area such as outdoors) are present, but cannot be immediately remediated. This may include situations where remediation is planned at a later date or the contamination is not readily accessible without significant damage to the building;
- (b) mould clean-up or abatement is actively being conducted in the building; or
- (c) workers are medically diagnosed as having adverse health effects consistent with mould exposure at the workplace, even though visible mould growth and/or conditions likely to support mould growth such as damp indoor conditions are not readily apparent.

The types of controls implemented—engineering, administrative or personal protective equipment—will be based on where mould is present and who may be affected by exposure. Note that the prevention of mould growth as a proactive step is the most effective way to manage potential mould hazards at a work site. Because mould spores can be found almost everywhere, the key to preventing mould growth is to limit the availability of water. This is done by keeping building materials dry. Mould cannot be effectively managed at a work site unless the conditions that created the initial mould growth are addressed.

For more information



Best Practices—Mould at the Work Site

Part 5 Confined Spaces

Highlights

- The concept of a “restricted space” has been introduced to this Part.
- Section 44 requires employers to have a code of practice governing the practices and procedures for workers entering and working in a confined space.
- Section 47 requires that employers establish an entry permit system for confined space entry.
- Section 52 requires continuous atmospheric monitoring of a confined space if there is a potential for the atmosphere to change unpredictably after a worker enters the confined space.
- Section 56 identifies the conditions under which an employer must provide a tending worker (trained in the evacuation procedures in the emergency response plan) at or near the entrance.

Requirements

Section 44 Code of practice

Confined spaces have a history of being potentially dangerous places to work as hazards within them are often magnified. Limited access may be combined with poor ventilation, hazardous surroundings or energized equipment. When workers unknowingly enter oxygen deficient or toxic atmospheres, the results can be fatal.

A code of practice describes the procedures to be followed to allow workers to safely perform work in a confined space. Section 14 of the *OHS Act* requires that the procedures be available to workers and Section 62 requires the code of practice to be available to workers.

The code of practice should include as topics the subject matter of each section of this Part, as well as hot work as described in section 169. Section 200 of the *OHS Code* also requires the employer, contractor or prime contractor (if there is one) to consult and cooperate with the joint work site health and safety committee or health and safety representative, as applicable, to develop codes of practice.

Workers should be consulted about the content of the code of practice as they often have the best understanding of the hazards involved in the work. It may also help to ask for the help of safety professionals such as industrial or occupational hygienists or engineers, as some situations may be particularly complex.

The code of practice must be maintained and periodically reviewed to ensure that its procedures are up-to-date and continue to reflect the work activities for which they were originally written. The code of practice must also identify all existing and potential confined space work locations at a work site so that workers can be made aware of unexpected hazards and reminded that special safety requirements apply.

A worker is considered to have “entered” a confined space when the worker’s breathing zone crosses the plane of the confined space access.

Restricted and confined spaces

This edition of the *OHS Code* introduces the concept of a “restricted space.” As discussed below, restricted spaces and confined space share certain common characteristics. They differ however in key areas that may help employers and workers to operate more safely and efficiently. Some employers and workers may eventually come to think of restricted spaces as “non-permitted confined spaces.”

Restricted space explained

Like confined spaces, restricted spaces have a limited means of entry and exit. Entry points may not be designed for easy walk in. Other limitations include access by ladders or by stairways that provide poor access because of steep slope, narrow width or extreme length. Physical obstructions such as bulkheads, collapsed material, or machinery may impede exit. Limited means of entry and exit can make escape or rescue difficult.

A “restricted space” is an enclosed or partially enclosed space, not intended for continuous human occupancy that has a restricted, limited or impeded means of entry or exit because of its construction. It can be thought of as a work area in which the only hazard is the difficulty of getting into or out of the space. Restricted spaces are therefore not subject to the permitting, atmosphere testing and tending worker requirements of a confined space. Employers and workers must be mindful that a restricted space can become a confined space if conditions or work practices change. Employers who voluntarily apply relevant sections of ANSI Z117.1-2003, *Safety Requirements for Confined Spaces*, might refer to restricted spaces as “non-permitted confined spaces.”

Examples of a restricted space can include:

- (a) an electrical or communication utility vault;
- (b) a building crawl space;
- (c) a trench with a temporary protective structure; and
- (d) a deep excavation requiring ladder or lift access.

Despite being classified as a restricted space, the following requirements of Part 5 Confined Spaces, continue to apply to workers entering a restricted space:

- a hazard assessment must be performed prior to entry—section 45;
- workers assigned duties related to the entry must be trained to recognize hazards and how to perform their duties in a healthy and safe manner—section 46;
- general safety requirements involving the use and availability of safety, personal protective, and emergency equipment, as well as a communication system—section 48;
- prevention of unauthorized persons entering a restricted space—section 50;
- protection of workers from hazards created by traffic in the area of the restricted space—section 51;
- workers cannot enter or remain in a restricted space unless an effective rescue can be carried out—section 55;
- a competent worker, designated by the employer, must be in communication with the worker(s) inside a restricted space—section 56; and
- a safe means of entry and exit must be available to all workers required to work in the restricted space—section 57.

Confined space explained

As defined in section 1 of the *OHS Code*, a confined space is an enclosed or partially enclosed space that is not designed or intended for continuous human occupancy with a restricted, limited, or impeded means of entry or exit because of its construction and may become hazardous to a worker entering it because of

- (a) an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity;
- (b) a condition or changing set of circumstances within the space that present a potential for injury or illness; or
- (c) the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

Confined spaces are not intended for continuous human occupancy. They are not sites of ongoing or regular work activity. They are usually entered only for such purposes as cleaning, inspection, maintenance, repair or construction. Figure 5.1 shows a flowchart that helps to determine if the space is a confined space or a restricted space.

Reasons for entering a confined space

Typical reasons for entering a confined space include

- (a) cleaning to remove sludge and other waste materials;
- (b) inspecting process equipment;
- (c) maintenance such as abrasive blasting and applying surface coatings;
- (d) tapping, coating, wrapping and testing underground sewage, hydrocarbon, steam and water piping systems;
- (e) installing, inspecting, repairing, and replacing, valves, piping, pumps, motors, . in below ground pits and vaults;
- (f) checking and reading meters, gauges, dials, charts and other measuring instruments; and
- (g) rescue of workers who are injured or overcome while inside the confined space.

In addition to other hazards, confined spaces may have limited means of entry and exit. This would not only make escape and rescue difficult, but could also restrict natural ventilation.

Types of confined spaces

Most confined spaces are designed to hold substances such as liquids, gases, and loose materials, or to house equipment. Though they come in many sizes and shapes, most can be classified in one of two ways:

- (1) spaces that are open-topped and have depth—examples include pits, wells, vats, hoppers, bins, degreasers, and kettles; and
- (2) spaces with narrow openings—examples include pipes, tunnels, silos, casings, and sewers.

Confined spaces may have poor natural ventilation and contain, or have the potential to contain, an atmosphere that is unsafe. Poor ventilation can be the result of unpredictable or limited air movement, or natural air currents that could draw contaminated air into the space. While unsafe atmospheres are most commonly associated with spaces that are fully enclosed, vats, pits and vessels that are open-topped can also contain an unsafe atmosphere. In these cases, the unsafe atmosphere results from the entry of a gas that is heavier than air, the release of gas resulting from wastes at the bottom of the space being disturbed, or the presence of a layer of air above the space that prevents fresh air from moving into it.

Confined spaces can become unsafe as a result of

- (1) atmospheric contamination by toxic substance or flammable vapours, or oxygen deficiency (less than 19.5 percent oxygen by volume) or excess (more than 23.0 percent oxygen by volume);
- (2) physical hazards, i.e., electrical, thermal, radiological, noise, engulfment, etc.;
- (3) liquids, gases, or solids being introduced to the space during occupancy.

Some confined spaces become unsafe as a result of the conditions or work that is done inside them. Examples of conditions that can make a confined space unsafe are

- (a) manholes in contaminated ground, e.g., near a leaking underground gasoline storage tank, into which toxic or flammable gases can seep;
- (b) manholes, pits or trenches connected to sewers, in which there can be a build-up of flammable and/or toxic gases and/or insufficient oxygen in the air;
- (c) tanks or pits containing sludges and other residues which, if disturbed, may partially fill the confined space with dangerous gases; and
- (d) confined spaces that contain rotting vegetation, rusting metal work, and similar natural oxidation processes that create an oxygen-deficient atmosphere.

Some examples of confined spaces in which changing conditions or activities being done can make the space unsafe are

- (a) some painting work and the application of certain adhesives, cleaners and liquids such as paint thinners. These can produce dangerous amounts of solvent vapour, which can cause dizziness and impair judgment. Such solvents are often flammable so there is an accompanying risk of fire and explosion;
- (b) welding activities may generate toxic gases or vapours;
- (c) the use of gasoline or diesel engines can lead to the build-up of carbon monoxide gas. There is also a risk of fire resulting from leaks; and
- (d) introduction of hot work.

In some cases, a confined space can become unsafe because of the inherent characteristics of activities that may occur external to the space. Examples include

- the filling/emptying of an adjacent compartment/tank;
- weather changes, such as thunderstorms, i.e., a drop in barometric pressure, lightning, etc.;
- heat of the day increasing vapourization and affecting personnel, i.e., heat exhaustion; and
- pipelines entering the confined space may contain hazardous materials.

Table 5.1 lists examples of confined spaces by industry.

Table 5.1 Examples of confined spaces by industry

Construction Industry Sewers Unprotected excavations Food and Similar Products Retorts Tubs and kettles Basins Cold rooms Ovens Flour bins Air scrubbers Batch cookers Caustic soda tanks Clay hoppers Conditioners Continuous cookers Extractors Heated lard tanks Heated sugar bins Holding bins Hydrogenators Metal bins Meal dryers Mixers Tallow tanks	Textiles Bleaching ranges J-boxes Kiers Die kettles Bale presses Dye becks Sizing tanks Steam boilers Paper and Pulp Chip bins Barking drums Rag cookers Acid towers Digesters Beaters Hydropulpers Stock chests Adhesive tanks Bleach tanks Chip silos Furnaces Machine chests Mix tanks Resin tanks Clay mix tanks Printing and Publishing Ink tanks Solvent tanks Rubber Products Solvent tanks Shredders Furnaces Ovens Mixers	Petroleum and Chemicals Reactors Storage tanks Distillation columns Cooling towers Dike areas Fire water tanks Precipitators Scrubbers Crystallizers Spray dryers Leather Products Dye vats Tanning tanks Sludge pits Stone, Clay, Glass and Concrete Products Kilns Aggregate bins Cement silos Crushers Dryers Hoppers Mills Sand bins Primary Metals Blast furnaces Cupolas Coal bins Coke bunkers Annealing furnaces Slag pits Water treatment tanks Submarine cars Gas holders Soaking pits Acid pickling tanks Plating tanks	Fabricated Metals Paint dip tanks Degreasers Caustic cleaning tanks Drying ovens Shot blasting enclosures Enclosed assemblies Sludge tanks Machinery Boilers Conveyors Dust collectors Tunnels Electronic Industry Degreasers Gas cabinets Plating/rinse tanks Electric, Gas and Sanitary Services Cable vaults Manholes Meter vaults Transformer vaults Bar screen enclosures Chemical pits Incinerators Pump stations Regulators Sludge pits Wet wells Valve pits Digesters Grease traps Lift stations Sewage ejectors Storm drains
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Based on similar table in:

Rekus JF. *Complete Confined Spaces Handbook*. National Safety Council, Lewis Publishers, Ann Arbor; 1994

For more information



Confined Spaces—*Guideline for Developing a Code of Practice for Confined Space Entry*

Section 45 Hazard assessment

Restricted spaces have a limited means of entry and exit. Entry points may not be designed for easy walk in. Other limitations include access by ladders or by stairways that provide poor access because of steep slope, narrow width or extreme length. Physical obstructions such as bulkheads, collapsed material, or machinery may impede exit. Limited means of entry and exit can make escape or rescue difficult.

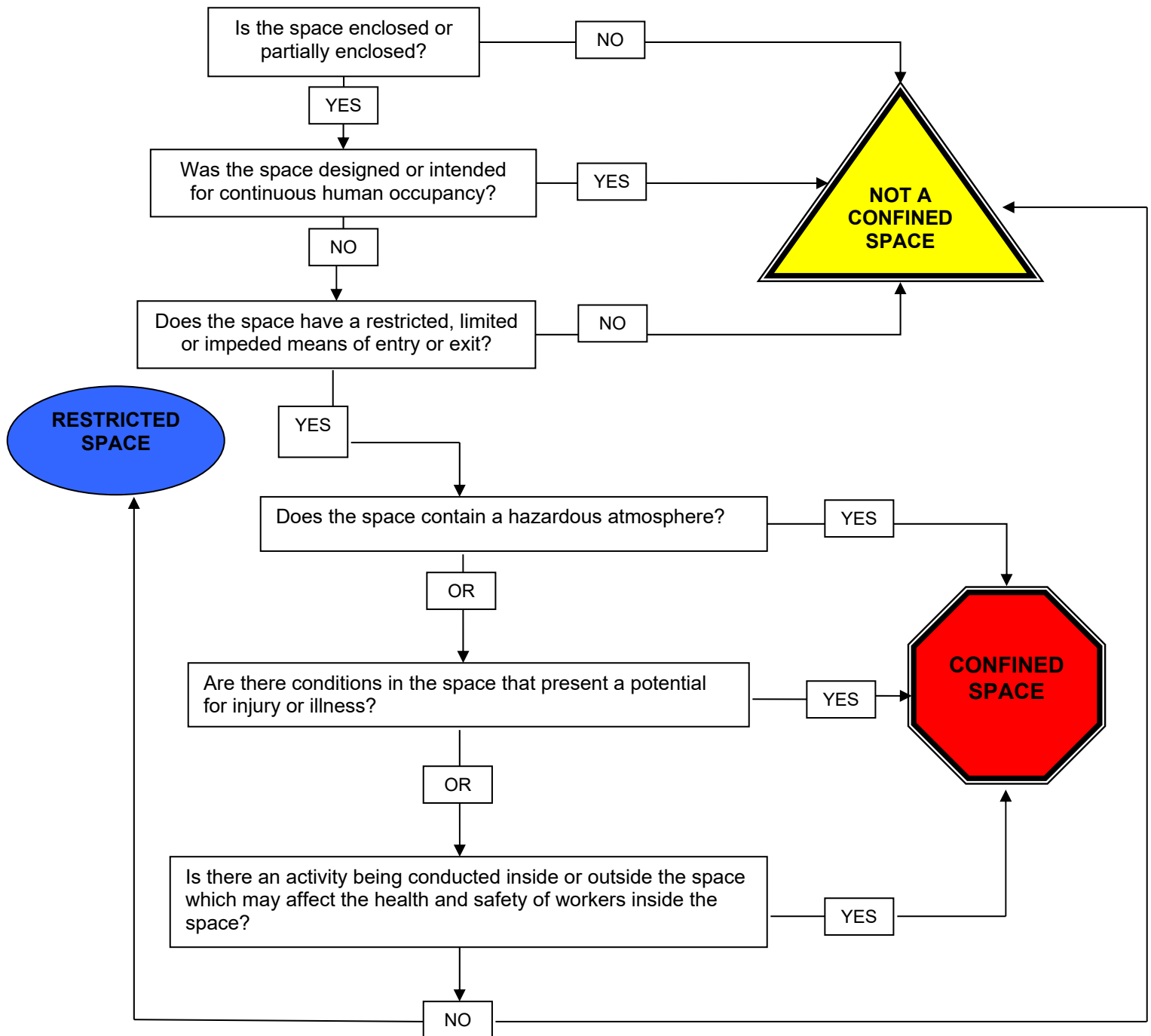
A “restricted space” is an enclosed or partially enclosed space, not intended for continuous human occupancy that has a restricted, limited or impeded means of entry or exit because of its construction. It can be thought of as a work area in which the only hazard is the difficulty of getting into or out of the space. Restricted spaces are therefore not subject to the permitting, atmosphere testing and tending worker requirements of a confined space. Employers and workers must be mindful that a restricted space can become a confined space if conditions or work practices change. Employers who voluntarily apply relevant sections of ANSI Z117.1-2003, *Safety Requirements for Confined Spaces*, might refer to restricted spaces as “non-permitted confined spaces.”

If a worker enters a confined or restricted space to work, the employer must designate a competent person to carry out the tasks listed in this section. The competent person must have specific knowledge about confined or restricted spaces and capable of carrying out each of the listed activities.

Figure 5.1 shows a flowchart that helps to determine if the space is a confined space or a restricted space.

Figure 5.1 Flowchart to determine type of space

Confined Space?



In assessing the hazards that workers are likely to be exposed to, the requirements of Part 2 of the *OHS Code—Hazard Assessment, Elimination and Control*—must be met. The hazard assessment needs to be revised whenever there is evidence to indicate that it is no longer valid and when any of the conditions listed in subsection 7(4) of the *OHS Code* is met.

Some of the hazards of confined spaces include the following:

- (a) *oxygen deficient atmospheres*—can cause brain damage and death. Oxygen deficiency can be caused by rusting (or oxidation) of a steel vessel, any form of burning, including welding or brazing, absorption by grain or soils, consumption by bacteria that can use up some or all of the oxygen in the space;
- (b) *asphyxiant gas*—physiologically inert gases can dilute or displace atmospheric oxygen below the level required for normal human functioning. Common examples of asphyxiant gases are carbon dioxide, ethane, helium, hydrogen, methane and nitrogen. During a process known as purging, an inert gas such as nitrogen is deliberately pumped into a confined space to purge or force out flammable or explosive atmospheres from a confined space. The inert gas is usually replaced with fresh air before the space is safe to enter;
- (c) *toxic atmospheres*—containing gases, vapours, dusts or fumes that have poisonous effects on the body. Cleaning, painting or welding may produce dangerous vapours or fumes. Gases such as hydrogen sulphide may leak into the space from gas pockets underground. Carbon monoxide may be generated in the space by an internal combustion engine. Methane may be created through the fermentation of plant material in the space;
- (d) *flammable or explosive atmospheres*—containing flammable gases, vapours or dusts that could be ignited by a spark or open flame. The risk of explosion increases if an oxygen-enriched atmosphere is present, i.e., if the oxygen content is greater than 23 percent by volume;
- (e) *engulfment*—workers can be trapped or buried by dry bulk materials such as grain, sand, flour, fertilizer and sawdust;
- (f) *operation of moving parts*—being trapped or crushed by augers, mixers, agitators, conveyor belts, etc. This equipment must be locked out before anyone enters the confined space;
- (g) *uncontrolled introduction of steam, water or other gas or liquid*;
- (h) *other hazards*—these could result from the work being done, e.g., noise, extremes of temperature, radiation, manual handling and falls.

Section 46 Training

Subsection 46(1)

All workers who work within confined or restricted spaces and all workers with related duties, e.g., rescue workers and tending workers or “safety watch” personnel, must receive training specific to confined or restricted spaces. Every worker who works in a confined or restricted space must be able to recognize the hazards of working in the space and safely perform assigned duties. The rescue portion of this training may be part of a company or operation-wide emergency preparedness and response plan and must be consistent with the requirements in Part 7 of the *OHS Code*.

Training on its own does not ensure that a worker is competent to safely perform work. In addition to training, a worker must be adequately qualified and experienced to work safely. In cases where a worker is new to the job and does not have sufficient experience, the worker must be teamed up with and work under the direct supervision of a competent worker.

Subsection 46(2)

Records of confined or restricted space training must be retained for as long as the worker in question is expected to perform work within confined or restricted spaces. If a worker changes responsibilities and no longer enters confined or restricted spaces as part of their work, the confined or restricted space training records for that worker are no longer required.

Subsection 46(3)

Whatever the combination of personnel responding to an emergency, all of the skills listed must be represented among the members of the rescue team. The required skills can be held by only one member of the rescue team, or shared among as many members as is necessary.

Section 47 Entry permit system

A confined space entry permit is essentially a document that sets out the work to be done and the precautions to be taken. In some ways it functions as a safety checklist to make sure that nothing is overlooked. Figure 5.2 shows an example of a typical confined space entry permit.

The entry permit must, at a minimum

- (a) list the name of each worker who enters the confined space and the reason for their entry;
- (b) provide the location of the confined space;
- (c) specify the time period for which the entry permit is valid;

- (d) take into account the work being done in the confined space, and therefore the safety precautions that must be taken; and
- (e) take into account the code of practice requirements for entering, being in and leaving the confined space.

The completed permit must be kept readily available. In some situations and circumstances, better practice is to have the permit posted at each entry point into the confined space.

An entry permit will cover a specific task or project, which may occur over a number of shifts. The time for which the entry permit is valid is based on the estimated time to complete the project's work activities and must be identified on the permit. An entry permit should be treated as expired sooner than the stated expiry time if one of the following occurs:

- (a) the confined space is returned to service;
- (b) continuity of responsible supervision for the confined space is broken; or
- (c) the task or project is interrupted for a significant time because of an emergency that affects the confined space, e.g., an incident, rescue or a breakdown of engineering control equipment.

Once an entry permit has expired, a new permit must be issued before entry into the confined space is allowed.

If an employer performs a hazard assessment of a representative sample of identical confined spaces, then a single entry permit can be used for these and any additional identical confined spaces. Readers are referred to the explanation of section 45 for further information.

An entry permit is not required for restricted spaces.

Figure 5.2 Example of typical confined space entry permit

<div style="border: 2px solid black; display: inline-block; padding: 5px 10px;">CONFINED SPACE ENTRY PERMIT</div>		Permit number _____ Date: _____																					
<u>Location and Description of Confined Spaces</u> _____ _____		<u>Purpose of Entry</u> _____ _____																					
Scheduled Start _____ a.m. _____ p.m. <small>Day Date Time</small>		Scheduled Finish _____ a.m. _____ p.m. <small>Day Date Time</small>																					
<u>Worker(s) in charge of entry:</u> Entrants _____ Attendants _____ _____																							
<u>Pre-Entry Authorization</u> (Check those items below which are applicable to your confined space entry permit) <table style="width: 100%; margin-top: 5px;"> <tr> <td><input type="checkbox"/> Oxygen-Deficient Atmosphere</td> <td><input type="checkbox"/> Engulfment</td> <td><input type="checkbox"/> Energized Electric Equipment</td> </tr> <tr> <td><input type="checkbox"/> Oxygen-Enriched Atmosphere</td> <td><input type="checkbox"/> Toxic Atmosphere</td> <td><input type="checkbox"/> Entrapment</td> </tr> <tr> <td><input type="checkbox"/> Welding/cutting</td> <td><input type="checkbox"/> Flammable Atmosphere</td> <td><input type="checkbox"/> Hazardous Chemical</td> </tr> </table>				<input type="checkbox"/> Oxygen-Deficient Atmosphere	<input type="checkbox"/> Engulfment	<input type="checkbox"/> Energized Electric Equipment	<input type="checkbox"/> Oxygen-Enriched Atmosphere	<input type="checkbox"/> Toxic Atmosphere	<input type="checkbox"/> Entrapment	<input type="checkbox"/> Welding/cutting	<input type="checkbox"/> Flammable Atmosphere	<input type="checkbox"/> Hazardous Chemical											
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<u>Tests to be taken</u>	<u>Date/Time</u>	<u>Re-Testing</u>	<u>Date/Time</u>																				
Oxygen _____ %	_____ a/p	Oxygen _____ %	_____ a/p																				
Lower Explosive Limit _____ %	_____ a/p	Lower Explosive Limit _____ %	_____ a/p																				
Toxic Atmosphere _____		Toxic Atmosphere _____																					
Instruments Used _____		Instruments Used _____																					
Worker conducting safety checks signature _____																							
Remarks on the overall condition of the confined space: _____ _____																							
<table style="width: 100%;"> <tr> <td><input type="checkbox"/> ENTRY AUTHORIZATION—All actions and/or conditions for safe entry have been performed</td> </tr> <tr> <td>Person in charge of entry _____ <small>Please print</small></td> </tr> <tr> <td><input type="checkbox"/> ENTRY CANCELLATION—Entry has been completed and all entrants have left the space</td> </tr> <tr> <td>Person in charge of entry _____ <small>Please print</small></td> </tr> </table>				<input type="checkbox"/> ENTRY AUTHORIZATION —All actions and/or conditions for safe entry have been performed	Person in charge of entry _____ <small>Please print</small>	<input type="checkbox"/> ENTRY CANCELLATION —Entry has been completed and all entrants have left the space	Person in charge of entry _____ <small>Please print</small>																
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Person in charge of entry _____ <small>Please print</small>																							

Section 48 Safety and protection—generally

An employer must ensure that all equipment to safely perform confined or restricted space work, including personal protective equipment and rescue equipment, is available and inspected to ensure it is in good working order. All workers must follow the code of practice for confined space and use the equipment as necessary to protect their health and ensure their safety.

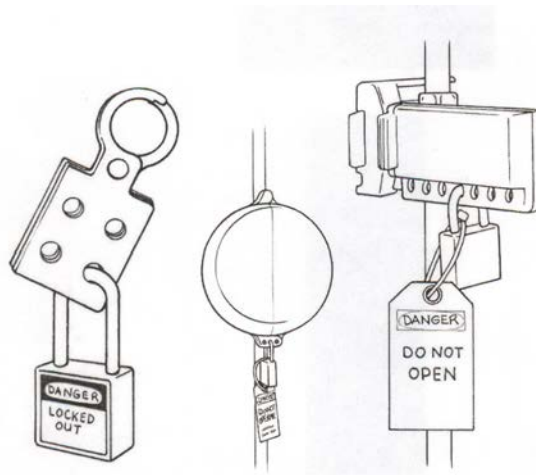
Lifelines can present a danger if they get tangled around equipment or wrapped around a protrusion in a confined or restricted space. Lifelines, in the event that they are required, may only be used in a manner that does not endanger a worker by creating another hazard.

Workers within a space must be able to effectively communicate amongst themselves (where necessary) and communicate with workers outside the confined or restricted space using a system that is appropriate to the hazards within the confined or restricted space, e.g., communication equipment that functions in the presence of hazardous gases.

Section 49 Protection—hazardous substances and energy

When a worker is in a confined space, uncontrolled energy sources and hazardous substances must be prevented from creating a hazard to workers. Examples of appropriate controls include blanking or blinding, double blocking and bleeding, misaligning or removing sections of lines, pipes or ducts, controlling all sources of hazardous energy, de-energizing equipment and immobilizing or disconnecting all mechanical linkages (see Figure 5.3). In certain cases, alternate means of isolation and safe work procedures, certified by a professional engineer, may be used to protect workers.

Figure 5.3 Methods of controlling hazardous energy



Blanking involves inserting a physical barrier through the cross-section of a pipe so that materials are prevented from flowing past that point (see Figure 5.4). Blinding involves disconnecting a pipe and attaching a physical barrier to its end so that materials are prevented from flowing out of the pipe. Double blocking and bleeding involves use of a three-valve system where a pipe has two closed valves and an open drain valve positioned between them so that material is prevented from flowing and is re-directed in case of a valve leak (see Figure 5.5). The valves of a double block-and-bleed system need to be locked to ensure an acceptable level of safety.

Figure 5.4 Example of blanking

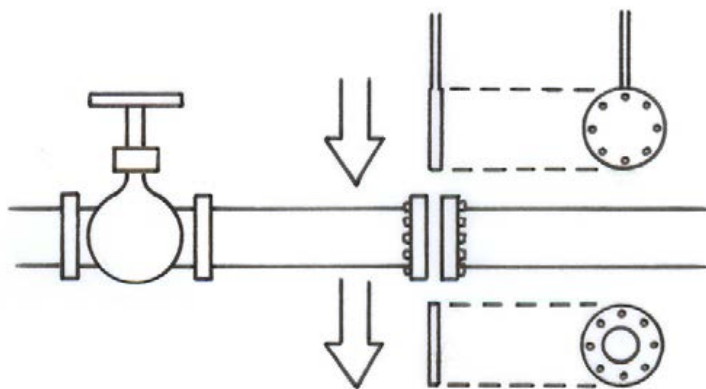
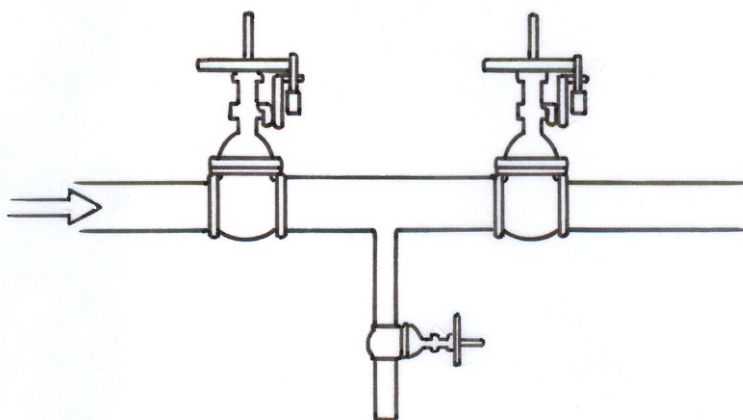


Figure 5.5 Example of a double block and bleed



Special care must be taken to ensure that workers are protected against drowning, engulfment, entrapment or other hazards presented by free-flowing material(s) that may be encountered within a confined space. In some circumstances for example, a full body harness and lifeline system may be needed. See Table 5.2 for a list of common non-atmospheric hazards.

Table 5.2 Common non-atmospheric hazards

Common non-atmospheric hazards		
Hazard	How it occurs	Why you should be concerned
Engulfment	Loose material drawn from the bottoms of storage bins can suffocate or bury an entrant. Liquids or materials are suddenly released into the space.	Liquid or loose materials can trap or bury a worker in seconds.
Mechanical and hydraulic energy	Mechanical and hydraulic equipment start or move unexpectedly.	Entrants servicing mechanical and hydraulic equipment can be seriously injured or killed if the energy isn't properly controlled.
Noise	Confined space can amplify sounds produced by tools and equipment.	Noise interferes with essential communication between entrants and attendants.
Falling objects	Objects fall into the space because topside openings are unguarded or improperly guarded.	
Extreme temperatures	The space's location and the equipment it contains make it very hot or cold.	Hot environments put workers at risk for heat stress, especially if they are doing strenuous work or wearing protective clothing—cold environment make tasks more difficult to accomplish.
Slippery surfaces	Leaks, spills and condensation make walking surfaces slippery.	Wet surfaces are usually slippery. They increase the risk of falls.
Corrosive chemicals	Corrosive chemicals are stored in the space, or entrants use them to do tasks.	Corrosive chemicals can cause severe eye or skin irritation if exposed workers are not wearing protective clothing.
Access problems	Confined spaces are difficult to enter and exit.	In an emergency, entrants may not be able to exit quickly.
Illumination problems	Most confined spaces are dark places.	Poor lighting makes it difficult for workers to enter, exit, and work in a confined space.

Section 50 Unauthorized entry

Only persons with a reason for being in a confined or restricted space are allowed to be there. Persons who are not authorized by the employer to enter a confined or restricted space must be prevented from entering.

Section 51 Traffic hazards

Workers within a confined or restricted space must be protected from traffic hazards such as idling vehicles situated outside the space that could contaminate the space with exhaust, lift trucks that could damage rescue equipment, or moving vehicles around manhole areas that could interfere with worker safety.

Section 52 Testing the atmospheric

Before entering a confined space that may contain a hazardous atmosphere, e.g., oxygen deficient or containing toxic or explosive substances, pre-entry atmospheric testing must be done to ensure that levels of oxygen are adequate and that any hazardous substance is identified (see Figure 5.6). Competent workers must conduct the testing with suitable test equipment that has been properly calibrated and is used in accordance with the manufacturer's specifications. It is particularly important for the individuals performing these tests to understand the limitations of the test equipment.

Figure 5.6 Atmospheric testing



After initial tests have been completed and workers are working within a confined space, periodic testing must be conducted as often as necessary to ensure the health and safety of the workers inside. The intervals at which periodic testing should occur depend on the outcome of the hazard assessment, the work being performed in the space, and the likelihood of the atmosphere changing substantially. Note that even for a restricted space, conditions can change and the atmosphere can become hazardous. This must be

addressed in the hazard assessment to ensure workers are following the correct health and safety work procedures appropriate to the hazards.

Situations may arise in which the atmosphere within a confined space, or the concentration of an airborne substance(s) within a confined space, can change unpredictably. If the hazard assessment identifies the potential for such a situation, then continuous atmospheric monitoring is required.

If tests identify additional hazards that were not identified in the original hazard assessment, these hazards must be addressed as required by the *OHS Code*. The resulting procedures and practices must be included in the code of practice so that the code of practice is complete and deals with all identified hazards.

All test results must be recorded. Employers have the option of conventional hard copy recording on paper or through some means of electronic data logging. See Table 5.3 for a list of common atmospheric hazards.

Section 53 Ventilation and purging

Ventilating means the use of mechanical ventilation to force fresh air into the confined space while workers are working. Purging means the introduction of substances such as an inert gas, steam or water into a confined space to displace or flush out contaminants prior to workers entering the space. Note that purging may itself create a hazard (oxygen deficiency) that may need to be addressed before workers enter the space.

If atmospheric testing identifies that a hazardous atmosphere is present or is likely to be present in a confined space, the space must be ventilated, purged or both before a worker enters the confined space. If ventilating or purging is impractical or does not eliminate the atmospheric hazards, workers are then required to wear appropriate personal protective equipment. Personal protective equipment is not an acceptable method of worker protection from flammable or explosive atmospheres.

If mechanical ventilation is required to maintain a safe work atmosphere within a confined space, the employer must ensure that the ventilation system incorporates a method of alerting workers if the system fails. Workers must be trained in the evacuation procedures to be used if the ventilation system fails.

Table 5.3 Common atmospheric hazards

Common atmospheric hazards		
Hazard	How it occurs	Why you should be concerned
Oxygen deficiency (less than 19.5 percent oxygen)	Chemical or biological reactions consume oxygen. Some chemicals displace oxygen (e.g., methane). Purging also displaces oxygen.	Oxygen-deficient atmospheres affect heart rate, muscle coordination, and breathing. Eventually, they lead to death.
Oxygen enrichment (greater than 23.0 percent)	Results from welding tasks and from the improper use of oxygen for breathing air.	Oxygen-enriched atmospheres increase the risk of fire or explosions.
Flammable atmospheres	Fuel, oxygen, and a source of ignition cause fires and explosions.	Flammable gases such as acetylene, butane, propane, hydrogen, and methane are often common in confined spaces. Grain, nitrated fertilizers, and ground chemicals can produce combustible dusts.
Toxic atmospheres	Accumulates through manufacturing, biological, or chemical reactions. Released during work or tasks such as welding and cleaning.	Many manufacturing processes, stored materials, and work tasks produce toxic gases, vapours, or dusts.
Corrosive atmospheres	Accumulates from some manufacturing processes, biological or chemical reactions.	Corrosive substances destroy living tissue. Some cause immediate damage to skin and eyes; some have no immediate effect, but cause cancer with prolonged exposure.

Section 54 Inerting

Inerting means the introduction of an inert (unreactive) gas such as nitrogen into a confined space to completely displace all oxygen.

For a flammable mixture to burn or explode, a source of oxygen and a source of ignition are required. Inerting is a technique that is used to remove air and the oxygen that it contains. This creates an oxygen-deficient atmosphere and workers who enter the space must be properly trained and equipped with self-contained breathing apparatus, self-contained oxygen generating apparatus or supplied-air breathing apparatus with an emergency escape bottle.

Care must be taken to ensure that the atmosphere remains inerted while workers are within the confined space. To ensure an additional level of safety, all ignition sources must be controlled so that they cannot trigger a fire or explosion. See Part 10 of the *OHS Code* for requirements dealing with fire and explosion hazards.

Section 55 Emergency response

Before work in a confined or restricted space is allowed, the employer must have an effective emergency response plan in place (see also Part 7). In the event of an emergency, workers must be able to carry out an effective rescue and workers must be able to immediately evacuate a confined or restricted space if conditions warrant.

Comments on the use of 911 for rescue

In the case of rescues involving workers in confined spaces and workers suspended in the air after a fall, calling 911 alone and awaiting the arrival of rescue services personnel is considered to be an insufficient emergency response. The employer must have some basic level of on-site rescue capability- see this section for confined spaces and section 140 for fall protection—in the event that rescue services personnel are delayed or unable to attend the scene.

In some situations, rescue services personnel may not have the equipment or skills to perform a rescue, e.g., a worker in a confined space deep below ground level in a horizontal tunnelling operation or a worker suspended 100 metres above ground level following the failure of a swingstage scaffold. In such cases, the employer's on-site rescue capability must be such that the work site is virtually self-sufficient in returning a rescued worker to the surface or ground level.

Section 56 Tending worker

With effective communication, work in a confined or restricted space is made easier, safer and in many cases, more productive. Care must be taken when selecting communication equipment for this unique work environment. Confined or restricted spaces are very different from any other work area and must be treated accordingly.

Radio signals do not penetrate metal or concrete reinforced with re-bar, which describes a majority of confined or restricted space environments, creating dead spots or reducing signal strength. Messages can become garbled or are not received. Noisy environments either within the confined or restricted spaces or immediately outside the spaces can create additional challenges. This prevents continuous communication in certain types of spaces.

Radio equipment is extremely effective when used by safety attendants outside spaces to maintain contact with their base or, in the event of a problem, to call for rescue assistance.

The preferred choice for reliable communication in confined or restricted spaces is a hardline full duplex system, which allows hands-free communication between a tending worker and workers inside the space.

No matter which method of communication is chosen, the equipment selected should be suited to the particular work environment. It should be extremely rugged, resistant to chemicals, environmentally sealed and intrinsically safe if used in a potentially hazardous location.

As required by subsection (3), a tending worker—a competent worker trained in the evacuation procedures in the emergency response plan and who is present outside the confined space, at or near the entrance—is required under the following four conditions:

- (a) the oxygen content of the atmosphere inside the confined space is less than 19.5 percent by volume;
- (b) the oxygen content of the atmosphere inside the confined space is greater than 23.0 percent by volume;
- (c) the concentration of a substance listed in Table 2 of Schedule 1 inside the confined space is greater than 50 percent of its occupational exposure limit; or
- (d) a hazard other than one listed in clauses (a), (b) or (c) is identified by the hazard assessment and the hazard cannot be eliminated or effectively controlled.

The role of the tending worker is to monitor the safety of the person(s) working inside the confined space and to take action if an emergency arises. This tending worker must

- (a) keep track at all times of the number of workers inside the confined space,
- (b) be in constant communication with the workers inside the confined space,
- (c) have a suitable system for summoning assistance, and
- (d) not leave the area until all workers have left the confined space or another tending worker is in place.

If the four conditions listed above do not apply to a particular confined space, then a tending worker as described above, having the duties described above, is not required. Instead, as required by subsections 56(1) and 56(2), a competent worker designated by the employer must be in communication with the worker(s) in the confined space. In some cases, this designated worker may be in a nearby vehicle, or may be at a central dispatch location. The competent worker designated by the employer must have a suitable system for summoning assistance in the event of an incident or emergency.

A newer development in confined space safety is the use of remote monitoring equipment, which generally consists of a live audio-video feed from both inside and immediately outside the confined space being sent to a monitoring station located outside the confined space and physically at the same work site. The equipment may be

more advanced in instances where there are multiple workers working in a confined space such as to track which workers are inside and outside the confined space. This allows a remote tending worker to see and hear what is happening inside and around the confined space and allows for two-way communication.

The *OHS Code* currently does not permit the use of a remotely located tending worker instead of a tending worker at or near the entrance to a confined space. If an employer wishes to use a remotely located tending worker to meet the requirements of this section, they must request an acceptance. In requesting an acceptance, the employer will need to comply with section 55 of the *OHS Act*, which states the request must be in writing and provide all necessary details a Director needs to evaluate the request. This includes the following:

- a detailed description of the remote monitoring system including how it will be used;
- how many workers and how many confined spaces will be monitored at one time by a remote tending worker;
- the physical location of the remote monitoring station relative to the location of the confined space(s); and
- a description of how communications with respect to confined space safety will occur between workers at the work site while confined space work is under way.

A Director may request additional information prior to making a decision on an acceptance request.

Section 57 Entry and exit

A safe means of entry and exit, free from traffic hazards, must be provided for all confined or restricted space workers and rescue personnel. For example, secured steps, temporary platforms and handrails may be suitable in certain circumstances.

Section 58 Retaining records

The employer must retain records of entry permits, air monitoring data, worker entry records and other applicable information related to each confined space entry for the periods specified.

Part 6 Cranes, Hoists and Lifting Devices

Highlights

- Section 59 states that this Part does not apply to drawworks on equipment that is subject to Part 37, *Oil and Gas Wells*.
- Section 63 requires employers to ensure that mobile cranes, boom trucks and tower cranes be equipped with load charts.
- Section 64 requires operators to be competent in the use of load charts.
- Section 65 permits the use of electronic log books. Log books are not required for manually operated hoists.
- Section 67 requires employers to develop procedures to prevent collisions during multi-crane lifts. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.
- Section 68 requires that employers provide the operator or person in charge of a lift with all the information necessary to determine the weight of the load being lifted.
- Section 68.1 establishes a requirement to conduct load calculations for lifts exceeding 75 percent of a crane's capacity.
- Section 69 describes restrictions on the lifting of loads above workers.
- Section 89 requires employers to have load-bearing components of a mobile crane undergo non-destructive testing at 12-month intervals.
- Section 112 requires employers to ensure that vehicle hoists meet the specified American National Standards Institute (ANSI) standards.

Requirements

Section 59 Application

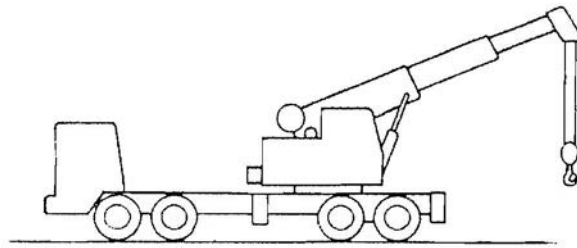
Subsection 59(1)

Except as described in subsection 59(4), all lifting devices with a rated capacity of 2000 kilograms or more are subject to the requirements of this Part. A lifting device is a device used to raise or lower materials or an object.

A crane is a lifting device that can move a load horizontally. Examples of cranes include the following:

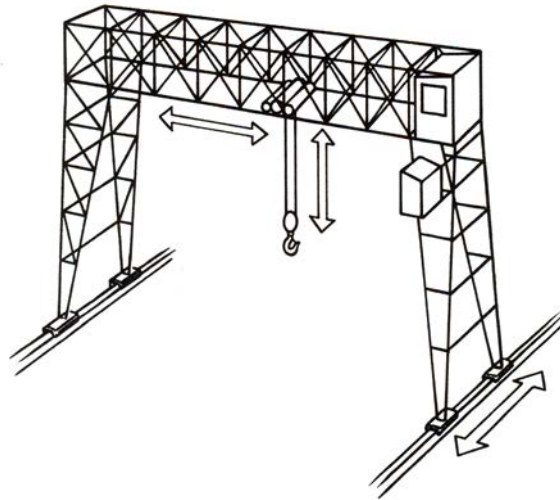
- Boom-type mobile—a self-propelled crane equipped with a boom and mounted on a chassis that is supported on either rubber tires, crawler treads or railway wheels running on railroad tracks. See Figure 6.1.

Figure 6.1 Example of boom-type mobile crane



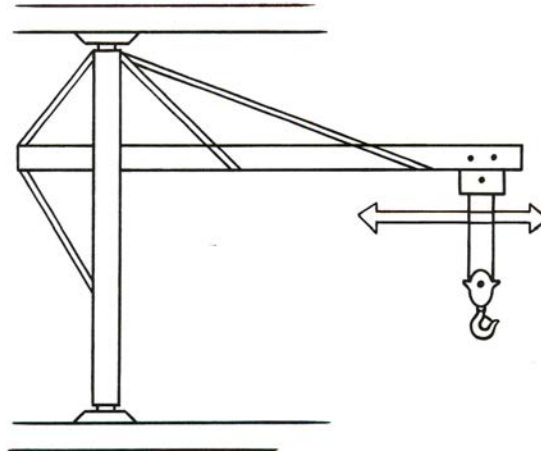
- Floor operated—a crane that is controlled via a pendant or wireless control console by an operator on the floor or a platform independent of the crane.
- Gantry—similar to an overhead travelling crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more movable legs running on fixed rails or other runway. See Figure 6.2.
 - Cantilever gantry—a gantry crane in which the bridge structure extends beyond the runway on one or both sides. Its runway may be either on the ground or elevated.
 - Portal (Whirley type)—a crane that has a boom attached to a revolving crane mounted on a gantry, with the boom capable of being raised or lowered at its head, i.e., outer end. Portal cranes may be fixed or mobile.
 - Semi-portal—a portal crane mounted on a semi-gantry frame instead of a gantry frame.
 - Semi-gantry or single leg—a gantry crane with one end of the bridge rigidly supported on one or more moveable legs, running on a fixed rail or runway, the other end of the bridge running on an elevated rail or runway.
 - Yard crane—rubber tired gantry crane.

Figure 6.2 Example of a gantry crane



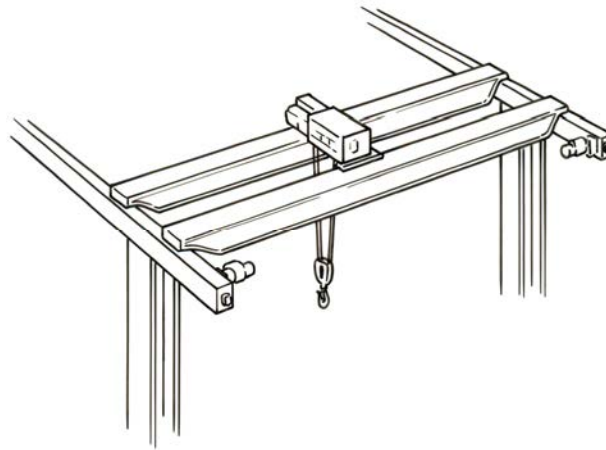
- Jib—a fixed crane consisting of a supported vertical member from which extends a horizontal swinging arm carrying the hoisting mechanism. See Figure 6.3
 - Travelling jib—a jib crane with the vertical member running on a track, its upper end guided by a parallel overhead track.

Figure 6.3 Example of a jib crane



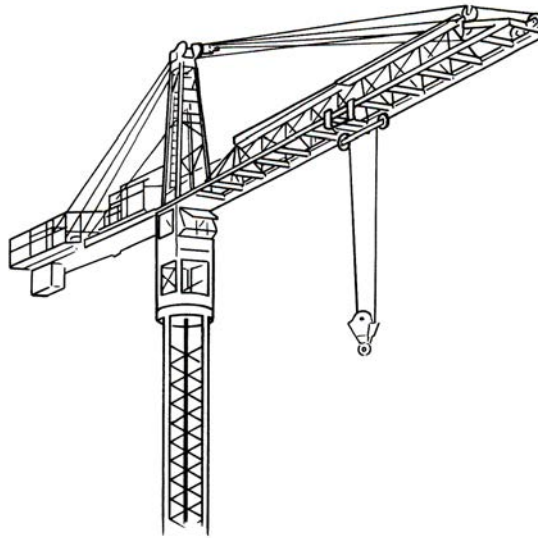
- Overhead travelling (also known as a bridge crane)—a crane on parallel elevated runways and consisting of one or more trolleys operating from a bridge operating on the runways. Operation of the travelling crane is limited to the area between the runways. See Figure 6.4

Figure 6.4 Example of an overhead travelling crane



- Pillar—a fixed crane consisting of a vertical member with a revolving boom supported at the outer end by a tension member.
 - Pillar jib—a pillar crane carrying a trolley.
- Polar—a bridge or gantry crane that travels on a circular track.
- Tower—a crane in which a boom, swinging jib or other structural member is mounted on a vertical mast or tower. See Figure 6.5.
 - Climber—a crane erected upon and supported by a building or other structure and that may be raised or lowered to different floors or levels of the building or structure.
 - Free-standing—a crane with a horizontally swinging boom that may be on a fixed base or mounted on rails.
 - Mobile—a crane mounted on a crawler tractor, truck or similar carrier for travel or transit.
 - Self-erecting—truck carrier mounted and capable of self-erection.
 - Hammerhead—a rotating, counterbalanced cantilever, equipped with one or more trolleys and supported by a pivot or turntable on a travelling or fixed tower.

Figure 6.5 Example of a tower crane



- Wall crane—a crane having a jib with or without a trolley and supported from a side wall or line of columns of a building.

A hoist is a lifting device designed to lift and lower loads. Examples include:

- Simple drum hoist—a hoist with one or more drums controlled by manual clutches, brakes or ratchet and pawl on a drum and powered by hand or electricity.
- Electric hoist—an electrically powered, motor-driven hoist, having one or more drums or sheaves for a rope or chain.

Subsection 59(1.1) Drawworks

This subsection clarifies that drawworks used in activities and auxiliary processes associated with exploring for and drilling, operating or servicing wells for gas, crude oil or geothermal energy are covered by Part 37. Drawworks on equipment used for other purposes continue to be covered by Part 6.

Subsections 59(2) and 59(3)

All requirements of this Part apply to roofer's hoists, regardless of size, except for the load chart requirements (section 63) and the log book provisions (sections 64(4) and 65).

This subsection prohibits the use, for vertical lifting, of devices not designed or intended for vertical lifting. This includes load binders, ratchet-drive pulleys (commonly known as "come-alongs"), grip-action devices (commonly known as "turfors"), etc. These units are typically designed for pulling only in a horizontal plane and are not to be used for vertical lifting unless complying with relevant provisions of Part 6 and specifically defined for vertical lifting in a manufacturer's specifications.

Subsection 59(4)

Subsection 59(1) states that this Part only applies to lifting devices with a rated load capacity of 2000 kilograms or more. Subsection 59(4) overrides this requirement with respect to the marking of rated load capacity. Knowing the load capacity of a lifting device is vital to preventing it from being overloaded. Subsection 59(4) requires all lifting devices with a rated load capacity of less than 2000 kilograms to have their rated load capacity shown on the equipment.

Section 60 Not commercially manufactured

Any lifting device must be either commercially manufactured or certified by a professional engineer as fit and safe for use. The certification must be in writing and bear the professional seal and signature of the certifying engineer as required by section 14 of the *OHS Code*.

In general, a commercially manufactured product has the following qualities:

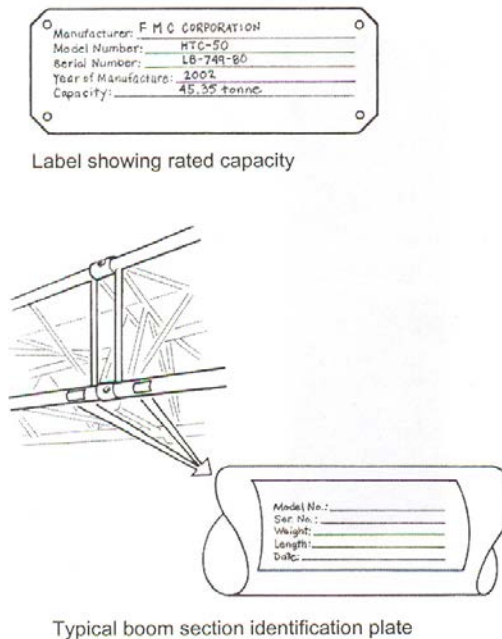
- (a) it is designed and built to some standard or generally accepted engineering principles that make it safe for use;
- (b) it is designed and built by person(s) with the skill or competence to be able to make the product safe;
- (c) it is produced with the intention of being generally available to anyone who wants to buy it—normally there is an exchange of money;
- (d) it is normally supported by the manufacturer with a warranty, guarantee, and product support; and
- (e) liability and safety issues related to its use have been addressed by the manufacturer.

It is implied by the *OHS Code*, that a product that is “commercially manufactured” is “safe” because it has been produced by a “manufacturer” that has the skills and competencies to do so.

Section 61 Identification of components

The intent of this section is to ensure that safe operation of a lifting device is not compromised by random selection and installation of components. The identification mark must be referenced to the manufacturer's specifications. Figure 6.6 shows examples of typical component marking tags.

Figure 6.6 Examples of component marking tags



Section 62 Rated load capacity

Subsections 62(1) and 62(2)

Rated capacity is the maximum load for which a lifting device is designed and built. Displaying this directly on the lifting device provides an employer with information necessary to comply with section 12 of the *OHS Code*.

For example, a lifting device with a rated capacity of 45 tonnes means that the device, with standard components and operated in accordance with the manufacturer's specifications, will lift a load of 45 tonnes without over-stressing any of the components and without exceeding safety factors. The 45-tonne rated capacity includes the weight of any auxiliary devices and rigging.

The rated capacity of a crane varies with the angle of the boom and its boom length.

In general, a commercially manufactured product has the following qualities:

- (a) it is designed and built to some standard or generally accepted engineering principles that make it safe for use;
- (b) it is designed and built by person(s) with the skill or competence to be able to make the product safe;
- (c) it is produced with the intention of being generally available to anyone who wants to buy it—normally there is an exchange of money;
- (d) it is normally supported by the manufacturer with a warranty, guarantee, and product support; and
- (e) liability and safety issues related to its use have been addressed by the manufacturer.

It is implied by the *OHS Code*, that a product that is “commercially manufactured” is “safe” because it has been produced by a “manufacturer” that has the skills and competencies to do so.

Subsection 62(3)

This labelling requirement does not apply to A-frames and gin poles.

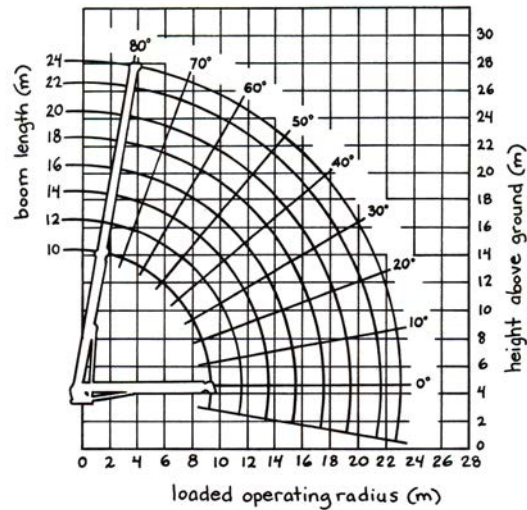
Section 63 Load charts

Subsection 63(1)

Load charts list a crane’s rated capacity at various boom lengths and incline angles (see Figure 6.7). Since these are the maximum loads that the crane can safely lift, these values must never be exceeded. The values found on crane load charts are referred to as gross capacities, rated capacities or rated loads. These values apply to a crane kept in “as new” condition and set up in accordance with the manufacturer’s specifications.

To determine the maximum load a crane can safely lift, i.e., net capacity, the weight of all auxiliary devices such as jibs, rigging (including the hook, slings, shackles, spreader bars, etc.), load blocks and ball must be deducted from the rated capacity.

Figure 6.7 An example of a load chart



Maximum Rated Load in LBS. With Outriggers Fully Extended										
Loaded Operating Radius	Loaded Boom Angle	Retracted Boom Length	Loaded Boom Angle	Boom Length	Loaded Boom Angle	Boom Length	Loaded Boom Angle	Boom Length	Loaded Boom Angle	Boom Length
Feet	<°	25 Feet	<°	35 Feet	<°	45 Feet	<°	55 Feet	<°	59 Feet
5	80	60,000								
8	73	43,000	78	40,500						
10	67	36,500	74	34,500	78	33,000	80	32,000		
12	62	31,900	71	30,100	75	28,600	78	27,500	79	27,000
14	57	28,500	67	26,500	73	25,400	76	24,300	77	24,100
16	50	25,500	63	24,100	70	22,600	74	21,600	75	21,400
18	44	23,000	59	21,800	67	20,400	71	19,400	73	19,200
20	36	21,000	55	19,900	64	18,600	69	17,700	71	17,400
25			44	16,600	57	15,500	64	14,700	66	14,500
30			31	13,500	49	13,100	58	12,400	60	12,200
35					39	11,200	51	10,700	55	10,500
40					27	9,300	44	9,300	48	9,200
45							35	8,300	41	8,300
50							24	6,900	33	7,200
55									21	6,000
60										

Ratings above the heavy line are based on structural competence and not machine stability.

Section 64 Operator requirements

Subsection 64(1)

An employer must ensure that the operator of a lifting device meets two conditions. First, the worker must be competent. Under the *Apprenticeship and Industry Training Act*, no person may work in the occupation of Crane and Hoisting Equipment Operator unless that person

- has a recognized trade certificate:
 - Alberta Journeyman Certificate
 - Alberta Qualification Certificate
 - Alberta Certificate of Completion of Apprenticeship
 - Alberta Certificate of Proficiency
 - Certificates of Completion of Apprenticeship issued by another province prior to May 9, 1996
 - Certificates bearing the Interprovincial Standards Program Red Seal
 - Effective June 26, 1988, certificates for the Trade issued by Saskatchewan Apprenticeship; or
- has applied to go into an apprenticeship program; or
- is in an apprenticeship program; or
- is a student in a work-training program; or
- is otherwise permitted under the *Apprenticeship and Industry Training Act* to work in the trade; or
- has a certificate from another jurisdiction that is not recognized and has applied to have it recognized and is working under apprentice-type supervision; or
- is in a recognized training program from another jurisdiction and working under apprentice-type supervision; or
- has applied for a certificate and is working under apprentice-type supervision.

These provisions under the *Apprenticeship and Industry Training Act* are limited to

- (a) tower cranes;
- (b) mobile cranes with a lifting capacity of 15 tons or greater;
- (c) stiff boom trucks that have a lifting capacity greater than 5 tons;
- (d) articulating boom trucks that have a lifting capacity greater than 5 tons equipped with a winch or 8 tons if not equipped with a winch; and
- (e) wellhead boom trucks.

A journeyman's certificate, or an equivalent credential recognized by Alberta Advanced Education, Apprenticeship and Industry Training, is *not* required under the *OHS Act, Regulation* or *Code* to prove the competency of a worker performing the work of a particular compulsory trade.

The absence of an Alberta trade certificate alone is insufficient to consider a worker not competent. The employer is ultimately responsible for ensuring that workers are

adequately qualified, suitably trained and have sufficient experience to perform their work safely. Employers need to be aware of OHS and other legislation that applies to their workers.

Subsection 64(2)

An operator must be able to demonstrate competency in operating the device, including, where relevant

- (a) operating the lifting device in a proper, safe, controlled, and smooth manner in accordance with the manufacturer's specifications;
- (b) reading and understanding lift plans;
- (c) maintaining the equipment log book and the operator's log book;
- (d) selecting the appropriate boom, jib and crane configuration to meet lift requirements and determine the net lifting capacity of this configuration;
- (e) determining the number of parts of line required;
- (f) thoroughly understanding the information in the operating manual and understanding the device's limitations;
- (g) knowing, understanding and properly using the load charts;
- (h) inspecting the lifting device and performing daily maintenance as required by the manufacturer's specifications or by the employer;
- (i) checking that all hazards have been identified;
- (j) shutting down and securing the device when it is unattended; and
- (k) understanding and using hand signals for hoisting operations.

Subsection 64(3)

Any worker who does not meet the requirements of subsection (1) is prohibited from operating the lifting device.

Subsection 64(4)

To ensure the safest possible lifting operation, the operator of a lifting device must be familiar with the device's operating condition. The device's log book is the record of that condition at any given time and the operator is required to review recent entries prior to operating the device.

For more information



Guidelines for Safety Training of Overhead Crane Operators and Supervisors, Government of Alberta OHS Bulletin

Section 65 Log books

Subsection 65(1)

Log books are a crucial source of relevant information about the operational condition of a lifting device. Employers have the option of using a conventional hard copy version that typically stays with the lifting device or an electronic version typically linked to a computer. Figure 6.8 is an example of a daily crane operation log book.

Subsection 65(1.1)

Manually operated hoists are used widely across many industries. Often these hoists are portable units such as come-alongs transported in vehicles and with equipment. Reflecting the difficulty and impracticality of maintaining log books for these hoists, log books are not required for manually operated hoists.

Subsection 65(2)

Because the information in the log book can be critical during a lifting operation, it is important that the log book

- (a) be readily available to an occupational health and safety officer and ready for inspection in a prompt, timely and cooperative manner,
- (b) be up-to-date, accessible and ready for use by an operator in a prompt and timely manner, and
- (c) stays with the lifting device if ownership of the device changes.

Subsection 65(3)

In addition to the listed details, it is good operating practice to record in the log book the results of a pre-use check that includes the following:

- (a) structural condition;
- (b) time, date, weather condition;
- (c) damage;
- (d) running repairs;
- (e) all accidents and incidents involving the crane; and
- (f) “shock loading” incidents.

In the case of tower cranes, CSA Standard Z248-04, *Code for Tower Cranes*, specifically requires that before commencing work each day, the crane must be operated through its full range of movements to ensure that all limit switches, signal lights, brakes, and audio and visual indicators are functioning properly.

Figure 6.8 Example of an operator's daily crane log book

DAILY CRANE OPERATION LOG BOOK

Week Ending:
 Saturday: _____, 20____ Operator: _____
 Unit Number: _____
 Model Number: _____ Hour Meter Reading: ____/____/____/____/____/____/____

Items Checked	S	M	T	W	T	F	S	Operator Comments
(1) Oil levels—engine, transmission, hydraulic								
(2) Antifreeze (coolant), fan belts								
(3) Headlights, taillights, clearance/marker lights								
(4) Brake lights, revolving beacon light								
(5) Backup alarm, horn, windshield wipers								
(6) All glass clear/good condition								
(7) Swing brake, house lock								
(8) Boom angle indicator								
(9) Weight load indicator								
(10) Anti two block device								
(11) All instrument gauges								
(12) Air pressure, low air pressure warning device								
(13) Air tanks drained								
(14) Parking brake, foot brakes								
(15) All controls for proper function								
(16) Outrigger pads, latches, outrigger float pads								
(17) Tire condition/pressure, wheel studs (or tracks)								
(18) Hoists (load, whip or boom)								
(19) Boom and attachments								
(20) Hooks, load block, headache ball								
(21) Fuel								
(22) Fire extinguisher								
(23) Operator manual								
(24) Walk around inspection for <ul style="list-style-type: none"> • Loose/missing bolts • Pins/cotter pins • Leaking fluids • Cracked/damaged hoses • Cracked welds • Dents/damage • Frayed/damaged wire rope • Protective guards/shields in place 								

Comments:

Subsections 65(4) and 65(5)

For control and audit purposes, it is important that each entry in the log book is

- (a) signed by the person performing the work if it is a paper log book, or
- (b) identifies the person doing the work if it is an electronic log book.

Subsection 65(6)

Having the employer's representative initial entries in the log book ensures that the employer has knowledge of all the crane's activities.

Section 66 Preventing an unsafe lift

The operator is responsible for being aware of conditions that may affect safety at the lift site. This can include site conditions, equipment conditions, or any other aspect of the lift. If the operator has any doubt as to the safety of the lift, the operator must cease operations until the condition is made safe.

Section 67 Preventing collisions

Whenever two or more lifting devices are on site and close enough that a collision might happen (see Figure 6.9), the employer must

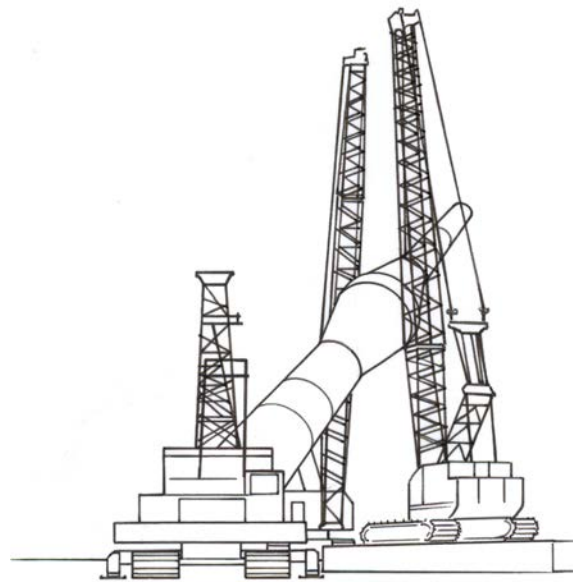
- (a) prepare procedures to prevent collisions. Section 14 of the *OHS Act* requires the procedures to be in writing or electronic format and available to workers, the joint work site health and safety committee and the health and safety representative, if there is one. Such procedures can take into consideration the following:
 - provision of adequate, qualified supervision
 - ground conditions
 - the use of proximity sensing and warning devices
 - exact load weight and configurations
 - the longest expected load radius of each crane
 - boom length and boom angles of each crane
 - line, swing and boom speeds
 - the need to travel with a load; and
- (b) ensure that operators are familiar with these procedures as required by section 13 of the *OHS Regulation*.

Unless specifically required elsewhere in this Part, the employer should

- (a) ensure that operators are kept aware of operating conditions, including the location and proximity of other lifting devices;
 - (b) ensure that all workers involved know exactly what they must do and what movements will be made before the lift begins; and
 - (c) ensure that operators are provided with a visual or auditory means of communicating with each other.
-

Only one person should direct and control operations involving multiple cranes. That person should be positioned to view the total operation and should maintain contact with the operators.

Figure 6.9 Example of multiple cranes in service



Section 68 Load weight

The weight of the load being lifted is perhaps the most critical piece of information needed to conduct a lift safely. Everyone involved in the lift must know this in order to carry out their duties. The rigger must be able to apply the appropriate type, number and configuration of slings and other attachments. The operator must be able to place the lifting device and adjust boom lengths and angles to the appropriate configuration. The person in charge of the lift, such as the lift coordinator, has ultimate responsibility at the lift site for the lift's safe execution. Depending on the complexity of the lift, a lift engineer or rigging specialist may be required to design the lift.

The total weight of a load is the sum of the actual load weight, the weight of the hook and block, and the weight of slings and other lifting attachments. These weights can be determined in information provided by manufacturers, engineering specifications, or calculations performed by a competent person.

Section 68.1 Lift calculation

Performing a lift calculation ensures that relevant and applicable factors for lifting a load have been considered and calculated. These factors include

- (a) load information (total weight of item to be lifted, weight of load block, weight of rigging/attachments, load centre of gravity, if applicable;

- (b) crane information:
- (i) mobile cranes, i.e., maximum radius, boom length/angle, configuration, relevant deductions, etc.;
 - (ii) overhead cranes, i.e., capacity;
- (c) calculated percentage of crane capacity; and
- (d) sketch, i.e., crane placement, clearance to surrounding facilities like buildings and power lines.

While this is a good practice regardless of the load weight, it is critical as the load approaches the crane's capacity. This calculation must be performed when the load reaches or exceeds 75 percent of the crane's capacity.

For multiple lifts, the "worst-case" lift can be used to satisfy this requirement. In the case of tower cranes, lifting operations are typically planned or engineered and test weights are lifted daily. This would satisfy this requirement.

Figure 6.9.1 Example of hoisting information and planning sheet

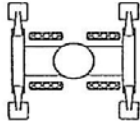
- HOISTING INFORMATION AND PLANNING SHEET -	
JOB DESCRIPTION:	DATE :
AREA CONTACT:	S.W.P. # :
LOCATION:	J.T. # :
OPERATOR NAME:	CRANE SIZE:
WEIGHT OF LOAD INFORMATION PROVIDED BY:	
- LIFT INFORMATION -	- LIFT DIAGRAM -
WEIGHT OF LOAD: _____ LBS ALLOWANCE FOR EXTRA WEIGHT: _____ LBS <small>(Scale, Sludge, Internals, Liquid etc.)</small> WEIGHT OF RIGGING: _____ LBS WEIGHT OF BLOCK OR BALL: _____ LBS WEIGHT OF ATTACHMENTS: _____ LBS TOTAL WEIGHT TO BE LIFTED : _____ LBS MAX. RADIUS TO BE USED: _____ BOOM LENGTH: _____ BOOM ANGLE: _____ CAPACITY FROM CHART: _____ LBS % OF CAPACITY: _____ (See example below) EST. CLEARANCE BETWEEN BOOM AND SURROUNDING FACILITIES: _____	
EXAMPLE: TOTAL WEIGHT TO BE LIFTED: <u>8.695</u> LBS DIVIDED BY CAPACITY FROM CHART: <u>15.500</u> LBS X 100 = % OF CAPACITY: <u>56.1%</u>	

Figure 6.9.2 Example of lift calculation form (A)

Overhead Crane Lift Calculation Form

Crane Unit Number	Capacity of Crane (A) Lbs/mt	Rigging Weight (R) Lbs/mt	Load Weight (L) Lbs/mt	Total Weight (R+L) Lbs/mt	Percentage of Load Capacity (R+L)/(A)	Operator's Name	Date

mt = metric tonnes

Figure 6.9.3 Example of lift calculation form (B)

Mobile Crane Lift Calculation Form

Name: _____ Date: _____

This form is to be filled out when working beyond 75% of charts.

Crane Information	Lift/Crane 1	Lift/Crane 2
Crane Size		
Make/Model No.		
Boom Length (ft/m)		
Jib Length (ft/m)		
Jib Stowed	Yes <input type="checkbox"/> No <input type="checkbox"/> Removed <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/> Removed <input type="checkbox"/>
Counterweight Configuration		
Mast Length (ft/m)		
Superlift (lbs/ton/mt)		
Lift Radius (ft/m)		
A Crane Capacity		
Load Information		
Load Description		
Load Weight (lbs/mt)		
Verified by		
Load Block Weight (lbs)		
Headache Ball Weight (lbs/mt)	Weight Installed <input type="checkbox"/> Removed <input type="checkbox"/>	Weight Installed <input type="checkbox"/> Removed <input type="checkbox"/>
Auxiliary Head (lbs/mt)	Weight On <input type="checkbox"/> Off <input type="checkbox"/> N/A <input type="checkbox"/>	Weight On <input type="checkbox"/> Off <input type="checkbox"/> N/A <input type="checkbox"/>
Jib Stowed or Erected (lbs/mt)		
Other (lbs/mt)		
Rigging (lbs)		
B Total Load Weight (lbs/mt)		
% Capacity = (B/A) x 100		

mt = metric tonnes (circle applicable units)

Lifting attachment used: Trunnions ☐ Lift Lugs ☐ Basket ☐ Other _____

Lift Plan:		
Reviewed by:		
Approved by:		

Section 69 Loads over work areas

Subsection 69(1)

The planning for a lift must ensure that, wherever possible, a load is not moved over workers. The planning process should assess

- (a) the type of load and its rigging requirements;
- (b) whether the load might drift, fall freely, or be released unintentionally;
- (c) whether the lifting device might strike workers; and
- (d) whether the lifting device might fail or fall over.

Subsections 69(2) and 69(3)

Subsection (3) prohibits workers from standing or passing under a suspended load, whether the load is moving or stationary. However, if there is no reasonably practicable alternative, the workers must be warned of the hazard and the lifting device operator must be aware of workers standing under the suspended load.

Subsection 69(4)

The load must be carried as close to the ground or grade as possible (and should be close to the lifting device) to reduce the possibility of injury or equipment damage in the event that the load is dropped. Other precautions that should be followed when moving a lifting device that is carrying a load include the following:

- (a) if the device has a boom, the boom should be as high as possible while still ensuring that the load does not swing;
- (b) the load should be carried in line with the device; and
- (c) the bottom edge of the suspended load should be carried at a height no greater than the shoulder height of workers attending to the load.

Section 70 Tag and hoisting lines

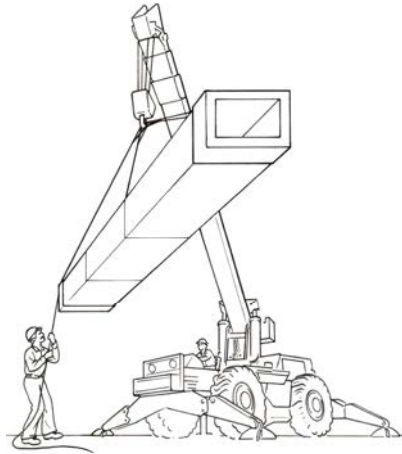
Subsections 70(1) and 70(2)

Tag lines (see Figure 6.10), which are usually made of nylon rope or other non-conductive material, are used to

- (a) help riggers control the motion of a suspended load. A load can move or swing dangerously if the crane boom moves rapidly or a gust of wind catches the load. To do so, they must be of sufficient length to allow control of the load and must be used in a manner that ensures the rigger holding the line will not be struck by the load;
- (b) allow riggers to stand a safe distance away from the load; and
- (c) provide some protection from electrocution as nylon rope is a poor conductor of electricity.

As an alternative to tag lines, an employer may consider options for securing the load to the crane or controlling equipment.

Figure 6.10 Example of tag line in use



To reduce the likelihood of a suspended load swinging or moving uncontrollably, the hoisting line must be positioned over the load's centre of gravity. The load's "centre of gravity" is the load's balance point or centre of weight. The location of a load's centre of gravity depends on the load's shape and how its weight is distributed, i.e., heavier at one end than the other, or distributed evenly.

Subsection 70(3)

Usually, tag lines improve the level of safety for riggers. They should not be used if there is a chance that the danger to workers would be increased. This could include:

- chance of contact with live electrical conductors;
- chance of entanglement in moving machinery;
- chance of getting caught on moving mobile equipment.

As an alternative to tag lines, an employer may consider options for securing the load to the crane or controlling equipment.

Section 71 Hand signals

It is common in many hoisting operations to use portable two-way radios when directing the motion of a suspended load. Where this is not possible, hand signals by a designated signaller may be required. Figures 6.11 and 6.12 are examples of standard hand signals for crane operations. The employer must designate signallers in accordance with section 191 of the *OHS Code*. All signals should be continuous and there should be no response to unclear signals.

Figure 6.11 Mobile crane signals

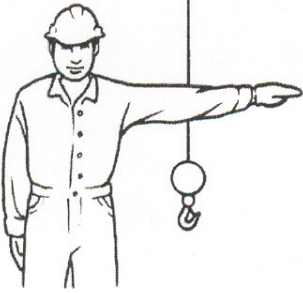


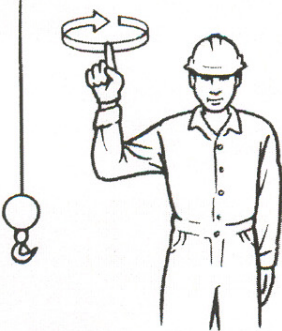
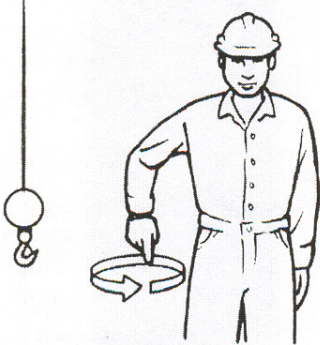
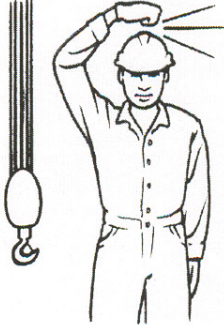
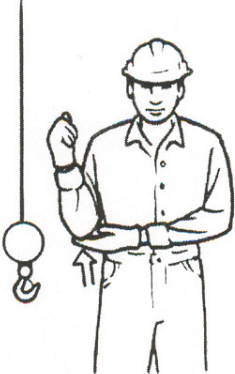
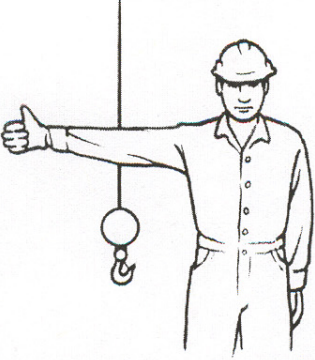
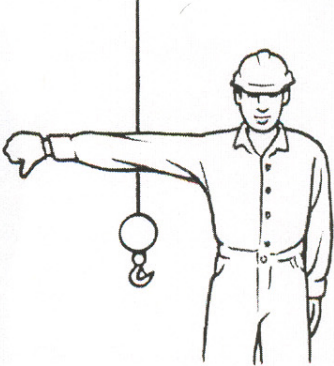
 <p>STOP Arm extended, palm down, move hand right and left.</p>	 <p>DOG EVERYTHING Clasp hands in front of body.</p>	 <p>MOVE SLOWLY Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly is shown as an example.)</p>
 <p>HOIST With forearm vertical, forefinger pointing up, move hand in small horizontal circles.</p>	 <p>LOWER With arm extended downward, forefinger pointing down, move hand in small horizontal circles.</p>	 <p>USE MAIN HOIST Tap fist on head, then use regular signals.</p>
 <p>USE WHIPLINE (Auxiliary hoist) Tap elbow with one hand, then use regular signals.</p>	 <p>RAISE BOOM Arm extended, fingers closed, thumb pointing upward.</p>	 <p>LOWER BOOM Arm extended, fingers closed, thumb pointing downward.</p>

Figure 6.11 continued

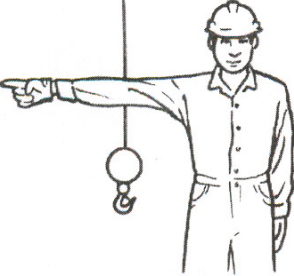
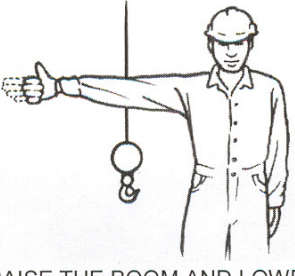
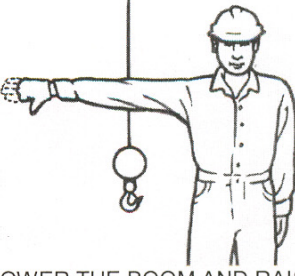
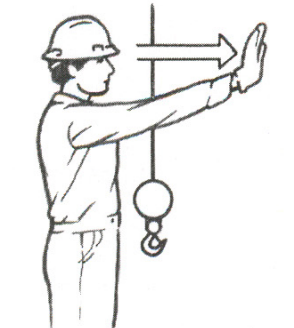
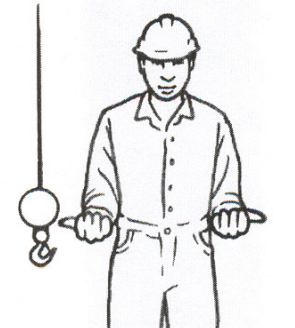
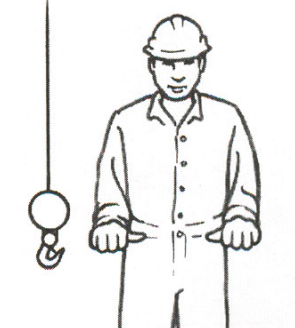
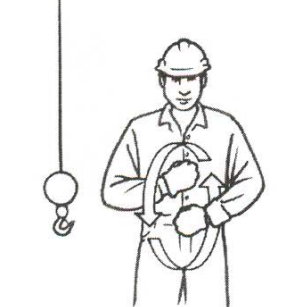
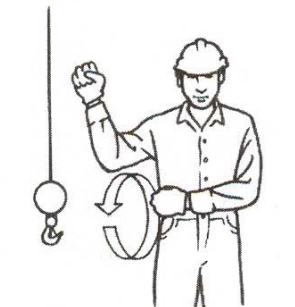
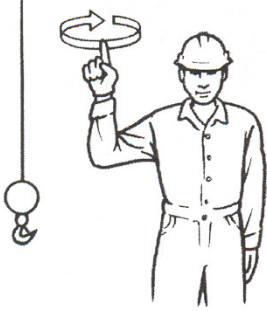
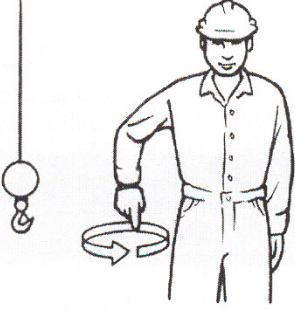
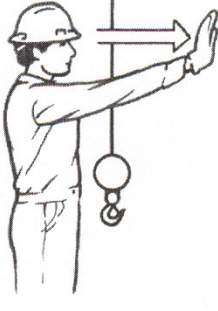
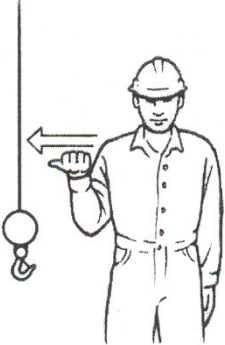
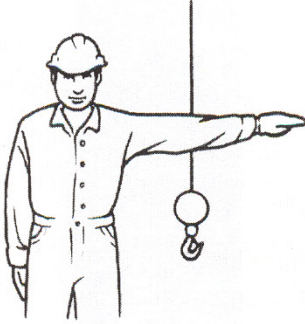
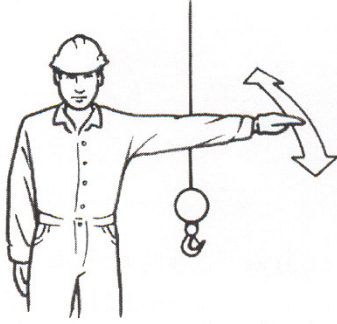
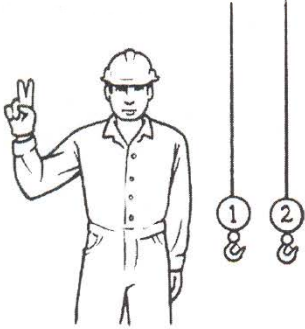
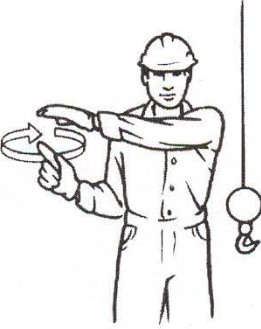
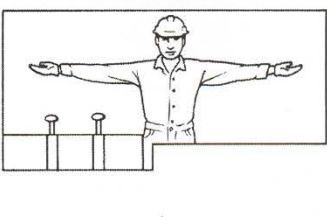
 <p>SWING Arm extended, point with finger in direction of swing of boom.</p>	 <p>RAISE THE BOOM AND LOWER THE LOAD With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.</p>	 <p>LOWER THE BOOM AND RAISE THE LOAD With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.</p>
 <p>TRAVEL (Rail mount or trolley) Arm extended forward, hand open and slightly raised, making pushing motion in direction of travel.</p>	 <p>EXTEND BOOM (Telescoping booms) Both fists in front of body with thumbs pointing outward.</p>	 <p>RETRACT BOOM (Telescoping booms) Both fists in front of body with thumbs pointing towards each other.</p>
 <p>TRAVEL (Both tracks) Use both fists in front of body making a circular motion about each other, indicating direction of travel, forward or backward. (For crawler cranes only)</p>	 <p>TRAVEL (One track) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For crawler cranes only)</p>	

Figure 6.12 Overhead crane signals

 <p>HOIST With forearm vertical, forefinger pointing up, move hand in small horizontal circle.</p>	 <p>LOWER With arm extended downward, forefinger pointing down, move hand in small horizontal circle.</p>	 <p>BRIDGE TRAVEL Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>
 <p>TROLLEY TRAVEL Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.</p>	 <p>STOP Arm extended, palm down, hold position rigidly.</p>	 <p>EMERGENCY STOP Arm extended, palm down, move hand rapidly right and left.</p>
 <p>MULTIPLE TROLLEYS Hold up one finger for block marked "1" and two fingers for block marked "2". Regular signals follow.</p>	 <p>MOVE SLOWLY Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal.</p>	 <p>MAGNET IS DISCONNECTED Crane operator spreads both hands apart, palms up.</p>

Section 72 Controls

Subsection 72(1)

“Constant manual pressure” is the deliberate, sustained application of force in order to operate the device. Typically, this force is applied by the operator’s hand or foot. Removal of this force is intended to immediately stop the operation. Any form of locking mechanism that keeps the control active without use of the operator’s hand or foot is not permitted.

Subsection 72(2)

A drilling rig is typically equipped with a control that maintains a pre-determined weight on the drill bit. This control can be hydraulically or air-operated and adjusts automatically as drilling conditions change.

Subsection 72(3)

“Visually distinguishable” means that the operator is visible at a distance and can be identified as the operator. This can be accomplished by the wearing of high-visibility clothing or markings of a distinctive colour.

Section 73 Repairs and modifications

For the purpose of this section,

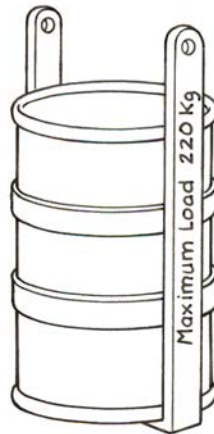
- (a) “repairs” are actions that restore, renew or mend to sound condition after damage or excessive wear, and
- (b) “modifications” are changes or alterations unrelated to any damage.

It is good practice to contact the manufacturer before repairs or modifications are undertaken. Any thin-walled structural sections that have buckled, been dented or deformed should be cut out and replaced with new components that are, at a minimum, equivalent in strength and capacity to the original. Any modifications must not by-pass or decrease any function or capability of the lifting device.

Section 74 Containers for hoisting

Containers must be strong enough to withstand hoisting forces and forces exerted by the load. See Figure 6.13.

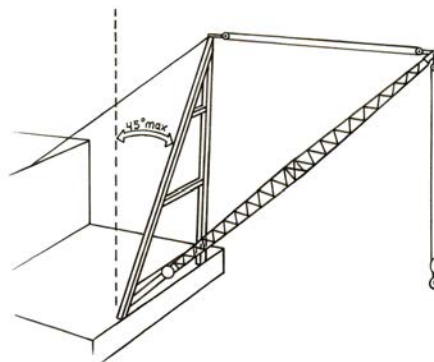
Figure 6.13 Example of an acceptable container for hoisting



Section 75 A-Frames and gin poles

Inclining an A-frame or gin pole at an angle greater than 45 degrees from the vertical can impose unusual forces on components leading to hoist failure.

Figure 6.14 Example of A-frame with boom



An A-frame is not typically built with a boom. However, where it is, adequate "boom stops" can be provided by using chains or guy lines.

Section 75.1 Suspended personnel baskets

Subsection 75.1(1)

Because its failure can have catastrophic consequences, a suspended personnel basket that has not been commercially manufactured must be designed and certified by a professional engineer as safe for use. Readers are referred to section 88.1 of this Explanation Guide for technical design requirements applicable to personnel baskets used with a mobile crane.

Figure 6.15.1 shows a commercially manufactured suspended personnel basket. This type of personnel basket may be manually operated or power driven, is generally suspended from a thrustout, and is equipped with a separate vertical lifeline, i.e., life safety rope. Figure 6.15.2 shows a typical personnel basket designed and certified by a professional engineer. It is generally suspended from a crane and is not equipped with a separate vertical lifeline, i.e., life safety rope, for each worker in the basket. This type of personnel basket requires a separate safety line as described below.

Figure 6.15.1
Example of a commercially manufactured
suspended personnel basket

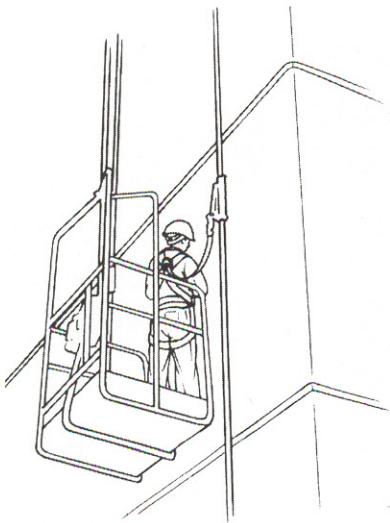
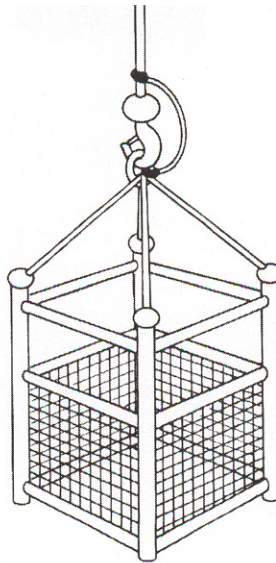


Figure 6.15.2
Example of a suspended personnel
basket designed and certified by a
professional engineer



Commentary about “commercially manufactured”

In general, a commercially manufactured product has the following qualities:

- (a) it is designed and built to some standard or generally accepted engineering principles that make it safe for use;
- (b) it is designed and built by person(s) with the skill or competence to be able to make the product safe;
- (c) it is produced with the intention of being generally available to anyone who wants to buy it—normally there is an exchange of money;
- (d) it is normally supported by the manufacturer with a warranty, guarantee, and product support; and
- (e) liability and safety issues related to its use have been addressed by the manufacturer.

It is implied by the *OHS Code*, that a product that is “commercially manufactured” is “safe” because it has been produced by a “manufacturer” that has the skills and competencies to do so.

Criterion (a) refers to the product being designed and built to some “generally accepted engineering principles.” It is expected that a “manufacturer” is able to provide drawings or sketches of the product that include an assessment of the product’s strength, load-bearing capacity, etc. Further, criterion (d) mentions “product support.” This may include, among other elements, the availability of written manufacturer specifications.

Subsection 75.1(2)

Under normal circumstances, a worker working from a suspended personnel basket is protected from falling by using a personal fall arrest system such as a vertical lifeline (life safety rope)/rope grab combination or a self-retracting lifeline. The lifeline is often secured to an anchor point on the boom of the crane from which the personnel basket is suspended. In the event that it is impracticable to provide a personal fall arrest system for one or more workers in the personnel basket,

- (a) a separate personnel basket support must be attached between the suspended personnel basket and the hoisting line above the hook assembly; and
- (b) each worker within the personnel basket must wear a full body harness with lanyard securely attached to fall protection anchorage points located in or on the personnel basket.

The separate or secondary personnel basket support, in combination with the worker being attached to the personnel basket, functions as a fall arrest system. To limit fall distance and the arresting force experienced by workers inside the basket, the secondary personnel basket support must be kept as short as possible.

Cantilever hoists

Section 76 Installation and use

Subsections 76(a) and 76(b)

No explanation required.

Subsection 76(c)

This requirement is intended to protect workers from the possibility of falling materials. Where the nature of the materials is such that the load must project beyond the edges of the platform or skip, the employer must provide an effective means of protection for workers against falling materials.

Chimney hoists

Section 77 Equipment requirements

A chimney hoist is used in the construction of chimneys, stacks, silos and similar structures. Chimney hoists are typically a freely suspended bucket, platform or cage. They are constructed progressively upwards.

Subsection 77(a)

“Positive drives” means that the load-carrying unit is driven in both up and down directions. “Non-positive” (free-wheeling) means that the load-carrying unit is driven in the up direction and may be permitted to descend freely.

Subsection 77(b)

Installation of a clutch is prohibited to prevent disengagement of the positive drive mechanism either through mechanical failure or accidental activation of the clutch control.

Subsection 77(c)

The hoist operator must be aware of the hoist’s speed if the hoist is capable of operating at speeds in excess of 0.6 metres per second. Section 78 prohibits lifting a worker at a speed greater than 0.6 metres per second.

Subsection 77(d)

This requirement is intended to ensure that the hoist platform or bucket is prevented from falling in the event of a hoisting cable failure or other mechanical malfunction. More than one braking system is required and each must be capable of stopping one and one-half times the maximum load rated capacity travelling at the maximum rated speed.

Subsection 77(e)

Requiring a swivel recognizes that wire ropes have a tendency to rotate. A swivel keeps the platform or bucket from rotating.

Subsections 77(f) and 77(g)

No explanation required.

Section 78 Operator responsibilities

Subsection 78(1)(a)

Since a chimney hoist is typically freely suspended, a maximum speed limit is required.

Subsection 78(1)(b)

Proper use of the positive drive mechanism is required to control speed.

Subsection 78(1)(c)

No explanation is required.

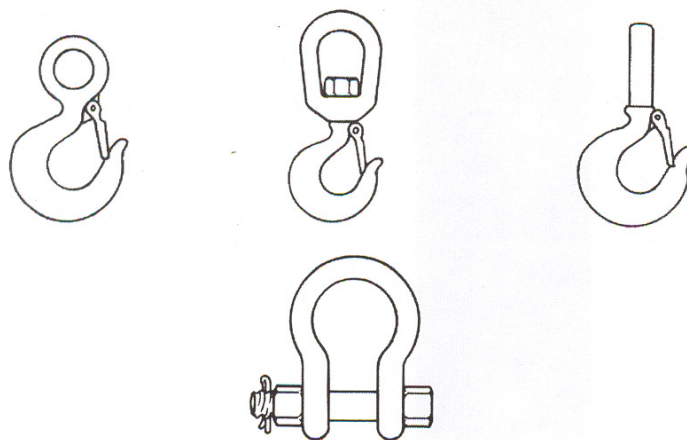
Subsection 78(1)(d)

This requirement is intended to prevent materials and equipment from striking and injuring the worker in the event that the hoist moves abruptly. The worker is permitted to hold hand held equipment while being raised or lowered.

Subsection 78(2)

Figure 6.16 provides examples of acceptable hooks and a shackle.

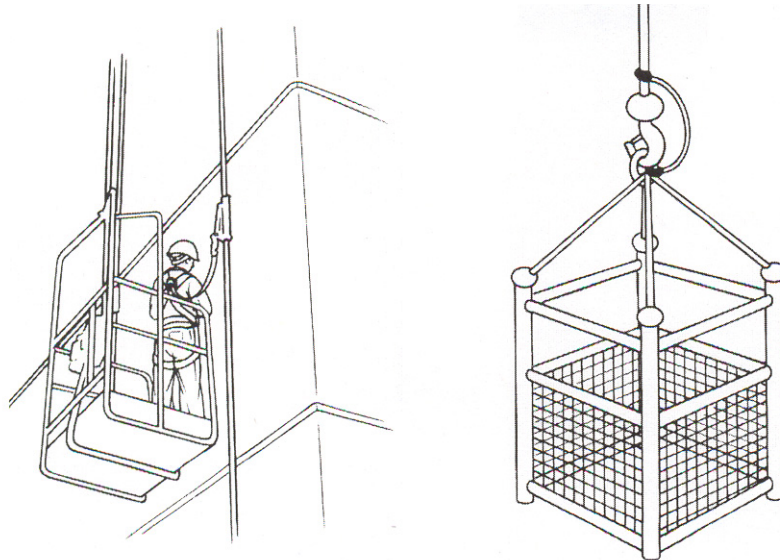
Figure 6.16 Examples of hooks with safety latches and a shackle equipped with a safety pin



Section 79 Worker in lifting device

To ensure the worker's safety, he or she must be in a personnel basket while being lifted or lowered by a chimney hoist. The requirements of section 75.1 of the *OHS Code* must be met.

Figure 6.17 Examples of personnel baskets

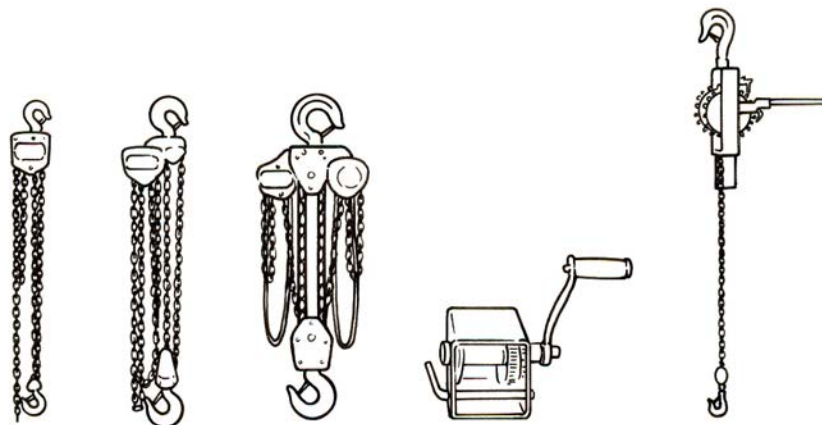


Hand-operated hoists

Section 80 Holding suspended load

"Hand-operated hoists" includes chain hoists, winches and "come-alongs." See Figure 6.18.

Figure 6.18 Examples of hand-operated hoists

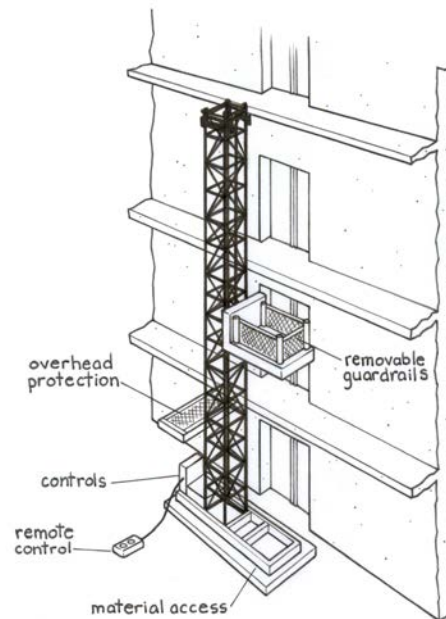


Material hoists

Section 81 Safety code for material hoists

CSA Standard CAN/CSA-Z256-M87 (R2006), *Safety Code for Material Hoists*, applies to hoists that are not a permanent part of structures and that are used to raise and lower material connected with or related to a building project. See Figure 6.19.

Figure 6.19 Example of a material hoist



The standard does not apply to

- (a) hoists for moving people;
- (b) temporary elevators installed in hoistways during the construction of buildings and incorporating a part of the permanent elevator to be installed later;
- (c) manlifts, counterbalanced or endless-belt type;
- (d) mine elevators;
- (e) cranes and derricks;
- (f) window cleaners and swingstages;
- (g) mobile forklift trucks and similar equipment; and
- (h) rope-guided and non-guided construction hoists for moving people.

The standard covers the design, construction, installation, operation, inspection and testing of material hoists. The following is a list of some of the standard's more critical requirements:

- *Part 6 Hoistway Enclosure*—this describes spacing and material requirements for a structure that isolates the hoistway, i.e., the space travelled by the car or counterweight, from all other parts of the building.

- *Part 7 Hoistway Landings and Doors*—this describes requirements for that portion of a floor, balcony, or platform used to receive the hoisted materials.
- *Part 8 Cars*—this describes requirements for the load-carrying units.
- *Part 15 Operation and Operating Devices*—this describes requirements for the hoist's actuating controls.
- *Part 20 Safeties and Governors*—this describes requirements for devices to stop and hold the car or counterweight in case of overspeed or free fall or if the hoisting ropes slacken.
- *Part 25 Communication*—this describes the requirements for communication and signal systems.
- *Part 26 Inspections and Tests*—this describes the requirements for when inspections should take place, what should be included in the inspection and the tests to be carried out.

Section 82 Rider restriction

Part 10 of CSA Standard Z256-M87 (R2001), *Safety Code for Material Hoists*, requires that a sign be posted on each landing door and inside the car that reads “No Person Shall Ride On This Hoist.” The only exception is for the purposes of inspection and maintenance of the hoist by a competent worker.

Section 83 Gate interlocks

No explanation required.

Section 84 Operator responsibilities

No explanation required.

Section 85 Signal systems

Part 25 of CSA Standard Z256-M87 (R2001), *Safety Code for Material Hoists*, requires the use of either

- (a) a two-way voice communication system; or
- (b) a system, or combination of systems, of hand, audible or electric signals.

If a signal system is used, visual contact with the hoist operator must be maintained. When hand signals are used, the signaller must wear clearly distinguishable clothing such as a vest or armlets.

A signal system that incorporates voice communications must be used if a material hoist erected at a building is more than 20 metres in height.

Section 86 Hoist brakes

Clauses 21.8 and 21.9 of CSA Standard Z256-M87 (R2001), *Safety Code for Material Hoists*, describe detailed requirements for brakes. Most material hoists are fitted with an auxiliary braking mechanism sometimes referred to as a “broken rope device.” Activated in the event of a hoisting rope failure, brake cams clamp the frame of the hoist mast and stop the car from descending.

Section 87 Location protected

Subsections 87(a) and 87(b)

Clause 6.1 of the CSA standard requires that the hoistway at grade level be enclosed up to a height of at least 3.5 metres from grade level. See Figures 6.20 and 6.21.

Clause 7.4.1 of the CSA standard requires that hoistway landings be protected by substantial door and gates/guardrails as shown in Figures 6.20 and 6.21.

Guardrails must meet the requirements of section 315 of the *OHS Code*.

Figure 6.20 Example of hoistway enclosure and guarding at a landing (plan view)

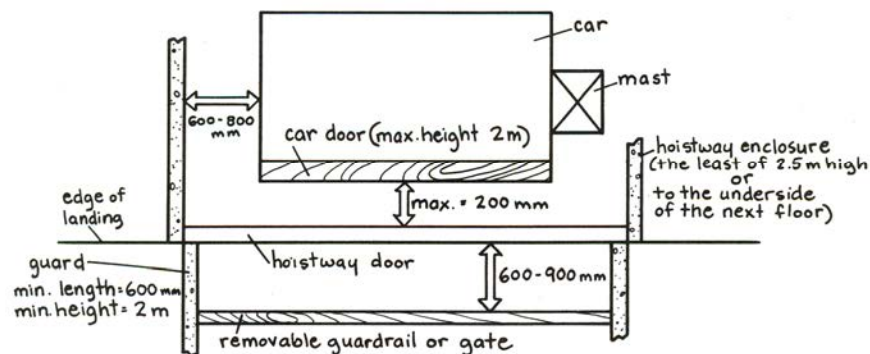
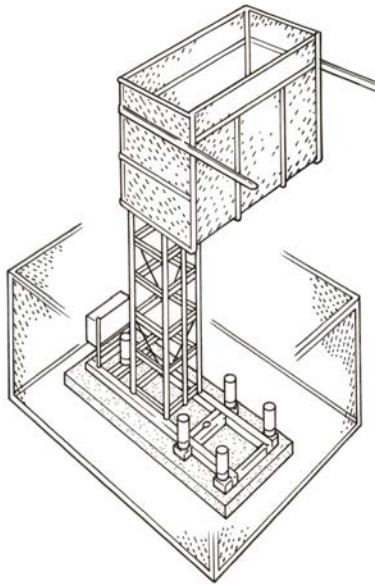


Figure 6.21 Example of typical enclosure at hoist base



Subsection 87(c)

An overhead protective covering must meet the requirements of section 318 of the *OHS Code*.

Mobile cranes and boom trucks

Section 88 Safety code for mobile cranes

CSA Standard CAN/CSA-Z150-98 (R2004), *Safety Code on Mobile Cranes*, describes the design, construction, load rating, installation, erection, inspection, maintenance, repair, modification, test and operation of lattice and telescopic boom mobile cranes.

The Standard applies only to machines that have all of the following fundamental characteristics:

- (a) the crane comprises, or is mounted on, a non or self-propelled, crawler or wheel-mounted mobile base;
- (b) the crane is designed and manufactured for the primary purpose of hoisting and lowering loads by means of tackle suspended from a boom;
- (c) the boom is lattice or telescopic and capable of being elevated and lowered in the vertical plane and of being rotated from side to side in the horizontal plane;
- (d) the tackle is suspended from the boom and is capable of being increased and diminished in length;
- (e) the crane uses an engine(s) or motor(s) of sufficient power to
 - (i) elevate and lower the boom in the vertical plane with the load suspended from the tackle;

- (ii) rotate the boom in the horizontal plane with the load suspended from the tackle;
- (iii) increase and diminish the length of the tackle with the load suspended from the tackle; and
- (iv) in the case of a self-propelled crane, propel the vehicle, carrier, or base on which or to which the boom and hoist mechanism is attached.

The Standard applies to crawler-mounted cranes, commercial truck-mounted cranes and boom trucks, and wheel-carrier-mounted cranes, as well as any variations thereof that retain the fundamental characteristics of these cranes.

The following are some critical requirements of the Standard.

Part 4 Inspection, Testing and Maintenance

(1) *Prior to initial use*

No crane is to be put into operation until it has been thoroughly inspected and any defects and hazards eliminated.

(2) *Cranes in regular use*

Inspections must be conducted at the intervals shown in Table 6.1.

Table 6.1 Inspection interval based on type of inspection

Type of Inspection	Inspection interval
Daily	To be performed daily.
Periodic	Every 3 months or every 350 hours of machine time or as specified by the original equipment manufacturer.
Annual	To be performed annually.
Complete structural inspection of telescopic boom	Any time the boom is disassembled or at a minimum once every 10 years or 10,000 hours of service or as specified by the manufacturer.
Special	Carried out as required after any form of actual, suspected, or potential damage is sustained.

Daily inspections

Daily inspections must include, but not be limited to, the following:

- (a) all rope reeving, including load lines, jib suspension, boom hoist and mid-point suspension;
- (b) all control mechanisms for incorrect and/or malfunctions interfering with proper operation;
- (c) all control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter;
- (d) all safety devices;
- (e) all air, hydraulic, lubricating and cooling systems for deterioration or leakage;
- (f) electrical apparatus for malfunction, signs of excessive deterioration, dirt, icing and moisture accumulation;
- (g) all hydraulic hoses;
- (h) hooks and latches for deformation, chemical and heat damage, cracks and wear;
- (i) hydraulic system for proper oil level;
- (j) swivels for freedom of rotation;
- (k) clutches, brakes and attachments for malfunction;
- (l) outriggers and outrigger boxes;
- (m) tires.

Periodic inspections

Periodic inspections must include, but not be limited to, the following

- (a) all daily inspection items;
- (b) deformed or corroded and cracked members or welds in the crane structure or boom;
- (c) loose bolts, nuts, pins;
- (d) cracked, worn or distorted parts such as pins, gears, rollers, and locking devices;
- (e) wear on brake and clutch system parts such as linings;
- (f) pawls and ratchets;
- (g) load, boom angle and other indicators;
- (h) all power plants;
- (i) hooks;
- (j) all control mechanisms for excessive wear and contamination;
- (k) travel steering and braking systems for malfunction;
- (l) worn or damaged tires and crawler undercarriage;
- (m) hoses, fittings and tubing for leakage, blistering, deformation, tight joints, excessive abrasion or scrubbing;

- (n) hydraulic and pneumatic pumps and motors for loose bolts, fasteners, leaks, shaft seal leaks, unusual noises or vibration, loss of operating speed, excessive heating, loss of pressure;
- (o) valves for cracks, leaks, sticking, failure;
- (p) cylinders for leaking, seals, welded joints, scored, nicked, dented rods, dented case, loose, deformed rod eyes and joints;
- (q) filters;
- (r) windows, horn, wipers, heater, defroster, lights, gauges, transmissions, differential, cooling, fuel, electrical system, drive belts, suspension, steering, brake systems, crawler chain, tracks, sprockets, rollers.

Annual inspection

An annual inspection must be performed by a qualified person and supervised by a professional engineer. Annual inspections must include, but not be limited to, the following:

- (a) all daily and periodic inspection items including test load, if specified by the manufacturer;
- (b) outrigger and outrigger boxes;
- (c) rotating frame and bearing including main baseplate welds;
- (d) steering knuckles;
- (e) boom foot section, lattice boom;
- (f) boom head;
- (g) boom hoist;
- (h) boom sections including sheaves, hooks, blocks, wedge sockets;
- (i) teardown inspection and lubrication of the swivel hook, and block assembly at least every five years and the hooknut disassembled and inspected for corrosion and wear.

Inspection of welds must be in accordance with CSA Standard W59-M1989 (R2001), *Welded Steel Construction (Metal Arc Welding)*. Critical areas identified by the manufacturer, the supervising professional engineer or the qualified inspector must be further examined by an appropriate non-destructive test.

Structural inspection of telescopic boom

In addition to daily, periodic and annual inspections, non-destructive testing and inspection of interior welds within 1.8 metres of the base or tip of each section of the telescoping boom must be performed every 10 years or 10,000 hours of service, whichever comes first, or as specified by the manufacturer.

(3) *Cranes not in regular use*

A crane that has been idle for more than one month but less than six months must be given a daily inspection before being placed into operation. A crane that

has been idle for more than six months must be given a periodic inspection before being placed into operation.

(4) *Testing*

Prior to initial use, all load-bearing parts that have been altered, replaced or repaired must be load tested to 100 percent of rated capacity by a professional engineer and re-rated by the original manufacturer or a professional engineer.

(5) *Maintenance*

A preventive maintenance program based on the manufacturer's specifications is required. Any adjustments must be in accordance with the manufacturer's specifications or a professional engineer.

Section 88.1 Personnel baskets

Subsection 88.1(a)

Clause 5.4.7 of CSA Standard CAN/CSA Z150-98 (R2004) states:

5.4.7.1 Personnel Lifting for Suspended Baskets

5.4.7.1.1 General

The person specifically responsible for the overall work function to be performed shall determine that there is no practical alternative way to perform the needed work or gain access to the area, and shall authorize its usage.

5.4.7.2.1 Platform Requirements

The platform that the worker is on shall

- (a) be capable of supporting, without failure, its own weight and at least five times the rated load of the platform;
- (b) have a minimum carrying capacity of 136 kg (300 lb);
- (c) be designed and approved by a professional engineer, and in accordance with good engineering practice;
- (d) have design drawings that set out the size and specifications of all components of the platform, including the type and grade of materials used for it, the rated load of the platform, and instruction for the proper maintenance and inspection of the platform;
- (e) be equipped with a second means of suspension or support, where the second means of support is secured above the hook. The secondary support shall, at all times, be connected to the travelling block, and neither impede the operation of the hoist line and travelling block nor compromise the structural integrity of the travelling block or the hoist line;
- (f) be constructed and maintained in accordance with the design drawings;

- (g) have all weldments conforming to CSA Standard W59 or ANSI/AWS D14.3. Similar standards or procedures are acceptable, providing the welding process meets or exceeds the criteria of CSA Standard W59 or ANSI/AWS D14.3;
- (h) not have synthetic slings and slings utilizing wire rope clips used as part of the main suspension system;
- (i) be modified or repaired in accordance with the manufacturer's specifications or as directed by a professional engineer;
- (j) be designed, constructed and maintained so that the failure of one means of support or suspension will not cause the collapse of all or part of the platform;
- (k) have the primary and secondary suspension designed with a factor of safety of 10 to 1;
- (l) have bridles and associated rigging for attachment to the hoist line that are identified and used only for the purpose of lifting or lowering workers;
- (m) be equipped with sufficient numbers of fixed supports for lanyards. Fixed supports for lanyards are clearly identified. Each support shall be free of sharp edges that might cut or chafe the connection and each shall have the ability to resist the arrest forces in case of a fall;
- (n) have all eyes in wire-rope slings fabricated with a Flemish eye, with mechanical splice;
- (o) have all wire rope, shackles, rings, master links, and other rigging hardware capable of supporting, without failure, at least ten times the maximum intended load applied or transmitted to that component;
- (p) have guardrail protection, consisting of a top rail, intermediate rail, toe board, and lower barrier. The top rail shall be no less than 900 mm (39 in) nor more than 1140 mm (45 in) in height with respect to the platform floor. The intermediate rail shall be positioned at an equal distance between the toe board and the top rail. The toe board shall be around the periphery of the platform and shall be a minimum of 90 mm (3.5 in) in height. The lower barrier shall span the distance between the toe board and intermediate rail and be of solid construction or expanded metal.
- (q) have continuous hand or grab rail inside the perimeter of the suspended platform;
- (r) have flooring with a slip-resistant surface, with provision to allow free drainage of liquids;
- (s) have means of securing loose items within the platform; and
- (t) if built with an access gate, be equipped with an acting device to restrain the gate from accidental opening. When provided, access gates shall swing into the platform.

Subsection 88.1(b)

See section 75.1.

Commentary about “commercially manufactured”

In general, a commercially manufactured product has the following qualities:

- (a) it is designed and built to some standard or generally accepted engineering principles that make it safe for use;
- (b) it is designed and built by person(s) with the skill or competence to be able to make the product safe;
- (c) it is produced with the intention of being generally available to anyone who wants to buy it—normally there is an exchange of money;
- (d) it is normally supported by the manufacturer with a warranty, guarantee, and product support; and
- (e) liability and safety issues related to its use have been addressed by the manufacturer.

It is implied by the *OHS Code*, that a product that is “commercially manufactured” is “safe” because it has been produced by a “manufacturer” that has the skills and competencies to do so.

Criterion (a) refers to the product being designed and built to some “generally accepted engineering principles.” It is expected that a “manufacturer” is able to provide drawings or sketches of the product that include an assessment of the product’s strength, load-bearing capacity, etc. Further, criterion (d) mentions “product support.” This may include, among other elements, the availability of written manufacturer specifications.

Section 89 Non-destructive testing

Non-destructive testing (NDT) is a method of testing materials and components that does not damage or destroy the test sample. NDT tests include measuring for flaws, thickness, material condition, corrosion, bulk conductivity, residual stress, alloy type, hardness, microstructure heat treatment verification and modulus.

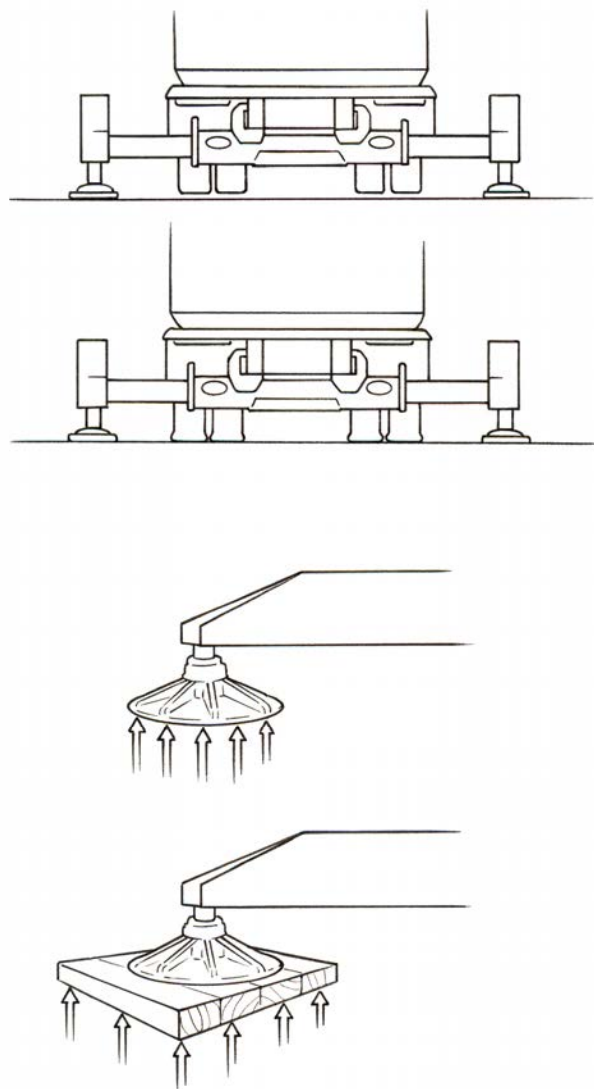
NDT methods include the use of

- (a) eddy currents;
- (b) ultrasound transducers;
- (c) acoustic emission;
- (d) magnetism, including induction or Barkhausen;
- (e) a beta gauge;
- (f) optical techniques such as a shearograph or holograph;
- (g) radiography, e.g., x-ray imaging.

Section 90 Counterweights and outriggers

Figure 6.22 shows examples of outriggers fully extended and supported on solid footings.

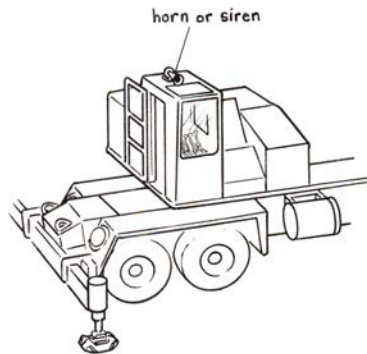
Figure 6.22 Examples of outriggers fully extended and how loads can be distributed over large, solid footings



Section 91 Warning device

This section requires a means of warning workers in the vicinity of a mobile crane. The warning must be sounded when hoisting is about to commence or the entire crane is about to be set in motion. Section 267 describes requirements for warning signals if the operator's view of the crane's path of travel is obstructed. See Figure 6.23.

Figure 6.23 Example of warning device



Section 92 Preventing damage

“Positive boom stops” are devices that prevent the boom from toppling or being pulled backwards over the top of the cab. Boom stops physically stop further motion of the boom at a predetermined safe angle.

“Boom stop limit devices” are limit switches that disconnect the drive or stop the engine when the boom reaches a predetermined angle. See Figures 6.24 and 6.25.

Figure 6.24 Example of boom stop

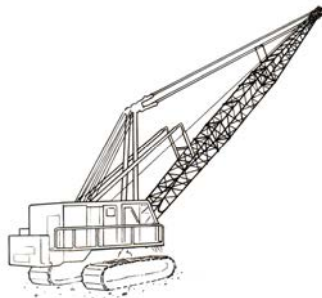
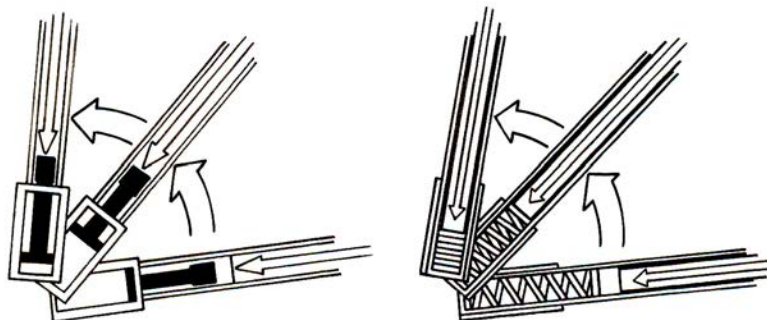


Figure 6.25 Examples of boom stop limit devices



Section 92.1 Load blocks

Load blocks are assemblies that consist of a hook or shackle, swivel, bearing, sheaves, sprockets, pins and frame. They are suspended by a hoisting rope or load chain and are designed for a variety of lifting applications.

Inspection, maintenance and repair requirements are typically specified by the manufacturer. Where such specifications exist, an employer is obliged, under this section, to follow them. If there are no manufacturer's specifications, an employer must follow the requirements of CSA Standard CAN/CSA Z150-98 (R2004) which states in Clause 4.3.5.2:

"Teardown inspection and relubrication of the swivel, hook, and block assembly shall be performed at least every five years and the hooknut shall be disassembled and inspected for corrosion and wear. The hooknut shall be relubricated with a high-pressure grease of medium consistency, to seal the assembly from moisture, or with molybdenum disulphide grease or another sacrificial lubricant possessing the same physical characteristics. The hooknut assembly shall be durably marked to indicate the date of inspection."

In a recent British Columbia incident, a tower crane was hoisting a load weighing approximately 4000 kg. The hook assembly on the load block failed, causing the load to fall. In the investigation, the threads on the hook and nut were found to be corroded and excessively worn. The damage was not visible when the load block was assembled. This type of wear and corrosion could be found on any crane hook with a threaded shank.

Section 92.2 Outriggers

Proper outrigger support is an important part of crane setup. Crane collapse can result from

- (a) failure to fully extend the outriggers;
- (b) not extending all outriggers;
- (c) failure to get completely "off rubber";
- (d) not accounting for poor ground conditions; or
- (e) failure to level the crane.

Outriggers improve crane stability. Accurate use of the "on-outriggers fully extended" load chart requires that outriggers be fully extended and raise the crane completely off the tires. If the tires are touching the ground, then the "on rubber" load chart is used. Manufacturers do not recommend extending only one or two outriggers. The load charts of some manufacturers now permit partially-extended outriggers, so use of the correct load chart is critical.

All crane outriggers are designed for good ground conditions. Poor ground conditions reduce the amount of load a crane can safely place on an outrigger. Because of this,

many crane operations require additional supports or “floats.” These floats may be of wood, steel or synthetic material but must be of sufficient size, strength and rigidity to transfer the outrigger load to the full area of the float. A float that is smaller than the outrigger pad will increase the pressure on the ground and will cause an outrigger to “punch through.” If the outrigger is set on an unlevel float, the pad may slide causing the crane to tip. Many manufacturers stipulate that the crane must be within 1 percent of level before their load chart applies. In a 20-foot span this is only 2 inches off-level. Past that, the crane can lose 15 to 20 percent or more of its capacity.

When sizing outrigger floats, it is important to know the maximum pressure applied by the outrigger as well as the required float area. The area (square feet) of float can be estimated by dividing the maximum capacity of the crane by five (5). [Construction Safety Association of Ontario]

A reasonable approximation for maximum ground pressure (worst case) applied by the outrigger is

$$\text{Pressure (tons per ft}^2\text{) applied by outrigger} = \frac{0.85 \times \text{total crane mass} + \text{maximum crane capacity}}{\text{individual outrigger area}}$$

[Construction Safety Association of Ontario]

This equation can then be used to calculate the required thickness of float.

Overhead cranes

Section 93 Electrical components and functions

Subsection 93(a)

Section 40 of the *Canadian Electrical Code*, Part 1, covers certain design features of electrical equipment and circuits for cranes. These are in addition to the general requirements of the *Canadian Electrical Code*. Section 40 does not cover equipment and wiring of cranes that are assembled and erected in the field, which must comply with CSA Standard C22.2 No. 33-M1984 (R2004), *Construction and Test of Electric Cranes and Hoists*. It is good practice to obtain a manufacturer’s certification of compliance with this requirement.

Subsection 93(b)

CSA Standard C22.2 No. 33-M1984 (R2004), *Construction and Test of Electric Cranes and Hoists*, is a manufacturing standard that applies to all types of electrical cranes for voltages of 750 volts and less between conductors, designed, installed and used in accordance with the rules of the *Canadian Electrical Code*, Part 1. It includes the design of the collector arrangements for the contact conductors along the main runway and applies to equipment for general industrial and commercial application, in non-

hazardous locations, both indoors and outdoors, and covers installation in a normal ambient temperature not exceeding 40° Celsius. It is good practice to obtain a manufacturer's certification of compliance with this requirement.

Section 94 Maintenance and inspection

CSA Standard CAN/CSA-B167-96 (R2007), *Safety Standard for Maintenance and Inspection of Overhead Cranes, Gantry Cranes, Monorails, Hoists and Trolleys*, specifies the minimum requirements for inspection, testing and maintenance of overhead cranes, monorails, hoists, trolleys, jib cranes, gantry and wall cranes, and other equipment having the same fundamental characteristics. All maintenance, inspections, repairs and modifications must be recorded in the equipment's log book. As well, the log book should contain verification that the supporting structure has been designed and approved by a professional engineer to carry the maximum load as rated.

The following is a list of the more critical requirements of the Standard:

- (a) *Section 4.1*—A crane inspector must have at least 10,000 hours of relevant experience including knowledge of legislation, safety practices and standards.
- (b) *Section 4.2*—Critical components and inspection criteria must be identified by the manufacturer or a professional engineer.
- (c) *Section 4.4*—Describes the type and frequency of required inspections based on type of service.
 - (1) Initial inspection
 - Prior to initial use, all new, re-installed, modified, or rebuilt equipment must be inspected by a crane inspector.
 - (2) Cranes in regular use
 - An operational inspection is a visual examination done by the operator or a qualified person in accordance with Table 6.2.

Table 6.2 Frequency of operational inspections based on service class

Service class	Frequency
A + B	At least monthly
C + D	At least weekly to monthly
E + F	Daily to weekly
Special	As recommended by a qualified person

The CSA standard defines the service classes as follows:

Class A (standby or infrequent service)

This covers cranes that may be used in installations such as powerhouses, public utilities, turbine rooms, motor rooms and transformer stations where precise handling of equipment at slow speeds with long idle periods between lifts is required. Rated capacity loads may be handled for initial installation of equipment and for infrequent maintenance.

Class B (light service)

This covers cranes that may be used in repair shops, light assembly operations, service buildings, light warehousing, etc. where service requirements are light and the speed is slow. Loads may vary from no load to occasional rated-capacity loads, with 2.5 lifts per hour, averaging 2.6 metres per lift.

Class C (moderate service)

This covers cranes that may be used in operations such as machine shops, papermill machine rooms, etc., where requirements are moderate. In this type of service, the crane handles loads that average 50 percent of the rated capacity, with 5 to 10 lifts per hour, averaging 3 metres per lift, with no more than 50 percent of the lifts at rated capacity.

Class D (heavy service)

This covers cranes that may be used in heavy machine shops, foundries, fabricating plants, steel warehouses, container yards, lumber mills, etc., and standard duty bucket and magnet operations where heavy-duty production is required. In this type of service, loads approaching 50 percent of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service, with 10 to 20 lifts per hour, averaging 3 metres per lift, with no more than 65 percent of the lifts at rated capacity.

Class E (severe service)

This covers a crane capable of handling loads approaching its rated capacity throughout its life. Applications may include scrap yards, cement mills, lumber mills, fertilizer plants, container handling, etc., with 20 or more lifts per hour at or near the rated capacity.

Class F (continuous severe service)

This covers a crane capable of handling loads approaching rated capacity continuously under severe service conditions throughout its life. Applications may include custom designed specialty cranes essential to performing critical work tasks affecting the total production facility. These cranes must provide the highest reliability.

Special service

This covers equipment that is not being used in the service classification for which it was designed or is subject to adverse conditions or environment.

Operational inspection

The operational inspection must include, but not be limited to, the following:

- (a) all operational functions;
- (b) leakage in line, tanks, valves, pumps and air or hydraulic systems;
- (c) deformed, worn or cracked hooks;
- (d) hook latches;
- (e) hoist ropes;
- (f) limit device(s) for function;
- (g) function labels for operator control;
- (h) all brakes.

Any defects found in this inspection must be corrected by a qualified person.

Periodic inspection

This is a visual examination done by a crane inspector in accordance with Table 6.3.

Table 6.3 Frequency of periodic inspections based on service class

Service class	Frequency
A + B	At least annually
C + D	At least semi-annually
E + F	At least quarterly
Special	As recommended by a professional engineer or the manufacturer
Out of service	Prior to being returned to service

The periodic inspection must include, but not be limited to, the following:

- (a) all elements of the operational inspection;
- (b) deformed, cracked or corroded members;
- (c) loose bolts or cracked welds;
- (d) sheaves and drum cracks, distortion and wear;
- (e) worn, corroded, cracked or distorted pins, bearings, bushings, shafts, couplings, gears, bumpers and trolley stops;
- (f) glazing, scoring, warpage, contamination or wear of electrical and mechanical brakes;
- (g) visible damage to hook, retaining nut and safety latch;
- (h) deformed hook or worn hooks for compliance with manufacturer's recommendations;
- (i) evidence of pitting or deterioration of electrical contacts;
- (j) electrical wire, cables and controls;

- (k) performance of limited switches;
- (l) worn and or damaged trolley and bridge wheel assemblies;
- (m) load brake or controlled lowering device;
- (n) wear, cracks, or corrosion of wire rope, load chain, end clamps or rope clips;
- (o) missing or loose bolts in the supporting structure.

If the crane has, at any time, been accidentally overloaded, it must be removed from service, a periodic inspection carried out, and the load rating certified by a professional engineer before returning the crane to service.

(3) Cranes not in regular use

- Before being placed in service, an operational inspection must be completed on a crane that has been in infrequent service or out of service for more than one month but less than a year.
- Before being placed in service, a periodic inspection must be completed on a crane that has been out of service for more than one year.

(d) *Section 5.1 Tests*

Before initial use, for all new, re-installed, modified or rebuilt equipment, the following functions and components must be tested:

- (1) all motions;
- (2) limit switches at full speed;
- (3) limiting and indicating devices;
- (4) all circuits, controls, interlocks and sequence of operation;
- (5) each crane motion, holding brakes and travel brakes with the hook carrying
 - rated capacity—during these tests the specified speeds are to be attained, provided the power supply to the crane is as specified, and
 - 125 percent of the rated capacity—during this test the specified speed need not be attained but the crane must show itself capable of dealing with the load without difficulty.

The rated capacity and 125 percent of rated capacity tests must be performed with the crane or hoist installed on its supporting members.

Prior to initial use, the vertical deflection of all new, reinstalled, modified or rebuilt equipment must be measured. The vertical deflection of the girder, produced by the weight of the trolley and the rated load, must not exceed the maximum allowed by the design specification.

A test report must be prepared and entered into the log book.

- (e) *Part 6 Maintenance*—Describes the requirements for preventive maintenance and specific maintenance procedures. Repairs must only be performed by, or under the direct supervision of, a person having at least 8000 hours of relevant experience.

Section 95 Safe movement

Subsection 95(a)

The purpose of this requirement is to prevent a crane from over running its movement limits or making “uncontrolled, unintended contact” with other equipment that may be on the same rail, track or trolley. It does not restrict a competent operator from performing a controlled low-speed contact as may be required during a multiple crane lift. The requirement can be achieved through the use of

- (a) shock-absorbing rail stops;
- (b) rail-mounted rubber bumpers. When mounted on a crane, a rubber bumper is considered to be part of the crane and not a positive stop or limiting device capable of preventing contact;
- (c) limit switches;
- (d) speed-limiting motion or proximity sensors mounted on the crane;
- (e) other equally effective means (see Figure 6.26).

If the limiting device is disabled to permit the crane to make a controlled contact, the lifting pendant or control panel should be tagged to show that normal functioning of the limiting device has been disabled. Once the lifting operation is complete, the limiting device should be restored to normal function and the tag removed by the operator.

For more information


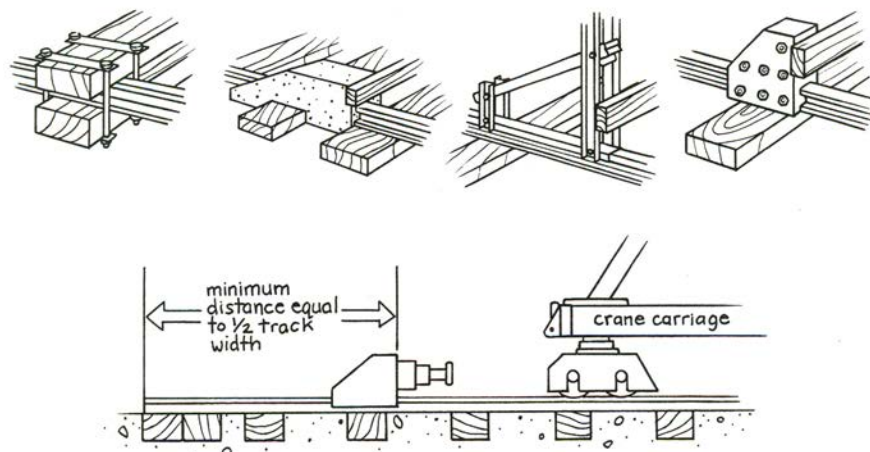
 *Preventing Overhead Crane and Hoist Collisions: Use of Rubber Bumpers*, Government of Alberta OHS Bulletin

Figure 6.26 Examples of positive stops installed to protect a rail-mounted crane



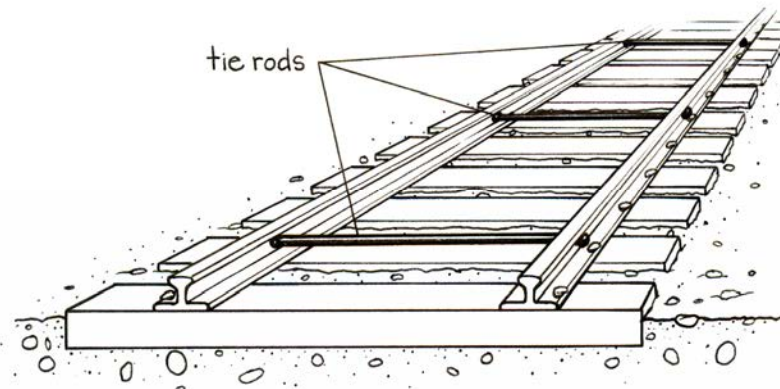
Subsection 95(b)

The crane must be fitted with a device that prevents an overspeed descent of the load in excess of manufacturer's specifications.

Subsection 95(c)

Figure 6.27 is an example of an acceptable means of ensuring that rails do not spread.

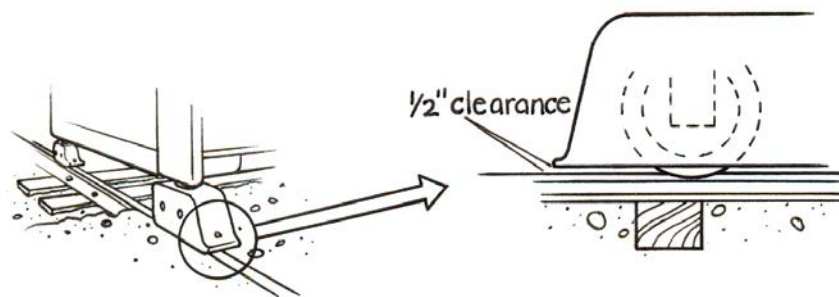
Figure 6.27 Tie rods that limit the spreading of rails



Subsection 95(d)

Figure 6.28 shows an example of acceptable sweepguards.

Figure 6.28 Example of trolley-mounted sweepguards



Subsection 95(e)

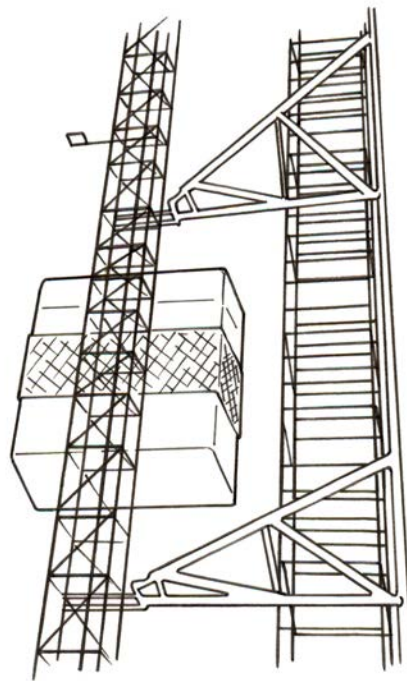
No explanation required.

Personnel hoists

Section 96 Safety code for personnel hoists

CSA Standard CAN/CSA-Z185-M87 (R2006), *Safety Code for Personnel Hoists*, applies to structures and hoists that are not a permanent part of buildings, structures, or other work and that are used during construction, alteration, or demolition to raise and lower persons and/or materials connected with or related to a building project. The Standard covers the design, construction, installation, operation and acceptance inspection and testing of personnel hoists. See Figure 6.29.

Figure 6.29 Example of a personnel hoist



The Standard does not apply to

- (a) hoists for raising and lowering materials and that are not intended to carry personnel;
- (b) temporary elevators installed in their hoistways during the construction of buildings and incorporating a part of the permanent elevator to be installed later;
- (c) manlifts, counterbalanced or endless-belt type;
- (d) mine elevators;
- (e) cranes and derricks;
- (f) window cleaners and swingstages;
- (g) mobile forklift trucks and similar equipment;
- (h) rope-guided and non-guided personnel construction hoists.

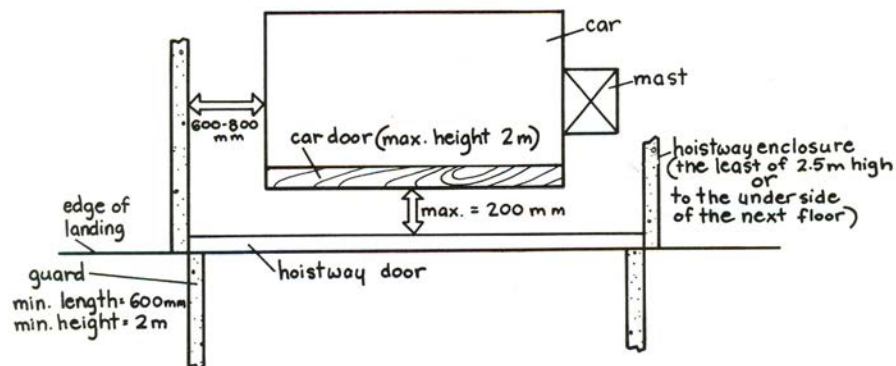
The following are some critical requirements of the Standard:

- *Part 6 Hoistway Enclosure*

The “hoistway” is the shaftway space travelled by the car or counterweight extending from the pit floor to the overhead structure. A “hoistway enclosure” is a structure that isolates the hoistway and on which hoistway doors are installed.

Figure 6.30 shows the design requirements that a hoistway enclosure must meet.

Figure 6.30 Example of a hoistway enclosure (plan view)



- *Part 7 Hoistway landings and doors*

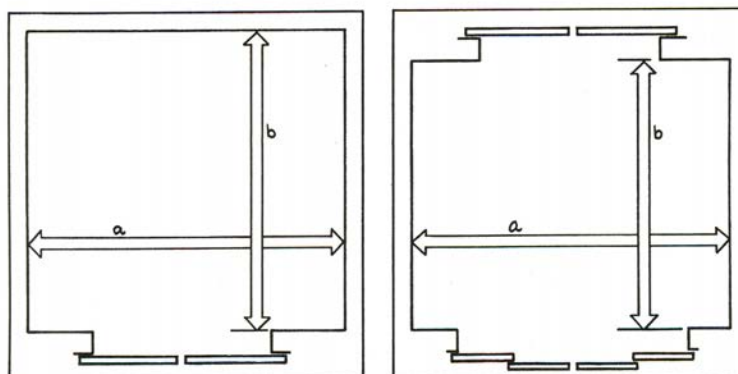
This part describes requirements for that portion of a floor, a balcony or platform used to receive and discharge passengers.

- *Part 8 Cars*

This part describes requirements for the load-carrying unit. The car’s rated load capacity is based on its inside net platform area, determined using the “a” and “b” measurements shown in Figure 6.31. The maximum allowable number of passengers is determined by:

- (a) multiplying the net inside area of the car, in square metres, by five; or
- (b) dividing the net inside area of the car, in square feet, by two.

Figure 6.31 Net inside area of the car (plan view)



-
- *Part 11 Counterweights*
This part describes the design and guiding requirements for counterweights.
 - *Part 14 Operation and control devices*
This part describes requirements for the actuating controls.
 - *Part 19 Safeties and governors*
This part describes requirements for devices to stop and hold the car in case of overspeed or free fall or if the hoisting rope slackens.
 - *Part 20 Drive, machines, sheaves, drums*
This part describes requirements for the hoist's drive mechanism. Maximum car speeds are
 - (a) 1.75 metres per second for traction machines and winding drums machines;
 - (b) 0.75 metres per second for single-speed operation;
 - (c) 1.60 metres per second for rack and pinion machines;
 - (d) 0.75 metres per second for inspection purposes.
 - *Part 23 Communication*
A two-way voice communication system between all landing entrances is required.
 - *Part 24 Required inspections and tests*
 - (1) Before being placed into service, a hoist must be inspected and tested after it has been installed or when:
 - (a) the mast is extended;
 - (b) entrances are added;
 - (c) hoisting ropes are changed; and
 - (d) a rack section is added or changed.

The tests must include

 - (a) operation of drive machine brakes;
 - (b) plunger-return and load/speed of buffers, except bumpers or spring buffers;
 - (c) operation of car safeties and governors; and
 - (d) operation of ground fault circuit interrupter.

The inspections are to include

 - (a) electrical grounding;
 - (b) wire rope; and
 - (c) teeth wear and clearances on rack and pinion devices.
 - (2) All parts of the machine and mast should be inspected daily before operations begin to ensure the hoist is in safe condition. The inspection must be conducted by a competent person and the tests must be conducted in the presence of a competent person.
-

Roofer's hoists

Section 97 Safe use and design

Subsection 97(1)

The counterweights used with a roofer's hoist (see Figures 6.32 and 6.33) must

- (a) be clearly designed to work as part of the hoist;
- (b) stay in place and remain firmly attached until the lifting operation is complete; and
- (c) provide a factor of safety against overturning of not less than 4.

Figure 6.32 Properly designed counterweights for a roofer's hoist

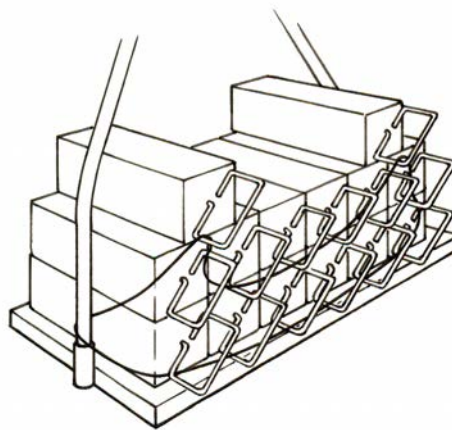
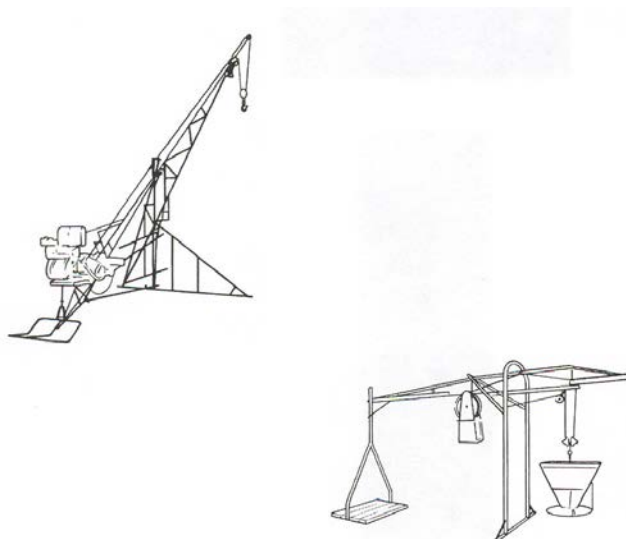


Figure 6.33 Examples of roofer's hoists

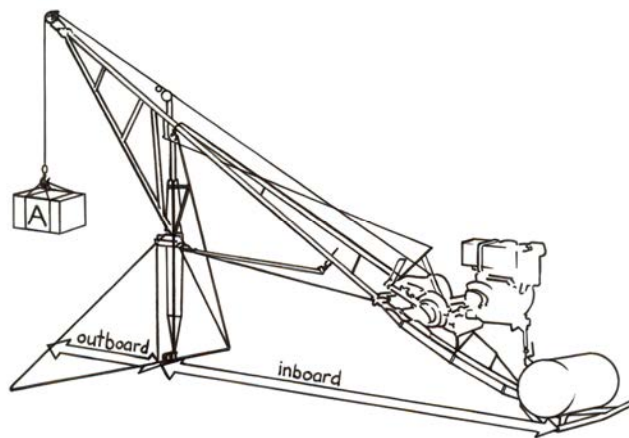


The weight of the counterweight can be calculated using the following formula:

$$\text{Weight of counterweight} = 4 \times \text{maximum weight of load being lifted} \times \left(\frac{\text{length of the outboard arm}}{\text{length of the inboard arm}} \right)$$

The length of the outboard arm is the horizontal distance measured between the hoist's fulcrum point and the hoisting line. The length of the inboard arm is the horizontal distance measured between the hoist's fulcrum point and the counterweight's centre of gravity (see Figure 6.34).

Figure 6.34 Illustration of "inboard" and "outboard" arms



Subsection 97(2)

Roofing materials cannot be used as counterweights. Counterweights must work as part of the hoist and remain secured in place while lifting. Bundles of roofing material can be unstable and are intended to be removed as work progresses, gradually reducing the weight and effectiveness of the counterweight.

Subsection 97(3)

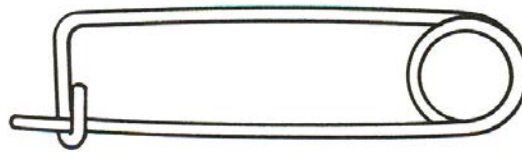
Before use each day, the hoist must be inspected by a competent person designated by the employer. The inspection must be in accordance with the manufacturer's specifications and should include, but not be limited to, the following:

- (a) members and welds in the hoist structure;
- (b) bolts, nuts, pins;
- (c) sheaves, ropes;
- (d) brake and clutch systems, pawls, ratchets;
- (e) control devices.

Subsection 97(4)

Figure 6.35 shows an example of a safety pin that is used on the bolts and pins of a roofer's hoist. The bolts and pins hold the hoist's components together—the safety pin prevents the bolts and pins from dislodging.

Figure 6.35 Example of a standard safety pin



Subsection 97(5)

Roofer's hoists are not typically designed to create or withstand horizontal forces that occur when swinging a load or pulling a load across a surface. Such horizontal movements could lead to overturning or component failure.

Subsections 97(6) and 97(7)

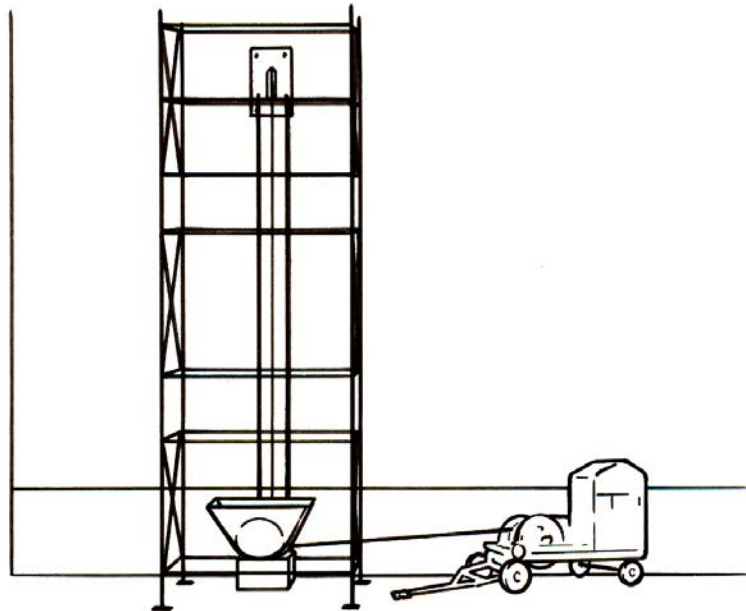
Gallows frame hoists are rarely used today, but may be found on relatively minor repair jobs. Where such a hoist is used, its construction must comply with the design limits specified in this subsection.

Tower and building shaft hoists

Section 98 Protective enclosure

A tower hoist is a materials-only hoist in which the platform on which loads are placed runs inside a framed tower. The platform is raised and lowered by a cable, drum or a rack and pinion drive system (see Figure 6.36).

Figure 6.36 Example of a tower hoist



Subsection 98(a)

The walls must be sufficient height and strength to prevent accidental contact with the tower or the hoist machinery. The fencing should be at least 600 millimetres from the sides of the tower.

Subsection 98(b)

The enclosure should be at least 600 millimetres from the sides of the shaft.

Subsection 98(c)

The use of an interlock system with each landing gate is required to ensure that workers are protected against falling into the open shaft.

Subsections 98(d) to 98(f)

No explanation required.

Section 99 Design

No explanation required.

Tower cranes

Section 100 Safety code for tower cranes

CSA Standard Z248-04, *Code for Tower Cranes*, applies to the design, characteristics, construction, installation, dismantling, operation, testing, maintenance and inspection of tower cranes.

The following are some critical requirements of the standard:

- *Section 6.4.3 Manuals*
A manual for the specific model of crane, containing all pertinent manufacturer's specifications and instructions relating to its operation and maintenance. This must be provided by the crane supplier.
- *Part 5 Erection, Dismantling and Climbing*
This part describes requirements for erecting, dismantling, and transporting the crane, including foundation design.
- *Part 6 Inspection, Testing and Repairs*
This part describes requirements for inspection, testing, maintenance and repairs. These must be performed by the crane operator or qualified personnel on a scheduled basis.

Before being placed into service

Once erected and before being placed into service, the crane must be inspected by the erector's personnel and the crane's operator. Operating tests must be conducted to ensure that

- (a) clearances and alignments are in order and all moving parts are engaged properly;
- (b) all controls and limit switches are set and operating correctly in accordance with the manufacturer's specifications;
- (c) all circuits and interlocks operate in accordance with the manufacturer's specifications;
- (d) all protective devices operate satisfactorily; and
- (e) each motion of the crane operates in accordance with the manufacturer specifications.

A load test must be performed as specified by the manufacturer. In the absence of such specifications, a load test must be performed with a load equal to 105 percent of the rated load.

Daily inspections

The operator must carry out the following daily inspection activities:

- (a) ensure that all wedges in slab openings are in place and are tight;
- (b) ensure that all guy lines and all guy line connections, if used, are acceptable;
- (c) inspect mast bolts and anchor bolts;
- (d) ensure that all limit switches (except line pull limit switches), signal lights, audio and visual indicators, and brakes are functioning properly;
- (e) inspect load hoist and boom hoist ropes according to Clause 6.5 of the CSA Standard;
- (f) inspect grounding connections;
- (g) inspect the tracks for loose connections, proper drainage, subsidence, and bogie wear on travelling cranes; and
- (h) inspect rail clamps, if used, daily or each time their application is made.

The rigger must:

- (a) check all slings and rigging used with the crane prior to use;
- (b) inspect the test block-lifting hardware prior to lifting the test block; and
- (c) inspect the load block and hook.

Weekly inspections

The following must be inspected weekly:

- (a) structural pins and keepers;
- (b) trolley rollers, tracks, slewing rings, and rollers;
- (c) gear shaft and belt drives;
- (d) sheaves, bushings, and pins;
- (e) guy ropes, pendant lines, cable clips, thimbles, and ferrules;
- (f) jib backstops (boom stops);
- (g) all rope attachments;
- (h) walkways, handrails, and ladders;
- (i) the location in the structure where accumulation of water could result in damage to ensure that such water is drained;
- (j) tie-ins to slabs or other bracing systems where used.

Monthly inspections

The following must be inspected monthly:

- (a) all running ropes, in accordance with Clause 6.5.1.3 of the CSA Standard to check for all types of deterioration;
- (b) mast and boom structure for cracks or buckling;
- (c) bogie wear on travelling cranes;
- (d) counterweight supports;
- (e) brake adjustment (wear); and
- (f) drums, sheaves, bearings and mounts.

Annual inspections

After a crane has been in service for 12 months, it must undergo

- (a) visual inspection of the structure with nondestructive inspection according to Clause 6.3.1 of the CSA Standard on suspect areas;
- (b) inspection of all load-carrying equipment, including sheaves, blocks, rings, shackles, hooks, chains, and slings
- (c) inspection of all fixed ropes according to Clause 6.5.1.3 for all types of deterioration;
- (d) inspection of all running ropes according to Clause 6.5.1.3 for all types of deterioration;
- (e) operational tests according to Clause 6.3.2; and
- (f) a load test in accordance with Clause 6.3.3.

Special inspections

Special inspections are inspections conducted following shock loading, electrical contact, other misadventures, repairs, alterations, or prolonged shutdown.

A crane that requires structural alterations, repairs, or replacement of parts related to hoisting or safety of operation must be tested and approved by a professional engineer or the engineer's designate. Repairs or alterations to structural parts must be carried out in accordance with the manufacturer's specifications and instructions or the specifications of a professional engineer. All welding must be done in accordance with CSA Standard W59-03 (R2008), *Welded Steel Construction (Metal Arc Welding)*.

A load test must be carried out after any alteration or repairs have been made to the load-carrying ability of the crane. This test must be performed as described in Clause 6.3.3. of CSA Standard Z248-04.

Prior to commencing work after a prolonged shutdown, a full soil inspection by a professional engineer competent in soil inspection and a structural inspection according to Clause 6.4.7 of the Standard must be carried out by a professional engineer competent in the inspection of tower cranes.

Clause 6.5 of the Standard describes inspection and replacement requirements for wire rope.

- *Part 7 Maintenance and Repairs*
This part describes proactive maintenance, lubrication, adjustment and repair requirements.
- *Part 8 Safe Operation*
This part describes operating responsibilities and requirements.

Section 101 Limit devices

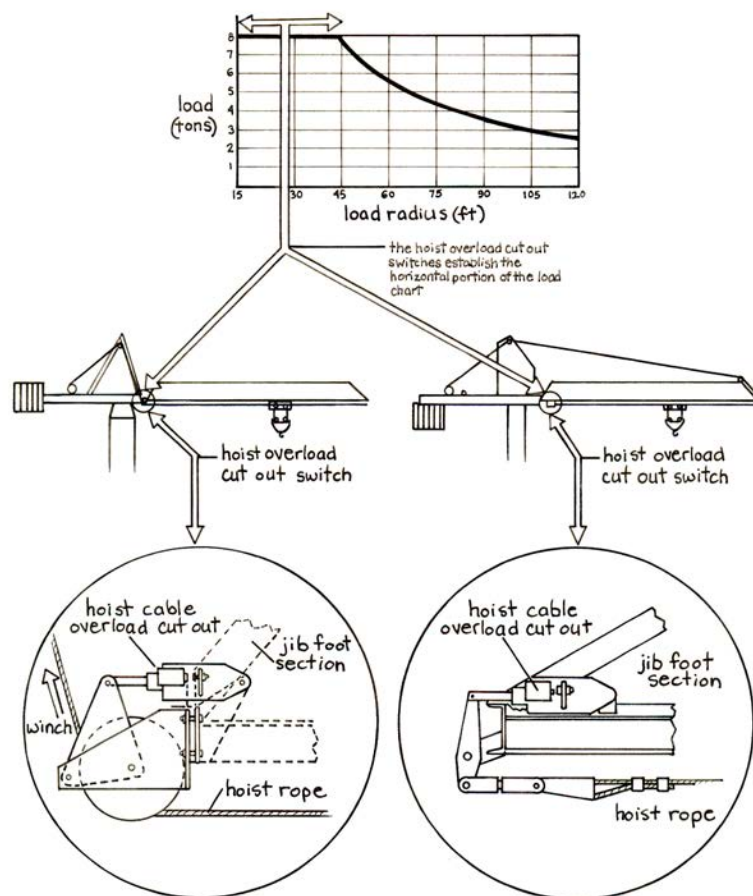
Subsection 101(1)

Limit devices are not to be used as operating “stops.” An operator must not operate a crane in which jumpers or by-passes have been installed in any limiting device, except under the supervision of a competent person and with the express authorization of the crane supplier.

Subsection 101(1)(a)

The overload device should be a hoist cable overload “cutout” that is set to cut out at no more than 5 percent suspended load. See Figure 6.37.

Figure 6.37 Examples of hoist cable overload cutouts



Subsection 101(1)(b)

“Movement” means a tendency to produce motion about a point of axis. The movement overload limit device senses the tension in the jib pendants, support cables, etc. This tension increases as the load moves out on a jib or as heavier loads are lifted. It must be set to “cutout” at no more than 5 percent overload. This device must also “cutout” the trolley as it is possible to overload the crane within the rated capacity at close radius simply by moving the trolley out along the boom. See Figures 6.38 and 6.39.

Figure 6.38 Examples of location of moment overload cutout switch and switch performance

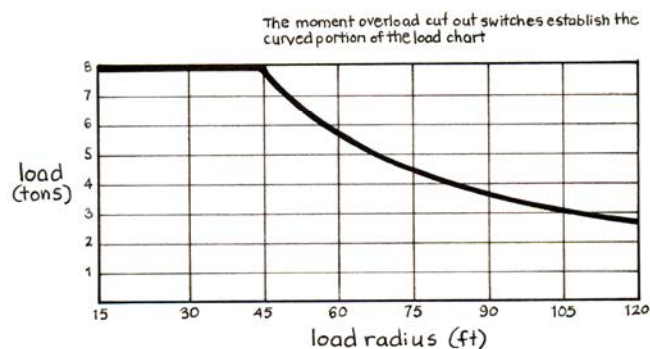
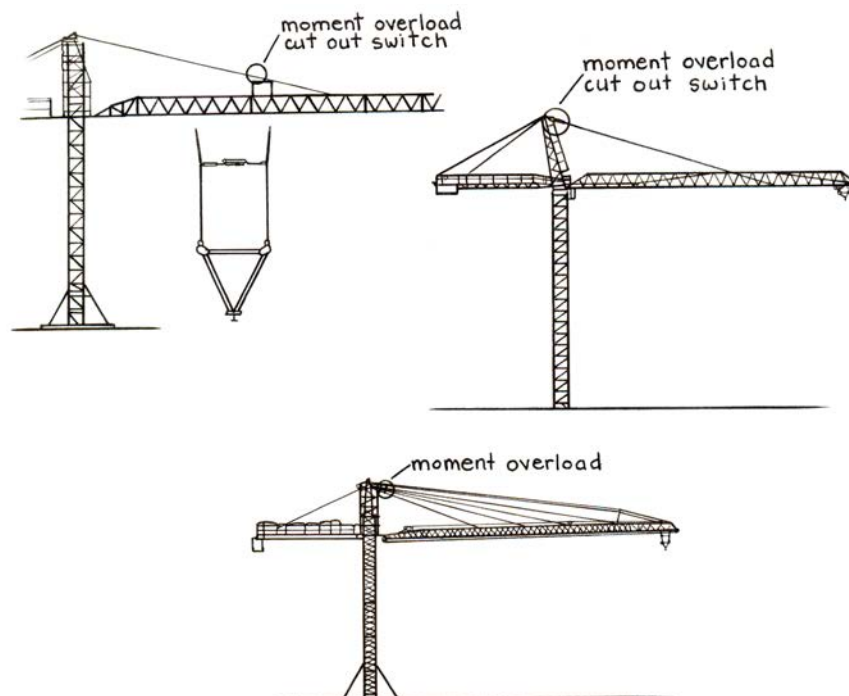
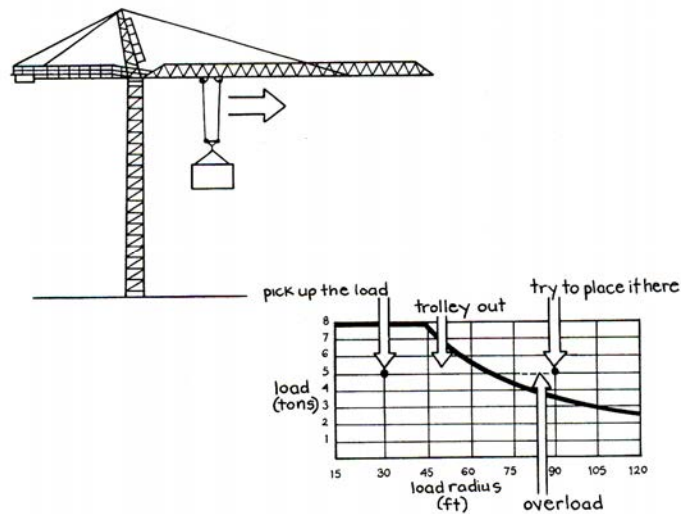


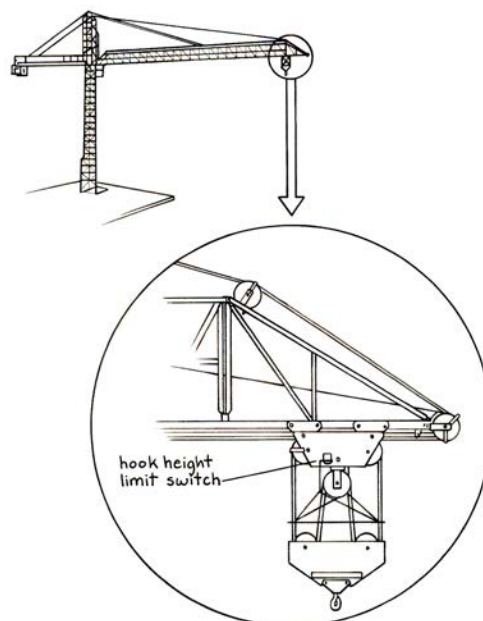
Figure 6.39 Example of travel limit switch performance



Subsection 101(1)(c)

A height limit switch causes the hoist drum to stop whenever the load hook reaches a predetermined maximum height position. See Figure 6.40.

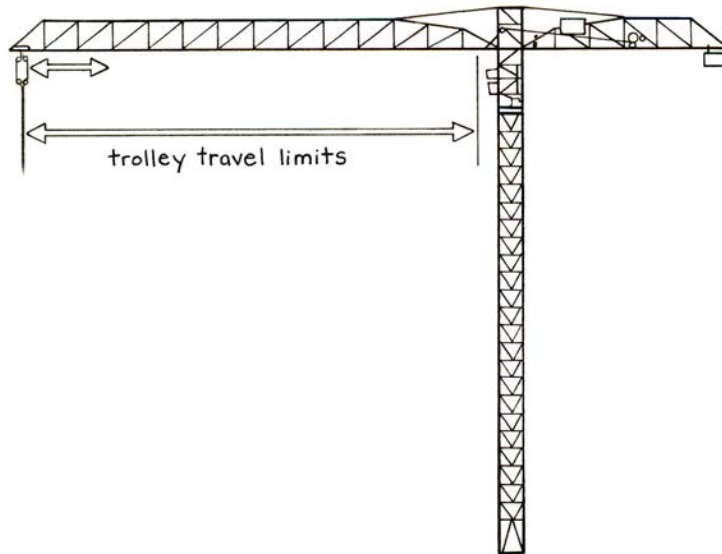
Figure 6.40 Example of height limit switch



Subsection 101(1)(d)

Trolley travel limit devices automatically prevent the trolley from running into either end of the track (see Figure 6.41).

Figure 6.41 Trolley travel limits



Subsection 101(2)

“Sealing” limit switches means to ensure that only authorized workers can adjust them. The employer can choose the most effective method as long as it does not conflict with the manufacturer’s specifications.

Section 102 Operation

No explanation required.

Section 103 Changing components

Subsection 103(1)

The major components of a tower crane are designed to perform in a specific manner. Using parts from another crane could adversely affect the crane’s safe performance.

Subsection 103(2)

The operator’s cab, when attached to the crane boom, imposes forces on the boom that are similar to the forces imposed by a load. If a cab is attached to the boom, all aspects related to its design, securement and use must be in accordance with the manufacturer’s specifications or the specifications of a professional engineer.

Section 104 Test weights

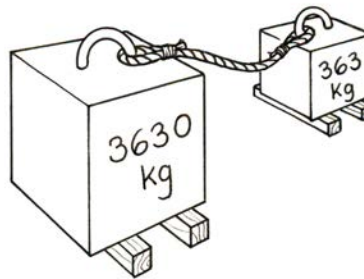
Subsection 104(1)(a)

Marking the test weights with their true weight must be done in a way that is legible, easily read and able to withstand the effects of the weather.

Subsection 104(1)(b)

To get an accurate indication of the weight being lifted, the test weight must not be prevented from being lifted. To avoid freezing to the ground or creating a vacuum, the weights can be placed on blocking when not in use. See Figure 6.42.

Figure 6.42 Accurate test weights placed on blocking



Subsection 104(2)

The lifting attachment of a test weight cannot be made of reinforcing bar (rebar) steel. This steel is of low ductility and low impact strength.

Section 105 Structural testing and examination

Subsection 105(1)

When a tower crane arrives in Alberta for the first time and before it is used at a worksite, all structural and rigging elements and components must be inspected for soundness using accepted methods of non-destructive testing (NDT). Several methods are available including:

- (a) eddy currents;
- (b) ultrasound;
- (c) acoustic emission;
- (d) magnetism, including induction and Barkhausen;
- (e) beta gauge;
- (f) optical techniques such as shearography, holography, etc.;
- (g) radiography, e.g., x-ray imaging.

Since transporting equipment and time out of service may impact the integrity of crane components, this testing must be carried out even if similar testing was conducted before the crane arrived in Alberta.

Subsection 105(2)

A tower crane in continuous service at a project must undergo a structural examination every 2000 operating hours or 12 months, whichever happens first.

Subsection 105(3)

The tests required by subsections (1) and (2) must be under the direction and control of a professional engineer and the results certified by the engineer.

Section 106 Wind and temperature limitations

Wind velocity limits for tower crane operation are set to prevent loads from shifting, the uncontrolled movement of loads, and prevent a load radius from increasing. Setting these operational limits prevents structural failure or the tower crane from overturning.

Temperature limits for tower cranes are set to avoid excessive stress on components due to cold temperatures.

Section 107 Multiple cranes

Subsections 107(a) and 107(b)

When the radii of multiple cranes overlap, collisions must be prevented. Operators of the cranes must be provided with a means of communication and the operators must use it. Portable two-way radios are often used in such situations.

Subsection 107(c)

Several options are available to prevent collisions between multiple cranes and their loads:

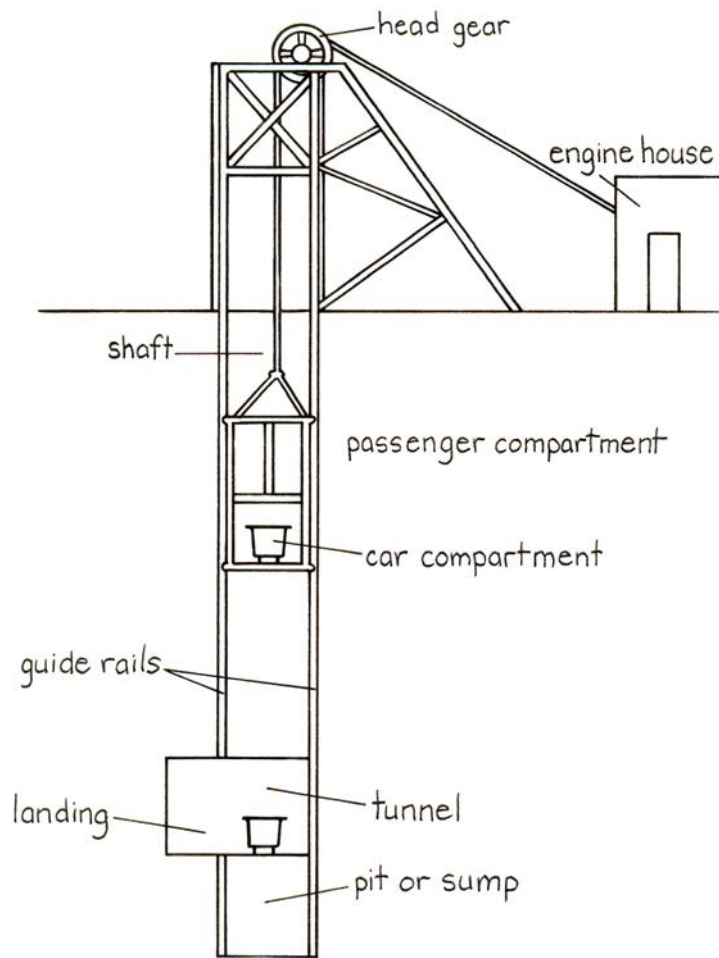
- (a) erecting the cranes at staggered heights, maintaining at least one metre clearance distance between all crane components under all conditions of loading;
- (b) installing “slewing” limit switches set to activate and stop the jib before it gets into the overlap zone;
- (c) developing written operating procedures in accordance with section 67; and
- (d) securing the jib of an unattended crane in a position facing downwind in line with any anticipated prevailing winds.

Underground shaft hoists

Section 108 Safety requirements

Figure 6.43 shows an example of an underground shaft hoist.

Figure 6.43 Example of an underground shaft hoist and its parts



Subsection 108(1)(a)

The base of an underground shaft hoist will typically be a rigid concrete foundation that should be designed by a professional engineer.

Subsection 108(1)(b)

“Positive drives” means that the load-carrying unit is driven in both up and down directions. “Non-positive” (free-wheeling) means that that load-carrying unit is driven in the up direction and may be permitted to descend freely.

Subsection 108(1)(c)

Installation of a clutch is prohibited to prevent disengagement of the positive drive mechanism either through mechanical failure or accidental activation of the clutch control.

Subsection 108(1)(d)

The braking system should be able to

- (a) stop the cage within the deceleration parameters specified by the manufacturer or a professional engineer, for both the descending and ascending modes;
- (b) apply automatically in the event of a power failure, whenever the safety circuit of the hoist is interrupted and whenever the pressure in the hydraulic or pneumatic brake actuating system drops below normal; and
- (c) be applied by the hoist operator in the event of an emergency.

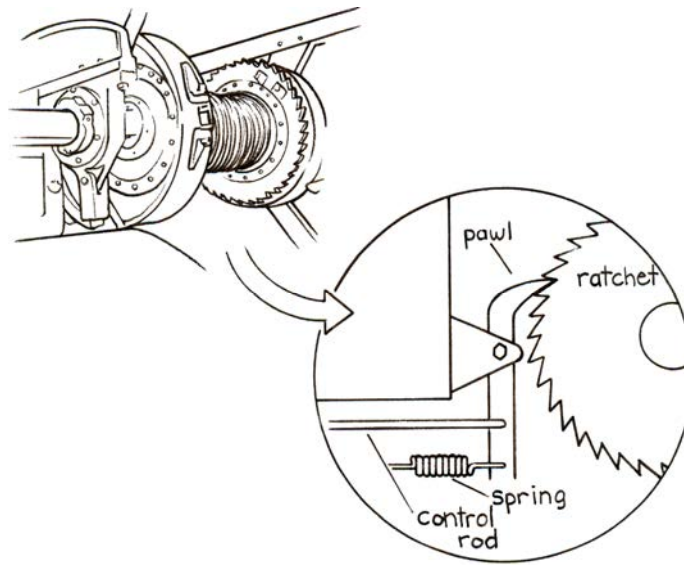
No hoist should be used for the transport of workers unless it has at least two sets of mechanical brakes, each of which should

- (a) be capable of safely stopping and holding the drum when carrying its maximum rated load;
- (b) be arranged so that it can be independently tested;
- (c) be arranged to apply normal braking effort before any linkage or brake piston reaches a limit of travel; and
- (d) if of a drum type, be equipped with a device to give positive indication of tread wear or slack linkage and prevent any movement of the hoist if predetermined limits are exceeded.

Subsection 108(1)(e)

A positive spring-actuated pawl remains engaged until manually released and then returns to the engaged position when the manual control is released. See Figure 6.44.

Figure 6.44 Example of a spring-actuated pawl mechanism



Subsections 108(2) to 108(4)

The required communication system should

- (a) enable clear, audible signals to be given that are separate and distinct for each shaft compartment;
- (b) be arranged so that the hoist operator can return a signal to the person giving the signal; and
- (c) be installed throughout the shaft and at every working level, landing deck and other necessary location.

A hoist should not be moved on manual control unless the prescribed signal has been given and returned by the hoist operator. Signaling systems should be tested daily. Optional systems include voice, telephone and speaking tube.

Section 109 Operator responsibilities

This section describes two of the more critical operator responsibilities when operating the shaft hoist. These are braking control and speed control.

Subsection 109(1)

The brake control may be hand or foot operated but must be of the positive pressure or “deadman” type where physical force or pressure is required to keep the brake in the “off” position. Release of this force automatically engages the brake.

Subsection 109(2)

Because the cage typically is guided, it is acceptable to operate the hoist at a rate of speed greater than that acceptable for a chimney hoist. However, the maximum speed at which the cage can be raised or lowered while transporting a worker must not exceed 1.2 metres per second.

Section 110 Hoist cage

Subsection 110(1)

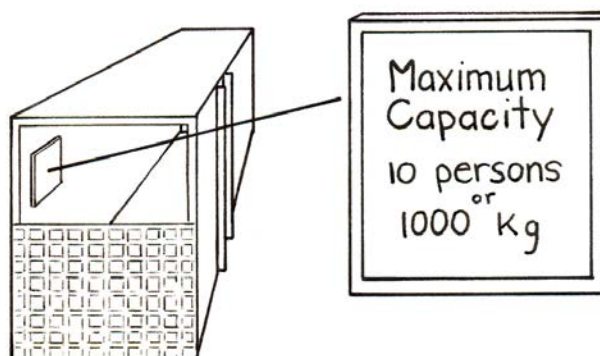
A car locking device is a method of securing the cage when it is at the landing. The device stabilizes the cage and prevents it from slipping. Where such a device is part of a friction hoist, it must be operated in accordance with the manufacturer's specifications to ensure that the hoisting rope does not slacken.

In addition to guiding the movement of the cage, guide rails are part of an emergency braking system. Should the cage descent speed exceed the specified limit, the overspeed limit device actuates roller arms extending outward to engage rollers against the guide rail and prevent or stop the hoist from falling.

Subsection 110(2)

The hoist cage must have a capacity plate similar to that shown in Figure 6.45.

Figure 6.45 Example of hoist cage capacity plate



Subsection 110(3)

An open hook cannot be used to attach the hoist cage to the hoist rope since any slack in the hoisting line might cause the line to come off the hook.

Section 111 Unguided suspended cage

No explanation required.

Vehicle hoists

Section 112 Safety standards

Subsection 112(a)

ANSI Standard ANSI/ALI ALCTV-2006, *American National Standard for Automotive Lifts—Safety Requirements for Construction, Testing and Validation*, lists requirements for the construction, testing and validation of automotive lifts that are

- (a) manually driven;
- (b) power driven;
- (c) stationary; or
- (d) mobile.

The lifts can be installed “in-ground” or at the surface (see Figures 6.46 through 6.50 for examples). The Standard does not cover lifts that are moveable, designed to tilt the superstructure, or are not “automotive vehicle service lifts.”

Figure 6.46 Two post, wheel or axle engaging, moveable piston, in-ground lift

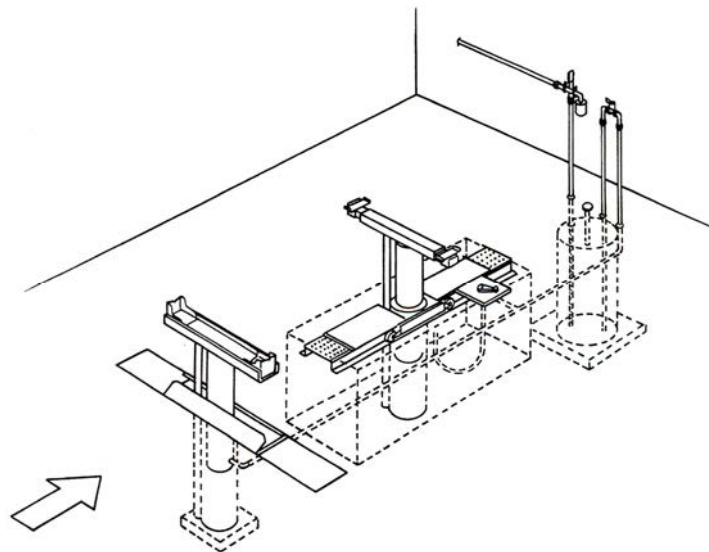


Figure 6.47 Single post, frame engaging, in-ground lift

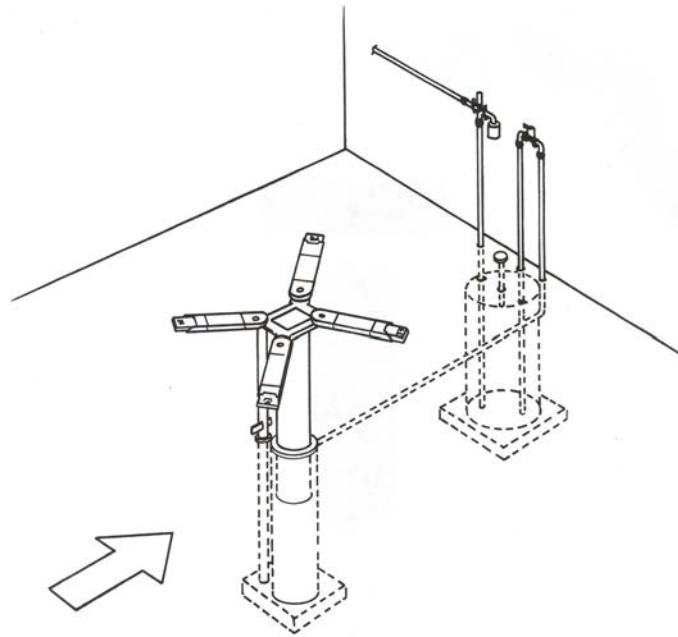


Figure 6.48 Two post, frame engaging, clear floor, surface mounted lift

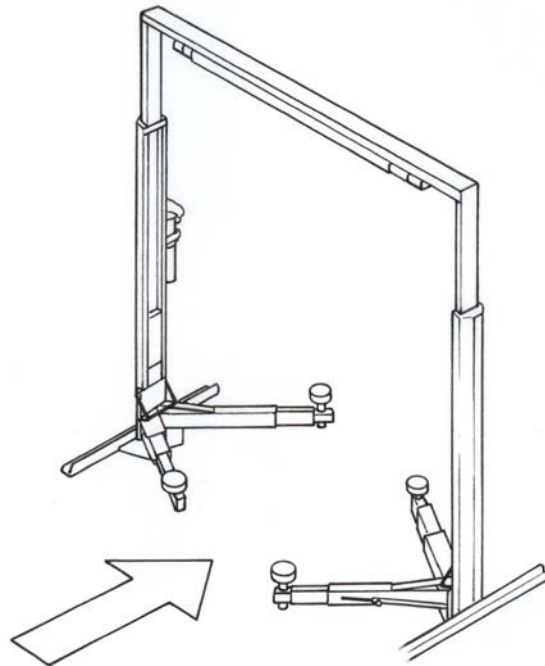


Figure 6.49 Roll-on, scissors, surface mounted, hinged lift

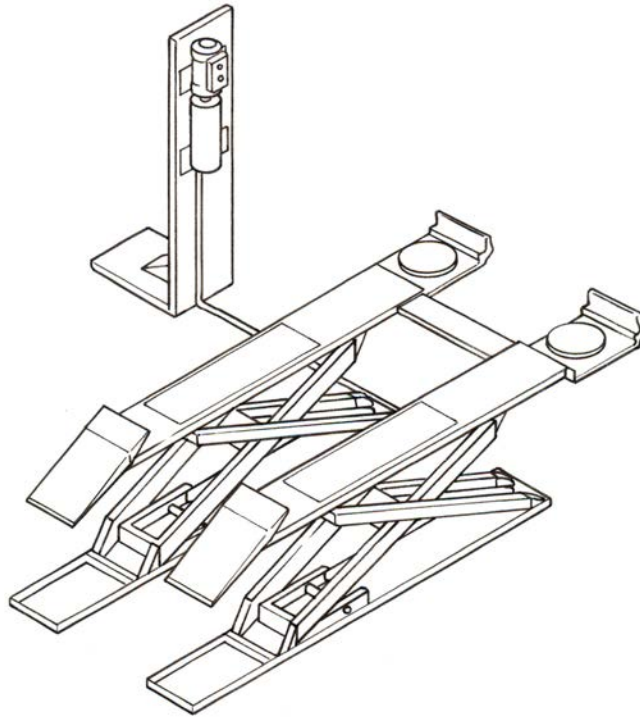
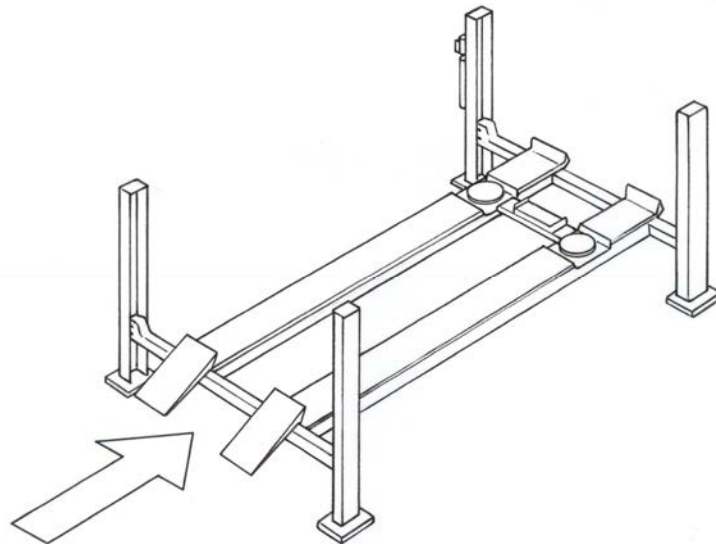


Figure 6.50 Four post, surface mounted lift



The Standard describes the installation, operation, inspection and maintenance instructions that must accompany each hoist. These include

- (a) design specifications;
- (b) installation instructions;
- (c) safety instructions;

- (d) operating instructions;
- (e) inspection and maintenance instructions; and
- (f) identification of vehicle lifting points.

The Standard describes labelling requirements for:

- (a) safety warnings and instructions;
- (b) components;
- (c) electrical safety;
- (d) product identification; and
- (e) third-party certification.

The third-party testing, evaluation and certification of these vehicle lifts must be conducted by a laboratory that is accredited by the U.S. Occupational Safety and Health Administration.

Subsection 112(b)

ANSI Standard ANSI/ALI ALOIM-2000, *Automotive Lifts—Safety Requirements for Operation, Inspection and Maintenance*, lists requirements for the operation, inspection and maintenance of installed automotive lifts.

Section 4.1 of the Standard describes operator qualifications, which include:

- (a) a demonstrated ability in written or oral communication;
- (b) a demonstrated ability to understand the mathematical, mechanical and electrical principles of automotive lifts; and
- (c) a demonstrated physical ability to carry out operator responsibilities in a safe manner.

Section 4.4 of the Standard describes operator responsibilities, which include

- (a) using all safety features and operating the lift in accordance with the manufacturer's instructions;
- (b) maintaining the lift in a clean and orderly manner;
- (c) conducting a daily inspection for and of
 - (i) operational controls;
 - (ii) deformation and excessive wear of structural components, hoses, wires, drive chains, cables, screws, lift contact points; and
 - (iii) evidence of hydraulic and pneumatic leaks, unusual noises or movements, cracked or loose concrete around anchor bolts.

Part 5 of the Standard describes the requirements for periodic, documented inspections that must be carried out in accordance with the manufacturer's instructions and in no case less than annually. Periodic inspections must be carried out by an inspector with

- (a) knowledge of personal safety practices;
- (b) the ability read and understand manuals, drawings, parts lists;
- (c) knowledge of the function of all components, devices, accessories;

- (d) a working knowledge of the principles of the following as applied to the operation and components of the lift:
 - (i) electrical and electronic control circuits;
 - (ii) mechanics;
 - (iii) hydraulics;
 - (iv) pneumatics; and
- (e) knowledge of the types, styles, uses and limitations of lifts.

Periodic inspections must include, but not be limited to, the following:

- (a) presence of required labelling;
- (b) confirmation of adequate clearances;
- (c) examination of structural components such as electrical components, lift controls, runways including runway stops, swing arms including swing arm restraints, fastening devices, exposed surfaces and edges, lift adaptors;
- (d) operation of the lift through its full cycle;
- (e) lowering speed when carrying a representative vehicle;
- (f) operations of synchronization or equalization systems;
- (g) working platforms, railings, stairways;
- (h) operation of up over-travel shutoff switch;
- (i) all chains and cables including checking for tracking and level winding;
- (j) potential pinch points;
- (k) presence of water in pits or enclosures; and
- (l) lift system checks for hydraulic lifts, mechanical lifts, hydraulically-driven mechanical lifts and pneumatic lifts.

Part 6 of the Standard describes requirements for preventive maintenance and repair maintenance.

Section 113 Safe use

Subsections 113(1) and 113(2)

“Constant manual pressure” is the deliberate, sustained application of force in order to operate the device. Typically, this force is applied by the operator’s hand or foot. Removal of this force is intended to immediately stop the operation. Any form of locking mechanism that keeps the control active without use of the operator’s hand or foot is not allowed.

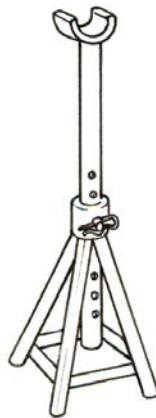
The vehicle hoist operator must not approach the vehicle while it is being raised or lowered. The operator controls the motion of the lift and must do so responsibly.

Subsection 113(3)

A worker is responsible for ensuring that work is not done under a suspended vehicle unless it is on

- (a) a vehicle hoist designed for that purpose; or
- (b) substantial stands that are placed on a solid, level foundation and under the axles or frame are in place (see Figure 6.51). The use of the lifting device called a jack, supplied with the vehicle by its manufacturer, or similar device, is not permitted.

Figure 6.51 Example of substantial stand designed to support a vehicle load



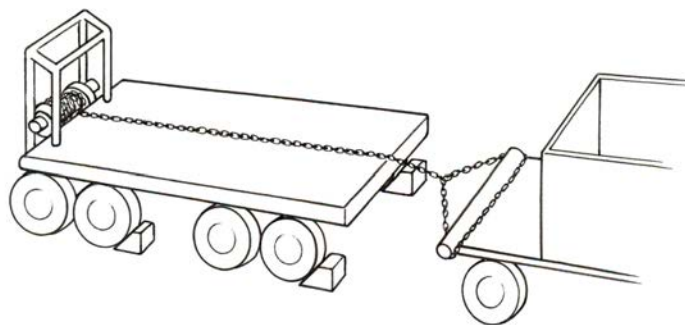
Winching operations

Section 114 Safe practices

To avoid unexpected movement when hooking or unhooking a vehicle-mounted winch line, the vehicle is typically restrained by placing blocks against the face of its tires.

Figure 6.52 shows how such blocking can be used.

Figure 6.52 Blocking tires when using vehicle-mounted winch



Part 7 Emergency Preparedness and Response

Highlights

- Section 115 requires employers to establish an emergency response plan for responding to an emergency that may require rescue or evacuation. (Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.)
- Section 116 specifies the minimum elements to be included in an emergency response plan.
- Section 117 requires employers to ensure designated rescue and emergency workers receive appropriate and adequate training.
- Section 118 requires employers to provide designated rescue and emergency workers with personal protective clothing and equipment appropriate to the work site and the potential emergencies identified in the emergency response plan.

Requirements

Section 115 Emergency response plan

An employer must have an emergency response plan for an emergency that may require the rescue or evacuation of workers (Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.). The plan establishes what the employer must do until emergency services personnel arrive.

The response plan must address the emergencies identified in the work site hazard assessment as per section 2 of the *OHS Code*. The plan is to be developed by the employer with the involvement of affected workers. The procedures to be followed and the personnel involved in emergency response must be specified in the plan. All affected workers must be aware of the plan and familiar with the procedures.

A very simple emergency response plan will often be appropriate for offices, small retail shops and small manufacturing settings. There are often few or no hazardous materials or processes in such settings and workers evacuate when an alarm sounds or are ordered to leave by means of a public announcement. Plans that are more complex are

required at workplaces containing hazardous materials or at workplaces where workers fight fires, perform rescue and medical tasks, or evacuation after alarms sound is delayed as workers shut down critical equipment. The employer must keep the plan up-to-date, reflecting current circumstances at the work site.

Comments on the use of 911 for emergency services

In some situations, an employer may use a “911” service as an acceptable means of providing emergency services at a worksite. Providing first aid and calling “911” may be the complete emergency response plan for this employer. For the most part however, this approach will be limited to employers located in urban areas where the timeliness of the “911” service meets the intent of the requirement.

Using a “911” service replaces some of the employer’s duties under this Part, but not all duties. For example, an employer must still identify potential emergencies, the procedures for dealing with the identified emergencies (which will include calling “911” for particular types of emergencies), fire protection requirements, workers who will supervise evacuation procedures in an emergency, etc.

Regardless of whether or not a “911” service is used, employers must meet the first aid equipment and service requirements of Part 11 of the *OHS Code*. Using the “911” service does not replace the employer’s obligation to provide the required first aid equipment and services.

Comments on the use of 911 for rescue

In the case of rescues involving workers in confined spaces and workers suspended in the air after a fall, calling 911 alone and awaiting the arrival of rescue services personnel is considered to be an insufficient emergency response. The employer must have some basic level of on-site rescue capability—see section 55 for confined spaces and section 140 for fall protection—in the event that rescue services personnel are delayed or unable to attend the scene.

In some situations, rescue services personnel may not have the equipment or skills to perform a rescue, e.g., a worker in a confined space deep below ground level in a horizontal tunnelling operation or a worker suspended 100 metres above ground level following the failure of a swingstage scaffold. In such cases, the employer’s on-site rescue capability must be such that the work site is virtually self-sufficient in returning a rescued worker to the surface or ground level.

Section 116 Contents of plan

Emergency response items such as first aid and fire protection are common to all work sites. Items (a) to (j) of this subsection are the minimum requirements to be addressed in an emergency response plan. It is essential that the emergency response plan be site

specific. Individual work sites may need to add additional items that are specific to their operation.

Section 117 Rescue and evacuation workers

This section defines the scope of the training required by workers assigned to provide rescue or evacuation services. The emergency response training must be appropriate to the work site and the potential emergencies identified in the emergency response plan. The training of designated rescue and emergency workers must include drill exercises that simulate the emergency response required.

In a simple situation where fire is the only emergency requiring evacuation (based on the hazard assessment of the work site), a fire warden should be assigned by the employer to coordinate the evacuation. The employer must provide training or instruction to the fire warden on how to coordinate the evacuation, including during fire drill practices.

Section 118 Equipment

The employer is responsible for providing proper personal protective clothing and equipment to workers assigned to perform the related emergency response activities. The equipment must meet the requirements of the *OHS Code* and must be appropriate for dealing with the potential hazards when the workers respond to related emergencies.

Designated rescue and emergency workers are exempt from the fall protection requirements of Part 9 (see section 138). Workers involved in the training and provision of emergency rescue services are permitted to use fall protection equipment and practices other than those specified in Part 9. The exemption is intended to provide rescue personnel with the flexibility to use their specialized skills, knowledge and training to safely perform their tasks.

Example of an emergency response plan

Figure 7.1 presents an example of an emergency response plan for a typical office-type workplace. A more complex emergency response plan is often needed at industrial settings.

Additional information about emergency preparedness and response can be found in the following documents:




-  CSA Standard CAN/CSA-Z731-03 (R2009), *Emergency Preparedness and Response*
-  CSA Standard Z1600-08, *Emergency management and business continuity programs*
-  *How to Plan for Workplace Emergencies and Evacuations* (OSHA Publication 3088, revised in 2001)

Figure 7.1 Example of an Emergency Response Plan—A & B Insurance Co.

Potential emergencies (based on hazard assessment)	The following are identified potential emergencies: <ul style="list-style-type: none">▪ Fire	
Emergency procedures	In the event of a fire occurring within or affecting the work site, the Fire Warden (or deputy) makes the following decisions and ensures the appropriate key steps are taken: <ul style="list-style-type: none">▪ advise all personnel▪ pull the fire alarm to alert the nearest fire station and initiate all fire alarms within the building▪ evacuate all persons to a safe point in the staff parking lot and account for everyone including visitors and clients	
Location of emergency equipment	Emergency equipment is located at: <ul style="list-style-type: none">▪ Fire Alarm<ul style="list-style-type: none">• 1—at the reception desk• 1—by the back door▪ Fire Extinguisher<ul style="list-style-type: none">• 1—in the office hallway▪ Fire Hose<ul style="list-style-type: none">• 1—in the office hallway next to the fire extinguisher▪ Panic Alarm Button<ul style="list-style-type: none">• 1—at the main reception desk under the computer	
Workers trained in the use of emergency equipment	(1) Smokey Bear (2) Joe Smith (3) _____ (4) _____	
Emergency response training requirements	Type of training	Frequency
	<ul style="list-style-type: none">▪ Use of fire extinguishers▪ Practice fire drills▪ ▪ 	<ul style="list-style-type: none">▪ Orientation and annually▪ At the call of building management
Location and use of emergency facilities	The nearest emergency services are located at: <ul style="list-style-type: none">▪ Fire station: 10 Fire Street—2 blocks east▪ Ambulance: 40 Sun Street—10 blocks south▪ Police: 1 Police Plaza—20 blocks west▪ Hospital: 101 Hospital Avenue—4 blocks east▪ Other:	

Fire protection requirements	<ul style="list-style-type: none">▪ Sprinkler systems are located in all rooms at the work site
Alarm and emergency communication requirements	<ul style="list-style-type: none">▪ Pulling the fire alarm automatically alerts the fire department and initiates an alarm within the building▪ The fire alarm signal is intermittent sharp beeps
First aid	<p>First aid supplies are located at:</p> <ul style="list-style-type: none">▪ Type No. 1 First Aid Kit at the main reception desk▪ Blankets in the storage room <p>First Aiders are:</p> <ul style="list-style-type: none">▪ Will B. Safe (Standard First Aider)▪ Sun Shine (Emergency First Aider) <p>Transportation for ill or injured workers is by ambulance. Call 911</p>
Procedures for rescue and evacuation	<p>In case of fire:</p> <ul style="list-style-type: none">▪ Advise all personnel▪ Pull the fire alarm▪ Evacuate all persons to a safe point in the staff parking lot and account for everyone including visitors and clients▪ Assist ill or injured workers to evacuate the building▪ Provide first aid to injured workers if required▪ Call 911 to arrange for transportation of ill or injured workers to the nearest health care facility if required
Designated rescue and evacuation workers	<p>The following workers are trained in rescue and evacuation:</p> <ul style="list-style-type: none">▪ Smokey Bear (Fire Warden)▪ Joe Smith (Deputy Fire Warden)▪ Will B. Safe (Standard First Aider)▪ Sun Shine (Emergency First Aider)

Completed on: _____

Signed: _____

Part 8 Entrances, Walkways, Stairways and Ladders

Highlights

- Section 119 requires the employer to identify a secondary escape route for situations in which a worker could become isolated from a primary escape route.
- Section 127 requires employers to ensure that ladders used near energized equipment are non-conducting.
- Section 130 references Process Industry Practices (PIP) Standard STF05501 (February 2002), *Fixed Ladders and Cages*, for the design and construction of fixed ladders. An employer must ensure that a fixed ladder installed on or after April 30, 2004, meets the requirements of this standard.
- Section 131 references American Society for Testing and Materials (ASTM) Standard C478-02, *Standard Specification for Reinforced Concrete Manhole Sections*, for fixed ladders used in pre-cast reinforced concrete manhole sections. An employer must ensure that a fixed ladder used in pre-cast reinforced concrete manholes installed on or after April 30, 2004, meets the requirements of this standard.
- Section 135 recognizes both Canadian Standards Association (CSA) and American National Standard Institute (ANSI) Standards for portable ladders.

Entrances, Walkways, Stairways

Section 119 Safe entry and exit

Subsection 119(1)

Workers must be provided with a safe way of entering and leaving a work area. Safe entry and exit must take into account both normal operations and emergency situations. For example, a proper climbing device may provide safe access to a derrickman's working platform but safe exit from the platform in an emergency may be by way of an escape buggy. Based on the hazards present at the workplace or in a particular work area, multiple entry and exit points may be required to permit safe entry or exit under emergency conditions.

Subsections 119(2) and 119(3)

All means of entry or exit must be maintained in a good state of repair, e.g., access ladders have all rungs in place, the hinges and panic bars on doors operate properly, the braking mechanism of an emergency escape buggy operates smoothly.

Means of entry and exit must be kept clear of materials, equipment, waste, and other obstructions. Doing so allows workers to safely move into and out of work areas, preventing slips, trips, and falls.

Subsection 119(4)

Multiple entry and exit points are required in situations where a worker could become isolated from a primary escape route and unable to return to it. A long trench for example, requires multiple access ladders in case a worker in the trench is unable to get back to the primary access ladder to leave the trench. A room in which an industrial process goes on involving dangerous chemicals may require multiple exit doorways so that workers can quickly leave the area in an emergency.

This secondary means of escape must be conveniently located, safe for use, maintained to be ready for use at all times (as in the case of the emergency escape buggy mentioned above), and must be kept free of obstructions. This subsection reminds employers that secondary doorways, stairways, ramps, emergency escape devices, etc., must be provided where necessary and cannot be forgotten.

Subsection 119(5)

Workers must be made aware of the escape routes they are expected to use.

Section 120 Doors

Subsection 120(1)

Doors must be appropriately selected and then maintained so that workers can open them without substantial effort. Doorways must be kept free of obstructions.

Subsection 120(2)

Enclosed areas may pose a hazard to workers entering them. Examples of enclosed areas include freezers, refrigerators, and rooms that present conditions hazardous to workers. The type of door and hardware used is left up to the employer.

The door must be kept in good working order and must be provided with a means of opening it from the inside. This is an obvious requirement for freezers and refrigerators. Enclosed areas that pose a hazard to workers also require doors that can be opened from the inside.

Section 121 Walkways, runways and ramps

Subsection 121(1)

Permanent and temporary walkways, runways and ramps must be
(a) strong enough to support all expected loads;

- (b) at least 600 mm wide to permit the safe movement of equipment and workers; and
- (c) where applicable, be equipped with guardrails and toe boards. Guardrails must meet the requirements of section 315 and toe boards must meet the requirements of section 321.

Subsection 121(2)

Walkways, runways and ramps must provide workers with enough traction to prevent slipping. For walkways, runways and ramps located in a controlled environment, non-slip, abrasive surfaces may be adequate. For locations exposed to weather, or at workplaces where debris or materials damage or coat these non-slip surfaces so that they are of little or no value, expanded metal or webbed metal should be used. This type of construction sheds ice, snow, and debris, providing reliable traction under a variety of conditions.

Subsection 121(3)

Employers in the farming and ranching sector may use controls and safe work procedures identified through their hazard assessment, rather than strictly complying with subsections (1)(b) and (d).

Section 122 Stairways

Subsection 122(1)

Throughout the length of a stairway, the width of the treads and the height of the rise must not change. This reduces the likelihood of workers tripping or stumbling due to unexpected changes as they move up or down the stairway. Treads must also be level.

Subsection 122(2)


Stairways with five or more risers must be equipped with a handrail meeting the requirements for handrails described in section 123. Handrails provide a handhold that helps workers to prevent falling.

A stairway having an open or unprotected side must not only have a handrail, but must also have an intermediate rail or equivalent safeguard, e.g., filled in with expanded metal, solid plywood barricade, etc. In effect, a “guardrail” is being placed across the open or unprotected side of the stairway.

Subsection 122(3)

Temporary stairs must be at least 600 mm wide to permit the safe movement of equipment and workers.

Readers interested in design specifications for fixed industrial stairs should consult the following source (there are many others that could also prove useful):

 *California Code of Regulations, Title 8, Section 3234, Industrial Fixed Ladders.*

Section 3234 contains specifications for the safe design and construction of fixed general industrial stairs. This includes interior and exterior stairs around machinery, tanks, and other equipment, and stairs leading to or from floors, platforms, or pits.

Subsection 122(4)

Employers in the farming and ranching sector may use controls and safe work procedures identified through their hazard assessment, rather than strictly complying with subsections (1), (2) or (3).

Section 123 Handrails on stairways

Subsections 123(1) through 123(3)

These subsections list the design requirements that apply to handrails on stairways having 5 or more risers.

Subsection 123(4)

Employers in the farming and ranching sector may use controls and safe work procedures identified through their hazard assessment, rather than strictly complying with subsections (1), (2) or (3).

Ladders—General

Section 124 Restriction on use

To enter or leave an elevated or sub-level area, a ladder should be used only if there is no other safe and recognizable way of doing so. Walking down an earthen ramp or walking up a set of stairs are preferred to using a ladder.

Section 125 Prohibition on single rail

Employers are responsible for making sure that ladders are used properly. This also means that employers must make sure that the correct type of ladder is used. Ladders made by fastening cleats or steps across a single rail or post must not be built, let alone used. Such a device is unstable and unsafe for use.

Section 126 Prohibition on painting

Paint and other coatings can prevent a person from seeing the condition of the wood of a wooden ladder. Only transparent, nonconductive finishes such as varnish, shellac, or a clear preservative should be used. A minimum amount of paint may be used for placing identifying information on a ladder. If this is done, the marking(s) should only appear on one face of the side rails.

In general, ladders should be kept free of any waste products such as drywall mud, cement, paint, adhesives or sealants. A build-up of these materials could cover up damage such as cracks and missing connecting hardware.

Section 127 Use near energized electrical equipment

Metal ladders and wooden ladders with side rail metal reinforcement wires must not be used during the servicing of energized or potentially energized electrical equipment. To maintain their non-conducting properties, ladders intended for use around energized electrical equipment need to be kept clean. All surface build-up of dirt, dust, grease, grime and other conductive materials needs to be removed. These materials may create a path for electrical current to travel along the surface of the ladder and endanger the person using the ladder.

Section 128 Ladders on extending booms

A ladder attached to an extending boom moves with the boom while the boom is being positioned. As a result, the ladder is an unsafe place for a worker to be because of the chance of losing balance and falling. With the exception of professional firefighters working on firefighting equipment, no worker is permitted to be on the ladder attached to an extending boom during boom motion.

Similarly, a boom-mounted ladder is an unsafe place to be until the powered mobile equipment to which the boom is attached is stable. If the equipment has outriggers, the outriggers must be set before a worker climbs the ladder.

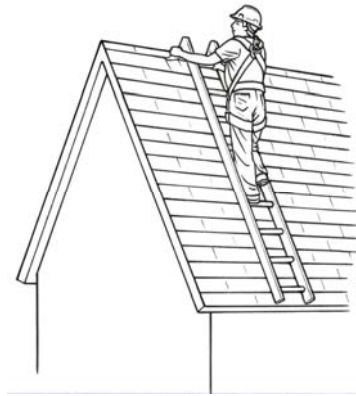
Crawl Board or Roof Ladder

Section 129 Safe use

Figure 8.1 shows a roof ladder in use on a very steep roof. The bracket at the upper end of a crawl board or roof ladder should be deep enough to reach over the ridge of the roof and overlap the roof framing.

Eavestroughs must not be used to support a crawl board or roof ladder. An eaves trough may not be strong enough to support the combined weight of the crawl board or ladder and the worker using it.

Figure 8.1 Roof ladder in use on very steep roof



Fixed Ladders

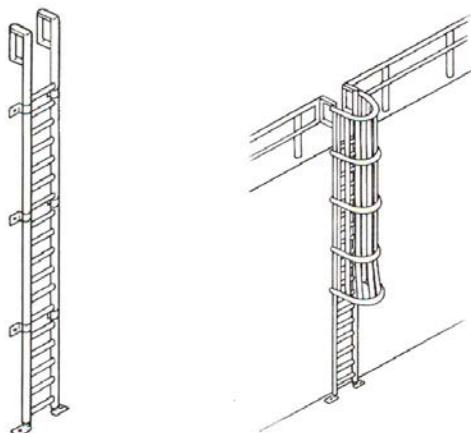
Section 130 Design criteria

Subsection 130(1)

A fixed ladder is a ladder that is an integral part of a building or structure. It is usually vertical but can be as much as 15 degrees from the vertical. A fixed ladder cannot lean back. Figure 8.2 shows a fixed ladder with a walkthrough at the top, and a similar ladder equipped with a ladder cage.

A ladder cage is a permanent structure attached to a ladder to provide a barrier between the worker and the surrounding space. It serves to support a worker if the worker needs to rest against a barrier. A ladder cage is not a means of fall protection.

Figure 8.2 Fixed ladder with walkthrough at top (left); same ladder with cage (right)



Process Industry Practices (PIP) Standard STF05501 (February 2002), *Fixed Ladders and Cages*, published by the Construction Industry Institute, specifies the design details for fabrication and installation of typical fixed ladders for structures, miscellaneous platforms, and vessels for regular operational entry and exit. These details are intended to be issued to fabricators supplying these ladders and to the erectors for use in installations.

Table 8.1 summarizes some of the most important differences between the requirements of the PIP Standard and the fixed ladder requirements that were in effect prior to when the first edition of the *OHS Code* went into effect on April 30, 2004. The requirement to comply with the PIP Standard is not retroactive to fixed ladders installed prior to the effective date of the first edition of the *OHS Code*.

Subsection 130(2)

The PIP standard referenced in this section is intended to be used as a design standard, i.e., one which can be directly referenced by an employer or owner. A fabricator can then fabricate the fixed ladder as described in the standard's mechanical drawings. To comply with the *OHS Code*, all the dimensional and strength requirements of the PIP standard must be met.

Some fabricators and employers have liberally interpreted subsection 130(2) of the *OHS Code*, suggesting that the PIP standard functions as no more than a design *guideline*. These parties have chosen to interpret the subsection as meaning that as long as "established engineering principles" are followed, the dimensions specified in the PIP standard need not be met. This is an incorrect interpretation of the words.

The phrase "established engineering principles" refers to the "material and process standards" referenced in the PIP standard. The reason for using this phrase is that the PIP Standard refers to material and process standards that reflect practices followed in the U.S. These standards may not be appropriate for use in Alberta. As a result, an employer may use applicable Canadian material and process standards.

There have been a couple of cases in which a minor dimensional difference has been discovered during commissioning following installation of a fixed ladder. In these cases, employers have requested an "acceptance." This is a letter granted to the employer by Occupational Health and Safety stating that the ladder in question "functionally" complies with the *OHS Code*. In each case the employer had to prove that the ladder with the dimensional error provided workers with a level of protection that was equal to or greater than that provided by a ladder meeting all of the PIP standard's dimensional requirements.

In each case to date the dimensional difference was minor and did not compromise worker safety. An acceptance was granted in each case. One of these acceptances resulted in the addition of paragraph 130(2)(b) to this edition of the *OHS Code*.

Recognizing that larger workers and workers wearing safety or rescue equipment may have difficulty passing through the ladder cage hoops, the allowable hoop dimension has been increased. The inside diameter of a cage hoop can now be as much as 760 mm. The existing dimensions shown in Section B-B of the PIP standard limit the width to 686 mm and the depth to 696 mm. If an employer uses the 760 mm dimension, then other dimensional measurements associated with the fixed ladder may need to be altered to accommodate the larger cage hoops.

Subsection 130(3)

The PIP Standard specifies that the fixed ladder must be made of steel. Situations may arise in which steel is not the preferred material of choice, e.g., exposure to chemicals. Fixed ladders made of aluminum or fiberglass are available. If a fixed ladder is made of a material other than steel, the employer must ensure that the design is certified by a professional engineer as being as strong as or stronger than that required by PIP Standard STF05501.

Subsections 130(4) and 130(5)

Ladderway floor openings and platforms are normally guarded by a standard guardrail and toe board on all exposed sides, except at the entrance to the opening (see subsection 321(5)). A self-closing double bar safety gate or equally effective means must be provided at the opening to prevent persons from walking directly into the opening and falling.

A safety gate is not required at landings.

Subsection 130(6)

An access ladder attached to a scaffold is subject to the requirements of section 327, not the requirements of section 130.

Subsection 130(7)

In the case of a farming and ranching operation, subsections (1) through (6) must be complied with unless a person who is competent or a service provider who is competent provides safe work procedures for the workers using fixed ladders.

Table 8.1 Comparison of selected fixed ladder design requirements

Requirement	Requirements Prior to April 30, 2004	PIP Standard
Rung spacing	250 millimetres min, 305 millimetres max	300 millimetres
Clearance between ladder rungs and structure to which ladder is affixed (hand and toe clearance)	150 millimetres min	178 millimetres; when distance to any unavoidable object, including insulation, is less than 178 millimetres, the minimum clearance is 39 millimetres
Platform spacing intervals and dimensions	6.5 metres; 760 millimetres x 760 millimetres (platforms not required if the ladder incorporates a fall arrest system)	9.1 metres; 762 millimetres x 762 millimetres (platforms not required if the ladder incorporates a fall arrest system)
Ladder cage	Required if the ladder is more than 6.5 metres long (cage not required if the ladder incorporates a fall arrest system)	Required on ladder having a minimum unbroken length of 6.1 metres; (cage not required if the ladder incorporates a fall arrest system)
Ladder length	Not specified	Max unbroken length of 9.1 metres unless ladder incorporates a fall arrest system
Lowest point of ladder cage	No more than 3 metres above landing or ground	Within 2.1 metres to 2.4 metres of the walking surface
Ladderway opening	Not specified	Requires safety gate or equivalent means
Width of rungs between rails	Not specified	450 millimetres

Section 131 Fixed ladders in manholes

ASTM Standard C478-07, *Standard Specification for Reinforced Concrete Manhole Sections*, includes requirements for the design of steps and ladders installed in pre-cast reinforced concrete manholes used in sewer and water works. These requirements include the dimensions of steps and rungs and appropriate clearance distances.

Section 132 Rest platform exemption

Because of the distance and number of times a worker may climb a fixed ladder on a drilling rig or service rig, and the impracticality of providing platforms on a rig, workers are permitted to use an assist device, often counterbalanced, to ascend and descend the ladder. This assist device does not replace the need for a fall arrest system or ladder cage, as appropriate.

Portable Ladders

Section 133 Prohibition

Unless permitted by the manufacturer's specifications, a worker must never work from the top two rungs, steps, or cleats of a portable ladder. Unless designed to permit such use, portable ladders can become unstable or workers can lose their balance for lack of siderails to hold while working from the top two rungs, steps, or cleats.

CSA Standard CAN3-Z11-M81 (R2005), *Portable Ladders*, recognizes step stools of a particular type as being a portable ladder. With that particular type of step stool, workers are permitted to stand on any rung, including the top plate.

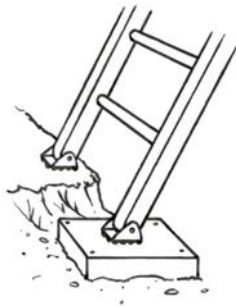
The following safety precautions should be followed when using a stepladder:

- Never work from the top two treads of a stepladder unless permitted to do so by the manufacturer's specifications (see Figure 8.3).
- Always face the stepladder treads when using a stepladder.
- Never use a stepladder for entry to or exit from another work area.
- Never lean to one side or overreach while using a stepladder.
- Unless permitted by the stepladder manufacturer, never use a stepladder as a support for a working platform as the ladder is too unstable.
- Always visually inspect the ladder before each use.
- Always place a stepladder on a firm, flat surface.
- Do not place a stepladder on boxes or scaffolds to gain extra height.
- Always take care when positioning a stepladder in corridors or driveways where it could be hit by a person or vehicle. Set up suitable barriers where necessary.
- Set base on secure, even surface. Shim the base if necessary (see Figure 8.4)


Figure 8.3 Safely working from a stepladder



Figure 8.4 Example of shimming the ladder base on uneven ground



For more information

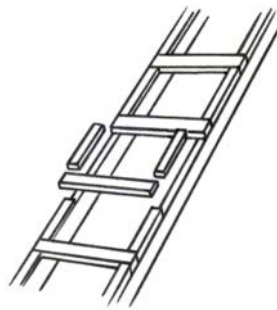
 *Portable Ladders—Types, Use, & Care* (Oregon OSHA)

Section 134 Constructed portable ladder

Many falls happen when a proper ladder is unavailable at a job site and a makeshift ladder is constructed. Accidents happen when workers throw something together quickly in order to reach a roof, climb in or out of a foundation, or get from one level to another before stairs are installed.

A ladder constructed on site, known as a “constructed portable ladder,” can solve the problem. The ladder can be built as single- or double-width. Figure 8.5 shows some of the construction details of a constructed ladder.

Figure 8.5 Design details of a single-width constructed ladder



Section 135 Manufactured portable ladder

Subsection 135(a)

CSA Standard CAN3-Z11-M81 (R2005), *Portable Ladders*, specifies design and performance requirements and tests for common types of portable ladders. CSA defines a portable ladder as one that can be readily moved or carried and usually consists of side rails joined at intervals by steps, rungs, cleats or rear braces.

The Standard classifies portable ladders into one of three grades based on how the ladder is used. The grades are shown in Table 8.2.

Table 8.2 CSA grades of portable ladders

Grade	Projected use	Load rating
1	Construction and industrial	Heavy
2	Tradesman and farm	Medium
3	Household	Light

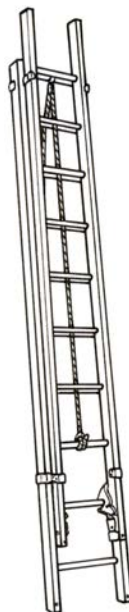
A ladder approved to the Standard bears markings indicating the grade, projected use, load rating of the ladder, and numerous safety precautions in both words and symbols. If certified by CSA, the ladder bears the CSA monogram. Section 135 does not require manufactured portable ladders to be certified.

The following types of portable ladders are covered by the Standard:

- *Combination ladder*—a portable ladder capable of being used either as a stepladder or a single or extension ladder. It may also be capable of being used as a trestle ladder or a stairwell ladder. Its components may be used as single ladders.
- *Extension ladder*—a non-self-supporting portable ladder consisting of two or more sections travelling in interlocking rails, guides, or brackets so arranged as to permit length adjustment (see Figure 8.6). The maximum length of an extension ladder is the sum of the lengths of the side rail of each section. The maximum length of the extension ladder depends on its grade as follows:
 - Grade 1: 18 metres with 2 sections; 22 metres with 3 sections;
 - Grade 2: 15 metres with 2 sections; 18 metres with 3 sections;
 - Grade 3: 9.5 metres with 2 sections.

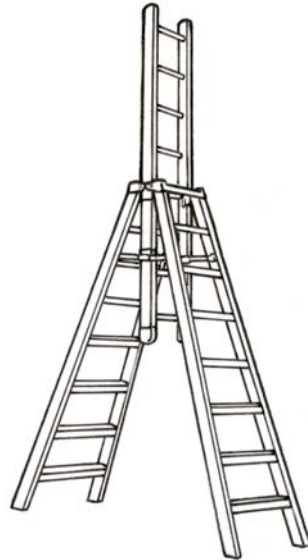
Because ladder sections must overlap by at least 1.5 metres, the overall maximum extended length of the longest extension ladder is 19 metres. Inclined at the recommended 75-degree angle (“4 up—1 out”), with 1 metre of the ladder extending above the upper landing area and assuming the worker to be 2 metres tall, the worker’s maximum height above ground would be approximately 15.5 metres.

Figure 8.6 Example of extension ladder



- *Extension trestle ladder*—a self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable extension section, with a suitable means for locking the ladders together (see Figure 8.7). Trestle ladders are used in pairs to support planks or staging. The rungs are not intended to be used as steps. The extension section and base section of a trestle ladder cannot be more than 6 metres long.

Figure 8.7 Extension trestle ladder



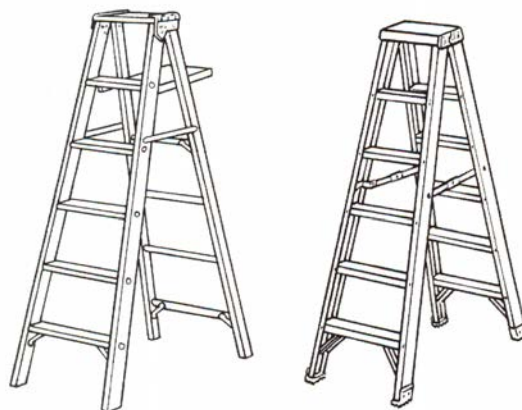
- *Sectional ladder*—a non-self-supporting portable ladder, non-adjustable in length, consisting of two or more sections, so constructed that the sections may be combined to function as a single ladder.
- *Single ladder*—a non-self-supporting portable ladder, non-adjustable in length, consisting of one section only (see Figure 8.8). Single ladders may be either step- or rung-type. The maximum length of a single ladder depends on its grade as follows:
 - Grade 1: 9 metres;
 - Grade 2: 7.5 metres;
 - Grade 3: 5 metres.

Figure 8.8 Example of a single ladder



- *Special-purpose ladder*—a ladder that represents either a modification or a combination of design or construction features of a general-purpose ladder, in order to adapt to special or specific uses.
- *Stepladder*—a self-supporting portable ladder, non-adjustable in length, having flat steps and hinged back (see Figure 8.9). The back section consists of either a single ladder or some other supporting device. The maximum length of a stepladder depends on its grade as follows:
 - Grade 1: 6 metres;
 - Grade 2: 3.6 metres;
 - Grade 3: 2 metres.

Figure 8.9 Standard stepladder (left) and two-way stepladder (right)



- *Step stool*—a self-supporting, fixed or foldable, portable ladder non-adjustable in length, 800 millimetres or less in overall size with flat steps and without a pail shelf. The ladder top cap is designed to be climbed on as well as all steps. The side rails may continue above the top cap.
- *Trestle ladder*—a self-supporting portable ladder, non-adjustable in length, consisting of two sections, hinged at the top to form equal angles with the base. Trestle ladders are used in pairs to support planks or staging. The rungs are not intended to be used as steps. A trestle ladder cannot be more than 6 metres (20 feet) long.

Subsections 135(b) through 135(d)

ANSI Standard A14.1-2007, *American National Standard for Ladders—Wood—Safety Requirements*, establishes minimum requirements for the construction, testing, labelling, care, and use of common types of portable wood ladders. ANSI Standard A14.2-2007, *American National Standard for Ladders—Portable Metal—Safety Requirements*, does the same for portable metal ladders and ANSI Standard A14.5-2007, *American National Standard for Ladders—Portable Reinforced Plastic—Safety Requirements*, does the same for portable ladders made of reinforced plastic. The Standards classify portable ladders into one of five types based on how a ladder is used. The types are shown in Table 8.3. Table 8.4 summarizes the maximum lengths of selected ladders as permitted by the standards.

Portable ladders meeting the requirements of the standards are labelled with their type or duty rating and a statement that they comply with ANSI Standard A14.1, ANSI Standard A14.2 or ANSI Standard A14.5. Section 135 does not require manufactured portable ladders to be certified.

Table 8.3 Portable ladder types according to ANSI Standards

Ladder type	Projected use	Duty Rating [working load]
Type IAA	Special duty work involving heavy workers in combination with heavy tools, equipment or loads.	Special duty [170 kilograms]
Type IA	Frequent extra heavy-duty applications such as industry, utilities, contractors, etc.	Extra heavy-duty [136 kilograms]
Type I	Industry, utilities, contractors, etc.	Heavy duty [114 kilograms]
Type II	Offices, light maintenance, etc. Must not be used with ladder jacks or scaffold planks.	Medium duty [102 kilograms]
Type III	Light household use. Must not be used with ladder jacks or scaffold planks.	Light duty [91 kilograms]

Table 8.4 Maximum ladder lengths permitted by ANSI ladder standards

Ladder	Type	Maximum length		
		Wood	Metal	Reinforced plastic
Stepladder	IA, I	6 metres	6 metres	6 metres
	II	3.6 metres	3.6 metres	3.6 metres
	III	1.8 metres	1.8 metres	1.8 metres
Single	IA, I	9 metres	9 metres	9 metres
	II	6 metres	7.3 metres	7.3 metres
	III	4.2 metres	4.9 metres	4.9 metres
Extension	IA, I	18 metres	21.8 metres	21.8 metres
	II	12 metres	18 metres	18 metres
	III	8.5 metres	9.7 metres	9.7 metres

Ladders

Ladder safety precautions

The ladder is an extremely useful, simple device that is not always used correctly. Climbing a ladder is usually easy, but descending can sometimes be quite hazardous. The types of injuries sustained from falling or slipping from a ladder can be quite horrendous. A fall from even a short distance can result in a person suffering severe injuries leading to disability or death.

In general, most ladder falls involve portable ladders that move, tilt, or shift while a worker is climbing or descending. Unstable or slippery base surfaces are the primary reasons ladders fail. Other reasons include a misstep or a slip of the foot, loss of balance, an overreach, and the ladder being struck by a vehicle or other object.

Too many ladders are not suitable for the job or are used incorrectly. During work site inspections, the most commonly observed problems with ladders are:

- base of ladder placed too close or too far away from the structure;
- ladder not secured at the top;
- ladder not extending 1 m above the upper landing surface;
- missing or broken rungs;
- missing or broken stays on stepladders;
- working from a stepladder on the top tread;
- ladder positioned incorrectly on a slope;
- inadequate ladder repairs.

Workers and employers can reduce ladder falls by doing the following:

- (a) frequently inspect and maintain ladders;
- (b) use the right ladder for the job. Ladders come in a variety of types and many special-purpose ladders are available. Examples include trolley, side-rolling, shaft, and manhole ladders. A worker and employer are likely to save time, energy, and reduce the risk of injury by using the right ladder for the job;
- (c) set up ladders correctly; and
- (d) climb and descend ladders properly

Employers are responsible for training workers so that they understand these safe work practices. Employers are also responsible for making sure that the safe work practices are followed.

Maintenance

All ladders should be checked regularly to make sure they are fit for use and to identify any defects. Any repairs should be done immediately or the ladder removed from service until the repairs are made. If the ladder cannot be repaired, it should be discarded and replaced.

Is a ladder the best choice?

Before using any ladder, the following questions should be asked:

- | | | |
|---|------------------------------|-----------------------------|
| (1) Is using a ladder the safest and best way to do the job? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (2) Is the ladder in good condition and suitable for the type and height of work? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (3) Can the ladder be positioned close enough to the work area so that the worker using it won't overreach? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (4) Can the ladder be secured at both the top and bottom? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| (5) Is the surface supporting the ladder at its base firm and level? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

If the answer to any of these questions is No, consider another method of gaining access to the work area.

Section 136 Securing and positioning

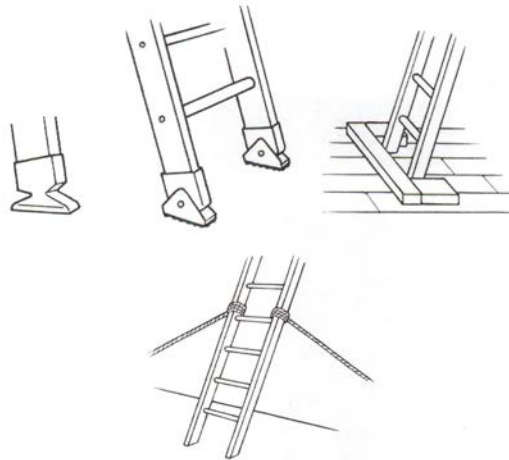
Subsection 136(a)

A portable ladder can be secured against movement in many ways. Because it can move at both its upper and lower ends, ideally it should be secured at both ends (see Figures 8.10 and 8.11). Slip-resistant or rubber safety feet at the bottom of a metal or reinforced plastic ladder are considered to offer securement if they rest on a firm, non-slippery surface. Neither CSA nor ANSI requires the feet of wooden ladders to be equipped with slip-resistant material. If the feet of a wooden ladder rest securely on a firm, non-slippery surface, then the intent of the requirement is met.

If the surface that the ladder rests on is slippery or it is possible for the base of the ladder to move, then the ladder must be secured. Examples of acceptable securement methods include

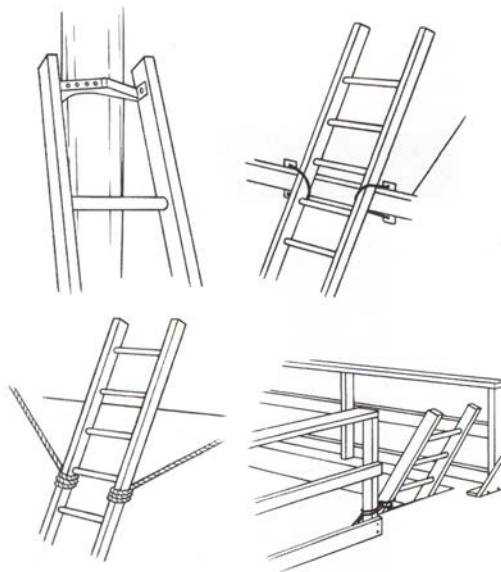
- (a) spikes driven through the feet into the surface upon which the ladder base rests;
- (b) cleats nailed into the surface to prevent movement;
- (c) tying the feet of the ladder to stakes in the ground to stop it from slipping (place a large flat wooden board underneath to help prevent it sinking);
- (d) butting the base of the ladder against a fixed structure such as a curb or wall, heavy blocks, or sandbags;
- (e) having a person stand at the base, one foot on the lowest rung, holding a side rail in each hand.

Figure 8.10 Examples of securing the base of a ladder (rubber safety feet, cleats nailed to the floor, tying off to stakes in the ground)



At the top of the ladder, both rails should be supported unless the ladder has a single support attachment. Ladder ties to the support at the top are often used. An alternative might be to tie ropes or straps from the side rails (not the rungs) to a fixed object.

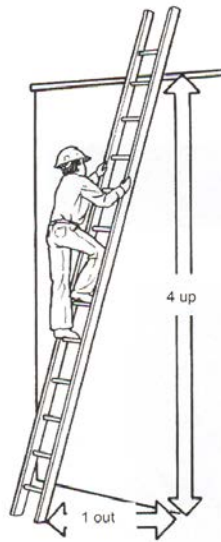
Figure 8.11 Examples of securing a portable ladder at the top



Subsection 136(b)

Ladders must be set up so that the base is out 1 metre for each 4 metres up (see Figure 8.12). “4 up—1 out” gives the right slope—approximately 75 degrees from the horizontal. This position offers the ladder, and the worker standing on it, the greatest stability.

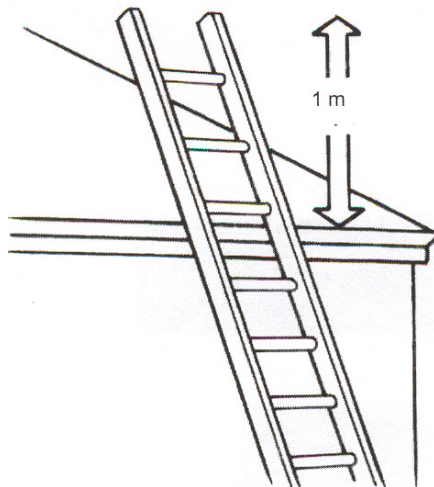
Figure 8.12 Proper placement of ladder



Subsection 136(c)

The side rails of a portable ladder must extend at least 1 metre above any platform, landing or parapet where the ladder is used as a means of access to the platform, landing or parapet (see Figure 8.13). Doing so provides the worker using the ladder with handholds for getting on and off the ladder.

Figure 8.13 Top of ladder extending above access level



Section 137 Fall protection

Under normal circumstances, workers are required to use some type of fall protection system, e.g., guardrails, nets, personal fall arrest system, etc., whenever they can fall a distance of 3 metres or more. This section permits a worker to move up or down a portable ladder without having to use a personal fall arrest system.

This section also permits a worker to work from a ladder without using a personal fall arrest system in circumstances where it is not reasonably practicable to do so. The most common example of such a situation is when an anchor of sufficient strength is unavailable or too impracticable to use. This easement of the fall protection requirements is subject to several conditions:

- (1) the work must be a “light duty task,” such as inspection or painting. The work done at each spot where the ladder is set up must be less than approximately 15 minutes in length;
- (2) while doing the task, the worker must keep his or her centre of gravity (indicated by the belly button) between the side rails of the ladder; and
- (3) the worker must maintain three points of contact whenever the worker extends an arm beyond a side rail.

If any one of these three conditions cannot be met, some form of fall arrest protection is required.

The maximum length of a three-section extension ladder is 22 metres. Because ladder sections must overlap by at least 1.5 metres, the overall maximum extended length of the longest extension ladder is 19 metres. Inclined at the recommended 75-degree angle (“4 up—1 out”), with 1 m of the ladder extending above the upper landing area and assuming the worker to be 2 metres tall, the worker’s maximum height above ground would be approximately 15.5 metres.

Being 15.5 metres above the ground is a considerable height. An extension ladder extended to its full-length bows and tends to be less stable than when it is only partially extended. It tends to vibrate and shake in strong winds and while a person ascends or descends it. Whenever an extension ladder must be extended to near its full limits, questions should be asked as to whether a ladder is the best choice for doing the work. Alternate approaches, such as the use of a manlift, boatswain’s chair, or scaffolding may be safer and more efficient ways of doing the work.

Part 9 Fall Protection

Highlights

- Section 138 allows rescue personnel involved in emergency rescue training or in providing emergency rescue services to use equipment and services other than those specified in this Part.
- Section 139 requires employers, supervisors and self-employed persons to ensure that workers use a fall protection system under these conditions:
 - if a worker could fall 3 metres;
 - if a worker could fall *less than* 3 metres and there is an unusual possibility of injury. An unusual possibility of injury refers to the potential for a worker to sustain injuries more serious than those likely to result from landing on a solid, flat surface.
- Section 140 requires employers to prepare a fall protection plan if a worker at a work site could fall 3 metres or more and is not protected by guardrails. The plan must include procedures for rescuing workers who have fallen.
- Section 141 presents comprehensive minimum worker training requirements that can serve as the basis for a training course curriculum. Both theory and hands-on components are required.
- Sections 142 through 149 list equipment requirements. The 2009 edition of the *OHS Code* marks the first time that Part 9 accepts fall protection equipment approved to standards from the U.S. and Europe. Fall protection equipment approved to any one of these standards is considered to offer an equivalent level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs.
- Section 152 requires fall arrest anchors to have a minimum breaking strength of 16 kN (3600 lbs), a reduction from the previous value of 22.2 kN (5000 lbs), specifies the limits for free fall and maximum arresting force.
- Section 156 lists requirements applicable to boom-supported elevating work platforms and aerial devices, and forklift mounted work platforms.
- Section 158 presents requirements specific to fabric and netting leading edge fall protection systems.
- Section 160 introduces new requirements specific to work positioning.

Requirements

Section 138 Rescue personnel exemption

The “rescue personnel exemption” presented in this section does not exempt rescue personnel from using fall protection equipment and practices. It *does* exempt rescue personnel from using the equipment and practices specified in Part 9, allowing the use of alternative equipment and practices. Whereas Part 9 specifies the use of “industrial”-type fall protection equipment and practices, the exemption allows rescue personnel to use alternative equipment and practices. The practices used must provide an effective measure of worker safety and address the unique hazards that a rescue presents. A fall protection plan as required by section 140 must be prepared. The requirements of other Parts of the *OHS Code*, such as those dealing with personal protective equipment, continue to apply.

Section 139 General protection

Subsections 139(1) and 139(2)

Subsection 139(1) refer to “temporary work areas” and “permanent work areas.” For the purposes of this Part, the words “temporary” and “permanent” describe the nature of the work being performed, not whether the work area is a temporary or permanent structure.

At fall heights of 3 metres or more, at lesser heights if there is an unusual possibility of injury, or if the fall is through an opening in a work surface, subsection 139(1) requires that workers be protected from falling, regardless of whether the work area is a temporary or permanent work area.

Situations involving an “unusual possibility of injury” may include work performed above moving water, operating machinery, open vessels containing potentially harmful substances, extremely hot or cold surfaces, etc. An unusual possibility of injury refers to the potential for a worker to sustain injuries more serious than those likely to result from landing on a solid, flat surface.

At fall heights of 1.2 metres or less, the *OHS Code* does not require the use of a fall protection method unless there is an unusual possibility of injury.

The concept of temporary and permanent work areas applies between the fall heights of 1.2 metres and 3 metres. When originally created, the distinction between temporary and permanent was intended to address fall safety at heights of less than 3 metres at elevated work areas such as loading docks and mezzanines.

In the *OHS Code*, differentiating work areas on the basis of whether they are temporary or permanent links the likelihood of injury to the concepts of exposure to a hazard and

frequency of exposure to that hazard. Applying the concepts tries to place practical requirements on where and how workers are to be protected from falling. For example, a flatbed trailer may have a deck height of 1.3 metres above grade. It may not be reasonable to expect all such flatbed trailers to be equipped with perimeter guardrails or some other fall protection option given how infrequently a worker is expected to be on the deck and exposed to a fall hazard.

In some situations, it may be very difficult to distinguish between a temporary work area and a permanent work area for the purposes of applying section 139. Unfortunately, there is no way that a frequency of exposure can be stated for each and every possible situation involving worker exposure to a fall hazard between the fall heights of 1.2 metres and 3 metres. The following examples are intended to help readers assess their own work areas and determine if the area is a “temporary work area” or a “permanent work area.”

Example 1

Any work area at a construction site is considered to be a temporary work area.

Example 2

A worker at a chemical plant stands on an elevated platform at a height of 2.1 metres above grade, adjusting a valve once a month. The work area is a temporary work area because the work activity is done infrequently. If the valve is adjusted weekly or more frequently, then the work area should be considered to be a permanent work area.

Example 3

A worker does work while standing on the deck of a flatbed trailer that is 1.3 metres above grade. Normally, workers do not need to go onto the deck to adjust the load, straps, tarpaulins, etc. In the rare case that a worker must work while standing on the deck, then this should be considered to be a temporary work area.

If the worker is frequently on the deck, then the deck should be considered to be a permanent work area and subject to the fall protection requirements applicable to permanent work areas.

Example 4

A worker is working from a loading dock that is open on three sides and the height of the loading dock is 1.6 metres above grade. If the worker is frequently on the loading dock, i.e., once every few days or more often, then the loading dock should be considered to be a permanent work area. The worker frequently accesses the loading dock as part of a routine work activity.

Example 5

A worker performs work from a highway billboard platform that is at a height of 2.1 metres above grade. The worker performs work from the platform once in every four to eight weeks, making the platform a temporary work area.

Determining the fall distance

The 3-metre fall distance is measured from the point on the platform, stair, working surface, etc., from which a worker may fall, usually measured from the position of the feet if the worker is standing, to a lower level. Lower levels include, but are not limited to, those areas or surfaces to which a worker can fall such as the ground, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment or structures.

On a sloped roof, the 3-metre fall distance is measured in two ways:

- (1) if the worker is upslope from the eave and more than 2 metres away from a gable end, the fall distance is measured from the top of the eave to a lower level. Lower levels include, but are not limited to, those areas or surfaces to which a worker can fall such as the ground, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment or structures. The vertical height that a worker may roll or slide down the sloped roof before he or she loses contact with the roof is not considered to be part of the “fall distance”;
- (2) if the worker is within 2 metres of a gable end at any point upslope of the eave, the fall distance is taken as the vertical distance from the worker’s feet to a lower level. The assumption here is that the fall hazard is the worker falling off the gable end—the worker is much less likely to roll or slide down to the eave and then lose contact with the roof.

In the case of multi-level sloped roofs, if a worker falls from one level to the next, a distance of 3 metres for example, and then continues to fall to the next level, an additional 2.5 metres for example, the need to provide fall protection is based on the overall fall distance of 5.5 metres. The sloped roof onto which the worker falls is not considered to be a safe lower level, i.e., one from which a further fall would be prevented.

Subsection 139(3)

Subsection 139(3) states the most general case for fall protection—that workers need to be protected from falling by the use of a guardrail. Engineering controls eliminate the hazard of falling rather than control the hazard. Examples of other engineering controls include eliminating the need to work at height by making equipment, lighting, controls, valves, etc., accessible from ground level or from a location where there is no hazard of falling.

Guardrails are required by subsection 139(3) because they are often the preferred first choice for fall protection purposes. Guardrails become a permanent part of the installation, eliminating the need to equip workers with personal fall protection equipment and training those workers at periodic intervals. As such, guardrails are a type of passive fall protection system that is available at all times and does not require workers to do anything special. Guardrails can be used at any height.

If a guardrail is used, it must meet the design requirements listed in section 315, i.e., position and location of horizontal and vertical members, strength of design, etc. In the world of fall protection, guardrails are similar to a travel restraint system because they prevent a worker from getting to an edge or work location from which the worker could fall.

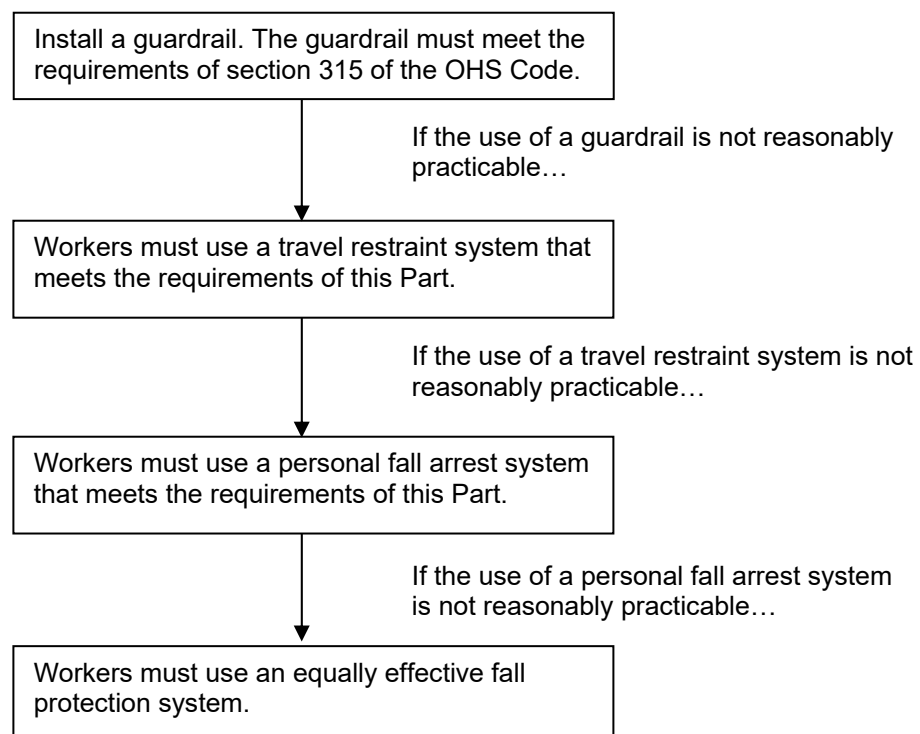
Subsection 139(4)

Repealed

Subsections 139(5), 139(6), 139(7)

These subsections specify a hierarchy for protecting workers against falling. They are intended to address the general case for preventing falls as required by subsection 139(1). The hierarchy is shown graphically in Figure 9.1.

Figure 9.1 Hierarchy of fall protection



Subsection 139(1)(d) applies to permanent work areas in which the vertical distance a worker can fall is more than 1.2 metres but less than 3 metres. This requirement is intended to address fall safety at heights of less than 3 metres at permanent elevated work areas such as loading docks and mezzanines. While guardrails are the preferred method of preventing a worker fall, guardrails are not always practicable.

The employer's and supervisor's, or self-employed person's, second choice is to protect workers by having them use a travel restraint system. If a travel restraint system is not practicable, the employer and supervisor, or self-employed person, must ensure that workers use an equally effective means that protects the workers from falling. While a personal fall arrest system is mentioned in subsection 139(6), it will rarely be used in this height range of 1.2 to 3 metres because of lack of sufficient clearance distance to prevent worker contact with a lower surface in the event of a fall.

Subsection 139(8)

This subsection clearly states the worker's duty to use a fall protection system required by this section.

For more information

📖 Ellis, NJ. *Introduction to Fall Protection*, 2nd edition. American Society of Safety Engineers, Des Plaines, IL; 1993.

📖 Sulowski AC. *Fall-Arrest Systems—Practical Essentials*. CSA International, Toronto; 2000.

Section 140 Fall protection plan

A fall protection plan is required if work is performed at a work site at which a fall of 3 metres or more may occur and guardrails do not protect workers. Section 14 of the *OHS Act* requires that the plan be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. The plan must be available at the work site before work with a risk of falling begins. Figure 9.2 shows a sample fall protection plan.

As listed in subsection 140(2), the fall protection plan must specify the following information:

- (a) the fall hazards at the work site;
- (b) the fall protection system to be used at the work site;
- (c) the anchors to be used during the work;
- (d) that clearance distances below the work area, if applicable, have been confirmed as sufficient to prevent a worker from striking the ground or an object or level below the work area;

- (e) the procedures used to assemble, maintain, inspect, use and disassemble the fall protection system, where applicable; and
- (f) the rescue procedures to be used if a worker falls and is suspended by a personal fall arrest system or safety net and needs to be rescued.

A fall protection plan is required if a travel restraint system is being used. Rescue procedures are not necessary in this case since a worker will not fall and be left suspended in the air.

A unique fall protection plan need not be created for each work site. If an employer faces the same fall hazards at multiple work sites, and the fall protection equipment and rescue procedures are identical at each work site, then a single plan applicable to all the work sites is acceptable. Alternatively, an employer can create a single fall protection plan that covers all of the fall hazards likely to be encountered during normal operations. Only in the event of a unique work situation arising would a new or amended fall protection plan be required.

Workers affected by the fall protection plan must be trained in all its elements and the plan must be made available to them.

Where a fall protection plan is not necessary

A fall protection plan is not necessary for

- (1) permanent work areas equipped with guardrails; and
- (2) situations involving the use of a boom-supported elevating work platform or the use of a fork-mounted elevating work platform intended to support a worker. These situations leave no choice as to the means of fall protection, and the rescue of a worker on the platform is generally straightforward—the platform can simply be lowered.

Figure 9.2 Sample fall protection plan

FALL PROTECTION PLAN		
Company / Work Site Name:		
Address / Location:		
FALL HAZARDS Identify all existing & potential fall hazards associated with the work site		
FALL PROTECTION SYSTEMS TO BE USED Identify the fall protection systems to be used at the work site to protect workers from the fall hazard (i.e. travel restraint, personal fall arrest system, safety net, control zone, etc)		
ANCHORS TO BE USED DURING THE WORK Identify the anchors, both engineered and improvised, that workers are to use		
CLEARANCE DISTANCE(S) TO BE CONFIRMED Clearance distances must be sufficient to prevent a worker from striking the ground, an object, or level below the area		
PROCEDURES Identify detailed procedures to assemble, inspect, use, maintain & dismantle the fall protection system identified above		
RESCUE PLAN Describe the procedures that will be followed if a worker falls and needs to be rescued		
This fall protection plan was developed by:		
Name:	Signature:	Date:

Workers sign the second page of this form to acknowledge that they have reviewed and understand this fall protection plan.

Page 1 of 2

Rescue after a fall

The *OHS Code* requires written rescue procedures. After an arrested fall, the fallen worker remains suspended in mid-air from his or her full body harness, awaiting rescue. In most cases, the worker is not injured and can alter body position within the harness to be more comfortable.

Unfortunately, a worker suspended in a near upright position with the legs dangling in a harness of any type is subject to what has come to be known as “suspension trauma.” This is one of the reasons that the fall protection plan must include rescue procedures.

Suspension trauma death is caused by orthostatic incompetence. A soldier standing almost motionless at attention for a long period of time and then fainting is an example of the problem. What happens with orthostatic incompetence is that the circulation of blood is reduced because the legs are immobile and the worker is in an upright position.

Gravity pulls the blood into the lower legs, which have a very large storage capacity. Enough blood eventually pools in the legs that return blood flow to the right side of the heart is reduced. This causes blood supply problems for both the heart and the brain. Normally the person faints at this point and falls to the ground. Now that the person is horizontal, blood from the legs flows back to the heart and on to the rest of the body.

While suspended in a harness however, the worker cannot fall into a horizontal position. The worker’s problem is that he or she is being held vertical while motionless. Fall victims can slow the onset of suspension trauma by pushing down forcefully with the legs, by positioning their body in a horizontal or slightly leg-high position, or by standing up. However, the design of the harness, the attachment points used, and the presence of fall injuries may prevent these actions.

The suspended worker faces several problems:

- (1) the worker is suspended in a near upright posture with legs dangling;
- (2) the safety harness straps exert pressure on leg veins, compressing them and reducing blood flow back to the heart; and
- (3) the harness keeps the worker in a near upright position, regardless of consciousness.

Rescue must happen quickly to minimize the dangers of suspension trauma. According to information summarized in the July 2008 issue of the *Journal of Occupational and Environmental Medicine*, suspension trauma begins within 3.5 to 10 minutes in most subjects, with a few very fit subjects developing symptoms after 30 minutes. This time increases significantly if the suspended person can move their legs against resistance during suspension.

Symptoms have been described as starting with a feeling of general physical discomfort, then intense sweating, nausea, dizziness, and hot flashes. Symptoms progress to difficulty breathing, increasing heart rate, and progressively worsening heart function.

Eventually the person loses consciousness. A person who is motionless and suspended in a harness is considered to be a medical emergency.

If a worker is suspended long enough to lose consciousness, rescue personnel must be careful in handling such a person or the rescued worker may die anyway. This post-rescue death is apparently caused by the heart's inability to tolerate the abrupt increase in blood flow to the right side of the heart after removal from the harness. Current recommended procedures are to take from 30 to 40 minutes to move the victim from kneeling to a sitting to a laying down position. A physician should examine the rescued victim. Among other things, the reduction in blood flow while suspended can affect the kidneys and lead to permanent damage. For more information about suspension trauma, readers are referred to the sources listed below.

A motionless, suspended victim suggests serious injury and a rescue must be performed quickly. A non-breathing, motionless victim must be ventilated within four minutes of when they stop breathing in order to prevent irreversible brain damage.

For more information



Harness suspension: Review and evaluation of existing information (A very comprehensive review of the topic, prepared for the Health and Safety Executive, United Kingdom)



Will your safety harness kill you? Electronic Library of Construction Occupational Safety and Health (eLCOSH.org)



Workers at Height are Required to Use Fall Prevention Systems. What are the Health Risks From Being Suspended in a Harness? Schwerha JJ, Journal of Occupational and Environmental Medicine. Vol. 50(7), July 2008.

Commentary on the use of 911 for rescue

In the case of rescues involving workers in confined spaces and workers suspended in the air after a fall, calling 911 alone and awaiting the arrival of rescue services personnel is considered to be an insufficient emergency response. The employer must have some basic level of on-site rescue capability—see section 55 for confined spaces—in the event that rescue services personnel are delayed or unable to attend the scene.

In some situations, rescue services personnel may not have the equipment or skills to perform a rescue, e.g., a worker in a confined space deep below ground level in a horizontal tunnelling operation or a worker suspended 100 metres above ground level following the failure of a swingstage scaffold. In such cases the employer's on-site rescue capability must be such that the work site is virtually self-sufficient in returning a rescued worker to safe ground.

While calling 911 may be part of a rescue response, Workplace Health and Safety expects an employer to have some means of basic rescue capability at the work site. Basic means of rescue may include

- (a) having access to a manlift or scissor lift at the work site that is capable of reaching a suspended worker. Someone must be able to competently operate the equipment;
- (b) having ladders on site that are capable of reaching a suspended worker;
- (c) equipping workers with leg loop extensions for their full body harnesses, i.e., suspension relief straps. These attach to the full body harness, providing foot loops into which a suspended worker can place his or her feet and then raise the legs. Doing so allows blood pooling in the legs to circulate. Using the foot loops may help the worker to remain comfortable until he or she returns to safe ground;
- (d) from above the fallen worker's suspended position, having a worker lower a loop of rope into which the worker can place his or her feet and then stand up. As in (c), the goal is to make the worker more comfortable by relieving the pressure of the harness straps on the legs and offering the legs something to push against to pump pooled blood back into circulation. Using the loop may help the worker to remain comfortable until he or she returns to safe ground. It may also allow the worker to connect to a descent system followed by disconnection from the fall arrest system;
- (e) using Type 3 self retracting devices that include an integral hand winch that allows the suspended worker to be raised upwards or lowered to safe ground. Use of this device does not require the suspended worker to be conscious; and
- (f) equipping workers in certain situations with self rescue devices such as specialized descenders that allow the suspended worker to remove themselves from their lanyard and descend to safe ground using one of these devices.

If a work platform or personnel basket is suspended from a crane or hoist, a fall protection plan must be in place for the rescue of the occupant(s) in the event that the crane or hoist is unable to lower the work platform or personnel basket.

Section 141 Instruction of workers

Workers must be trained in the safe use of fall protection equipment and the procedures they must follow to ensure their personal safety while using this equipment. This training must include the procedures to assemble, maintain, inspect, use and disassemble the fall protection system or systems in use (see section 15 of the *OHS Regulation*). Workers expected to rescue a worker who has fallen and is suspended by a fall arrest system must be trained in rescue procedures.

Section 142 Full body harness

Full body harnesses are the only type of harness allowed in personal fall arrest systems. Full body harnesses have four main functions:

- (1) to securely hold the worker's body during free fall, deceleration and final arrest;

- (2) to distribute arrest forces to those parts of the body able to absorb the forces without significant injury. Full body harnesses with straps that pass across the buttocks are particularly good at doing this;
- (3) to keep the body in an upright or near upright position after the fall and until the worker is rescued; and
- (4) to allow workers to do their work without restricting their movement.

Chest harnesses without leg straps, and sit harnesses having only leg and waist straps (no shoulder straps) are not permitted for fall arrest. Sit harnesses commonly used in mountaineering are unacceptable. Only full body harnesses approved to one of the listed standards are acceptable.

For compliance purposes, the full body harness must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the harness has been approved to the requirements of the Standard. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

The 2009 edition of the *OHS Code* marked the first time that Part 9 accepted fall protection equipment approved to standards from the U.S. and Europe. Fall protection equipment approved to any one of these standards is considered to offer an equivalent level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs. Readers are referred to section 3.1 for information about previous editions of the standards.

Section 142.1 Body belt

Body belts have their use restricted to travel restraint and fall restrict systems. The use of body belts in a fall arrest system is prohibited due to the possibility of death or injury resulting from a worker falling out of the belt or abdominal injuries.

Travel restraint systems prevent workers from reaching an edge or work location from which they could fall. Travel restraint systems have no fall arresting capabilities. Fall restrict systems offer limited fall arrest in combination with a work positioning system.

For compliance purposes, the body belt must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the body belt has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

The 2009 edition of the *OHS Code* marked the first time that Part 9 accepted fall protection equipment approved to standards from the U.S. and Europe. Fall protection

equipment approved to any one of these standards is considered to offer an equivalent level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs. Readers are referred to section 3.1 for information about previous editions of the standards.

Section 142.2 Lanyards

For compliance purposes, lanyards must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the lanyard has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

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Whenever possible, a lanyard used for fall arrest should be equipped with a shock absorber. The shock absorber helps to limit fall arrest forces so that they do not exceed the injury threshold of the human body. The only fall arrest system in which a shock absorber or shock absorbing lanyard is not desired is one in which the added fall distance (1.1 metres [3.5 feet] for North American shock absorbers, 1.75 metres [5.75 feet] for European shock absorbers) created by the shock absorber fully extending creates a greater risk of injury than if the shock absorber were not used. A shock absorber should not be used where this added distance could result in worker injury.

A lanyard incorporating a shock absorber may be used for travel restraint as it takes considerable force, e.g., approximately 600 lbs, before the shock absorber's stitching begins to release.

A lanyard incorporating a shock absorber may ~~not~~ be used for travel restraint as it takes considerable force, e.g., approximately 600 lbs, before the shock absorber's stitching begins to release.

A wire-rope lanyard should be used in any situation that involves welding, cutting with a torch or other similar operations. Synthetic fibre lanyards can be cut, burned, melted or otherwise damaged during such operations. In the event that a worker works near an energized conductor or in circumstances where a lanyard made of conductive material cannot be used, the worker must use another effective means of fall protection. See Figure 9.3 for examples of lanyards.

Figure 9.3 Examples of lanyards



Nylon rope lanyard



Synthetic web lanyard



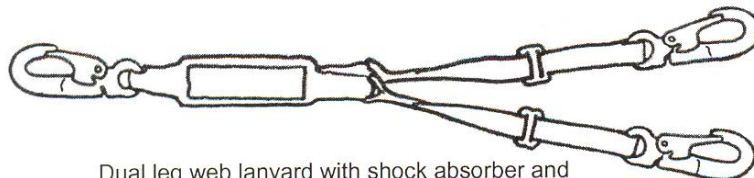
Wire rope lanyard



Adjustable length web lanyard with shock absorber



Fixed length web lanyard with shock absorber



Dual leg web lanyard with shock absorber and adjustable legs



Web lanyard with shock absorber



Shock absorbing lanyard

The lanyard length must be as short as possible for the work involved, yet allow reasonable maneuverability and working convenience. When in use, all lanyards, whatever their length, must not allow a worker to drop more than the free fall distance specified in section 151.

Lanyards must not be “daisy-chained” to extend the distance that a worker can move. The fall arrest system must be repositioned to extend or alter worker movement. Daisy-

chaining is unacceptable because it can greatly increase a worker's fall distance, resulting in arrest forces capable of injuring the worker or allowing the worker to contact a lower level.

Section 142.3 Shock absorbers

Subsection 142.3(1)

The newest edition of CSA Standard Z259.11-05, *Energy absorbers and lanyards*, creates two categories of shock absorber (re-named as energy absorber by CSA), known as E4 and E6. An E4 shock absorber is equivalent to the type of shock absorber that has been in use for many years, i.e., it limits the arresting force to 4 kN under normal conditions and allows the arresting force to increase to 6 kN if the shock absorber is wet and frozen.

An E6 shock absorber limits the arresting force to 6 kN under normal circumstances, allowing it to increase to 8 kN when the shock absorber is wet and frozen. CSA created the two ratings to better protect workers of different body weights. The E4 shock absorber is intended for use by workers weighing 45–115 kg (100–254 lbs) while the E6 shock absorber is intended for use by workers weighing 90–175 kg (200–386 lbs).

In the case of a heavy worker, an E4 shock absorber may be unable to absorb all the energy of a big fall, causing the worker to “bottom out” and be jolted with the residual energy. Heavier workers should be using an E6 shock absorber. In the case of a heavy worker who takes a long free fall, perhaps because the only anchor location was at the worker's feet, a European shock absorber may be a better choice. Because of its 1.75-metre (5.75-foot) elongation, it should be able to absorb all the energy of the fall.

For compliance purposes, the shock absorber must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the shock absorber has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

The 2009 edition of the *OHS Code* marked the first time that Part 9 accepted fall protection equipment approved to standards from the U.S. and Europe. Fall protection equipment approved to any one of these standards is considered to offer an equivalent level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs. Readers are referred to section 3.1 for information about previous editions of the standards.

Subsections 142.3(2) and 142.3(3)

Situations may arise in which a personal fall arrest system must be used without a shock absorber. The most common circumstance encountered is a lack of adequate clearance

distance. All else being equal, eliminating a shock absorber reduces the required clearance distance by 1.1 metres (3.5 feet) to 1.75 metres (5.7 feet) depending on the type of shock absorber used (see Figure 9.14).

If the shock absorber is removed from the personal fall protection system, then the worker's free fall distance is limited to 1.2 metres. Even with this fixed distance, employers and workers need to be aware that, depending on the type of lanyard selected, the maximum arresting force of 6 kN stated in subsection 151(3) can be exceeded.

It is crucial that the employer carefully select the type of lanyard used in such situations and determine the maximum arresting force so that workers are not endangered.

Subsection 142.3(4)

No explanation required.

Section 143 Connectors, carabiners and snap hooks

Carabiners, D-rings, O-rings, oval rings, self-locking connectors and snap hooks used to interconnect the components of a personal fall arrest system are subjected to the full maximum arresting force developed during a fall. The failure of any portion of this connecting hardware can lead to the failure of the entire fall arrest system. Carabiner users must remember that the forces stamped on the body of a carabiner represent the ultimate strength of the product, not the working load or safe working load. See Figure 9.4 for examples of carabiners.

Figure 9.4 Examples of carabiners



For compliance purposes, carabiners, D-rings, O-rings, oval rings, self-locking connectors and snap hooks must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the connector has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with one or both of the listed CEN European standards.

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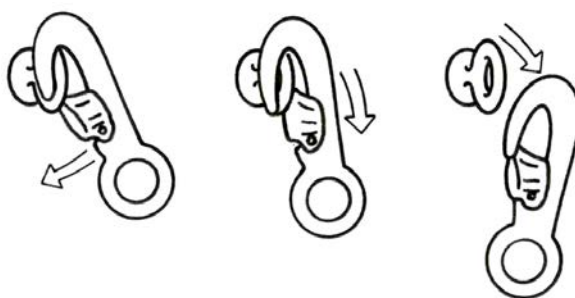
equipment approved to any one of these standards is considered to offer an equivalent level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs. Readers are referred to section 3.1 for information about previous editions of the standards.

Carabiners and snap hooks used as interconnecting hardware in fall arrest systems must be self-closing and self-locking. This prevents unintended detachment of fall protection system components resulting from a worker forgetting to close or lock a carabiner or snap hook. For these connecting components to be acceptable for use, their gates require at least two consecutive, deliberate actions to open.

Snap hooks and carabiners that are not self-closing or self-locking cannot be used as connecting hardware in fall protection systems and must be removed from use and storage. Such components can be used in other applications that do not involve fall protection. These other applications should not allow the connectors to mistakenly make their way back into use as fall protection components. Screw gate carabiners that rely on the user to twist a collar across the gate opening cannot be used in personal fall arrest systems.

The other reason for having this self-closing, self-locking requirement is to prevent “roll-out” (see Figure 9.5). When a force is applied on the top of a non-locking gate, the gate opens, releasing the mating hardware. The most typical roll-outs have been known to occur between snap hooks and D-rings. Although no manufacturer in North America or Europe uses non-locking snap hooks anymore, thousands of them may still be in service. Employers must remove this equipment from use and storage if it is used or could be used for fall protection.

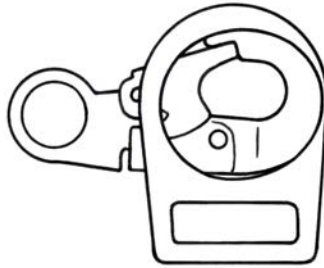
Figure 9.5 Example of accidental roll-out of a snap hook



False connection

Connecting components can create a serious hazard when they engage improperly or incompletely. Such a hazard is possible when the internal dimensions of the D-ring of the full body harness or body belt are very close to the external dimensions of the snap hook being connected to it (see Figure 9. 6).

Figure 9. 6 Example of improper or incomplete connection

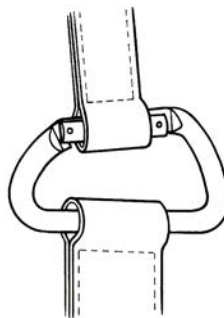


A false connection relies on a friction fit between the two closely dimensioned components. The worker thinks that the components are properly connected while in fact the snap hook only sits inside the D-ring. This improper or incomplete connection—unseen by the worker if it involves the D-ring on the worker’s back—is unsafe and likely to come apart during the arrest of a fall or sudden jerk on a travel restraint system.

Gate cross-loading

Snap hooks and carabiners are designed to handle maximum loads in line with their long axes. However, because of their shape or circumstances of use, e.g., loops of webbing or rope coming to rest across the gate and then being placed under tension, snap hooks and carabiners can be subjected to gate cross-loading, resulting in much lower breaking strengths (see Figure 9.7). Connections between hardware components must be made carefully when using snap hooks and especially carabiners.

Figure 9.7 Example of cross-loading a carabiner gate



Compatibility of materials

Workers need to be aware that aluminum carabiners and snap hooks should not be connected directly to wire rope and slid along the rope’s length. Being softer than steel, aluminum wears and the carabiner or snap hook loses some of its strength. Steel carabiners or snap hooks should be used in such cases. Manufacturers of horizontal lifelines commonly provide special steel rings or rollers into which a safe, non-wearing connection can be made.

Section 144 Fall arresters

Fall arresters, commonly referred to as rope grabs or cable grabs, are used when workers need to move vertically, normally over substantial distances (see Figure 9.8). Typical users include window washers suspended from swingstages and in growing numbers, workers climbing tall ladders (see Figure 9.9). A fall arrester travels along a life safety rope or rail, following the worker's movements. The friction created between the device and the life safety rope or rail during a fall arrests the fall. A sliding hitch knot or other system incorporating a knot is not a fall arrester.

It is important to recognize that no fall arrester can safely be used on every life safety rope. For this reason, fall arresters must only be used on compatible ropes as described in the manufacturer's instructions. In general, there are two classes of fall arrester.

- (1) **Manual Fall Arresters** are the simplest type. They are well suited to positioning systems on sloped roofs or travel restraint and may also be used for fall arrest systems. In positioning systems on sloped surfaces, the worker's weight may be supported some of the time. In travel restraint, the worker needs to correctly position the device on the life safety rope so that it is impossible to reach an unprotected edge.

Manual fall arresters must be continually manually repositioned on the life safety rope as the worker moves. There is a danger that if a worker falls while manipulating the device, the worker may panic and squeeze the device—"Panic Grab"—holding it open and preventing it from locking onto the rope. To protect against "Panic Grab," it is recommended that manual fall arresters be selected that have integral panic hardware that prevents this from happening.

Workers should be reminded to reposition their fall arrester frequently to eliminate unnecessary slack which increases fall distance, clearance requirements, and impact forces.

- (2) **Automatic Fall Arresters** trail up and down the life safety rope as workers move vertically providing "automatic" protection. Workers do not need to manipulate these devices while moving up and down, so there is a reduced danger that the worker will "Panic Grab" the device.

The disadvantage of automatic fall arresters is that the free fall distance is increased. The standards permit the lock-off distance of the device to be up to 1 metre in the case of the referenced CSA standard and 1.4 metres for the referenced ANSI standard. In addition, when automatically trailing the worker's movements, the device will sometimes be a lanyard length below the worker at the start of the fall, creating a free fall of twice the lanyard length plus the lock off distance of the device.

For compliance purposes, fall arresters must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the fall arrester has been approved to the requirements of the Standards. Products bearing a CE

mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

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Figure 9.8 Example of a fall arrester in use



Figure 9.9 Example of a fall arrester in use on a vertical structure



Section 145 Self-retracting device

CSA Standard Z259.2.2-98 (R2004), *Self-Retracting Devices for Personal Fall-Arrest Systems*, defines a self-retracting device (SRD) as a fall arrest device that performs a tethering function while allowing vertical movement (below the device) to the maximum working length of the device (see Figure 9.10). SRDs are designed to arrest a fall while minimizing fall distance and impact force. An SRD has a housing that is normally attached to the anchor of a fall arrest system. The housing contains a drum-wound lifeline.

The retracted end of the lifeline unwinds from the drum under the tension created by the worker's normal movement below the device. When tension is released, the drum automatically retracts the lifeline. Once the speed at which the lifeline pays out reaches approximately 1.5 metres per second (5 feet per second), a velocity-sensing device engages a brake or locking mechanism that arrests the worker's motion.

Only self-retracting devices approved to CSA Standard Z259.2.2-98 (R2004), *Self-Retracting Devices for Personal Fall-Arrest Systems*, are acceptable. This standard requires that Type 2 and Type 3 SRDs be inspected two years after being placed into service, and annually thereafter. Because of their critical importance to the safety of workers using them, and the mechanical workings inside the housing, these units need to be inspected regularly according to the manufacturer's specifications. Because it is the only standard known to require such follow-up maintenance, it is the only standard listed in this section. For compliance purposes, the self-retracting device must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that it meets the requirements of the Standard.

Figure 9.10 An example of a self-retracting device used in the vertical position



CSA classifies SRDs into three types as follows:

Type 1 Self-Retracting Device (SRD)

This is a compact and lightweight SRD having a working length of 1.5 to 3.0 metres. Early versions of these devices resembled an automotive seatbelt mechanism and have a web-type lifeline. The internal locking mechanism of a Type 1 SRL is not capable of absorbing significant amounts of energy since it does not operate as a dynamic brake. The resulting deceleration distance is very short and the maximum arresting force will therefore be greater than if a Type 2 or Type 3 SRD were used.

Because of this greater arresting force, a Type 1 SRD should be used with a separate shock absorber if it is not already equipped with an integral shock absorber.

Employers using these devices should carefully read the manufacturer's specifications to confirm the conditions under which these devices can be used, i.e., indoors versus outdoors, in dusty workplace settings. Many of these devices have markings that state that the peak impact force will be below 4 kN, but this is only tested by the manufacturer with the device overhead. Therefore, it is recommended that Type 1 SRDs only be used where the device is anchored above the worker. Like a standard lanyard, an SRD subjected to the force of a fall must be retired from service.

Type 2 Self-Retracting Device (SRD)

This is a heavier SRD, generally having a working length of more than 3 metres. It has an internal brake to minimize impact forces. The SRD must have a visual load indicator that allows the worker intending to use the SRD to determine if it has arrested a fall. Type 2 SRDs are repairable after a fall incident and are subject to a manufacturer's service schedule. This type of SRD is also sometimes referred to as a self-retracting lifeline.

Type 3 Self-Retracting Device with Retrieval Capability (RSRD)

This type of SRD performs the same fall arrest function as a Type 2 device and has a visual load indicator. However, a Type 3 device incorporates a rescue winch that permits a single rescuer to raise or lower the victim to a safe level. Type 3 devices have a working length of more than 3 metres. This type of SRD is also sometimes referred to as a self-retracting lifeline.

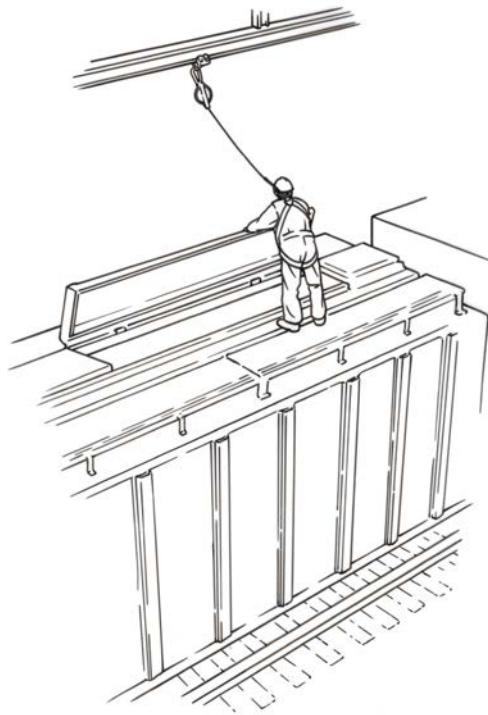
Test before using

Workers should field test the locking feature of an SRD before using it by pulling down on the line quickly and forcefully. The visual load indicator on a Type 2 SRL or Type 3 RSRL should also be inspected. If the device does not lock or the visual load indicator has been activated, the SRD should be removed from service and returned to the manufacturer for re-certification. Only the manufacturer is capable of disassembling, refurbishing and re-certifying an SRD.

Proper use

To minimize free fall distance when using an SRD, the device must be anchored above the worker's work location and there should be no slack in the lifeline (see Figure 9.11). The lifeline should not ride over any sharp edges. When under the tension of a fall, a lifeline in contact with the edge of an I-beam or hatchway opening can be damaged to the point of complete failure. The risk of damage and failure can be reduced by physically protecting the lifeline where it passes over an edge and using a shock absorber positioned between the worker's D-ring and the free end of the SRD.

Figure 9.11 Example of a self-retracting device in use



Self-retracting devices and travel restraint systems

Self-retracting devices must not be used in a travel restraint system unless the length of the lifeline on the drum of the unit prevents the worker from reaching the edge from which he or she could fall. If a worker approaches the edge and there is some lifeline still spooled on the drum, the worker could go past the edge and fall.

Section 146 Descent control device

Descent control devices are designed and intended to be used and operated by one person for personal descent or to lower another person from an elevation. A descent control device may be used for egress (exit), for work positioning, or both. Descent control devices can be either automatic or manual. Once engaged, an automatic descent

control device lowers the worker at a constant speed and the worker has no ability to stop or control the rate of descent. A manual descent control device gives the user control over the rate of descent and the ability to stop the descent.

For compliance purposes, descent control devices must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the descent control device has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

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Section 147 Life safety rope

Subsection 147(1) Standards

This edition of the *OHS Code* marks the introduction of the term “life safety rope” as an alternative to the more familiar terms “vertical lifeline” (still used in some sections within the *OHS Code*) or “fall protection rope.” The new term reinforces the importance of the rope as a component of a fall protection system on which workers rely for their safety and perhaps their lives. The term is widely used by persons involved in rope rescue and industrial rope access activities.

For compliance purposes, NFPA- and EN- compliant life safety ropes must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the life safety rope has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

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Ropes meeting the requirements of the CSA and ANSI standards are simply required to “meet the requirements of” these standards as these standards are not associated with certification programs. Manufacturers normally “declare” or “self-attest” that their products meet the requirements of the standards. CSA does certify life safety ropes under CSA’s fall arrester standard but only when supplied with a manufactured end termination and supplied with a fall arrester. Users are required to use the rope supplied with the fall arrester.

CEN Standard EN 1891

CEN Standard EN 1891: 1998, *Personal protective equipment for the prevention of falls from a height. Low stretch kernmantle rope*, applies to low stretch textile rope of kernmantle construction from 8.5 mm to 16 mm in diameter, for use by persons in rope access including all kinds of work positioning and restraint, for rescue and in caving. Low stretch kernmantle ropes are defined as Type A and Type B.

Kernmantle rope is a textile rope consisting of a core enclosed by a sheath. The core is usually the main load-bearing element and typically consists of parallel elements that have been drawn and turned together in single or multiple layers, or of braided elements. The sheath is braided or woven and protects the core from, for example, external abrasion and degradation by ultraviolet light.

Type A rope is designed for general use by persons in rope access including all kinds of work positioning and restraint, rescue and caving. Type B rope is of a lower performance than Type A rope, requiring greater care in use.

Type A rope has the following performance characteristics:

- (a) elongation (stretch) must not exceed 5 percent under test conditions;
- (b) static strength without terminations—at least 22 kN;
- (c) static strength when terminated with a knot or other method—at least 15 kN; and
- (d) fall arrest peak force must not exceed 6 kN under the test conditions.

NFPA Standard 1983

Chapter 5 of NFPA Standard 1983: 2006, *Standard on Life Safety Rope and Equipment for Emergency Services*, presents requirements for life safety rope. The rope must have the following performance characteristics:

- (a) elongation must be at least 1 percent but not more than 10 percent at 10 percent of minimum breaking strength;
- (b) the breaking strength of light use rope must be at least 4500 lbs (20 kN);
- (c) the breaking strength of general use rope must be at least 9000 lbs (40 kN);
- (d) light use rope must have a diameter of not less than 3/8 in. (9.5 mm) and not more than 1/2 in. (13 mm);
- (e) general use rope must have a diameter of not less than 1/2 in. (13 mm) and not more than 5/8 in. (16 mm); and
- (f) fibre used in rope must have a melting point of not less than 4000° F (2040° C).

CSA Standard Z259.2.1 and ANSI Standard Z359.1

Life safety rope meeting the minimum requirements of these standards is allowed to stretch up to 22 percent when loaded to a force of 8 kN and have a minimum breaking strength of 27 kN.

Subsection 147(2) Safe use of life safety ropes

1.2-metre distance

The purpose of the 1.2-metre distance is to ensure that a worker on a suspended work platform, such as a boatswain's chair or swingstage scaffold, can be secured to a life safety rope through the full range of travel of the work platform.

In some circumstances it is not practicable or safe for the life safety rope to extend to within 1.2 metres of the lower landing spot. For example, if a work platform is rigged over an underground parking entrance and the lower end of the life safety rope came to within 1.2 metres of the roadway, there would be a danger of the rope being caught by a vehicle unless access was blocked. Blocking access may not be practicable in which case the life safety rope must be terminated at a safe distance above the danger area. The work platform must also be rigged to prevent it being lowered below a level at which the fall protection equipment becomes ineffective and traffic is a danger to the work platform.

Knots and splices

Life safety ropes must be free of knots or splices along their travel portion so that rope strength is not reduced and fall arresting devices such as fall arresters, i.e., rope grabs, can move freely. This requirement is not intended to prohibit the use of a knot at the upper end of the rope where the rope is secured to an anchor either directly or via a connecting device such as a carabiner. Ropes with a manufactured termination eliminate the need for workers to know how to tie a secure anchor knot, reducing the chances of the rope separating for the anchor. The stopper knot at the life safety rope's lower termination serves to prevent the fall arrester from sliding off the rope.

Abrasion protection and hazard selection

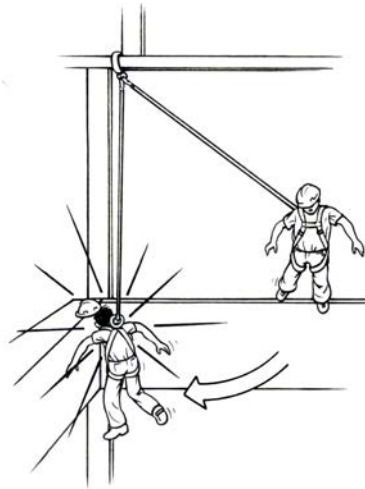
When under the tension of a fall, a life safety rope in contact with the edge of an I-beam or hatchway opening can be damaged to the point of complete failure. The risk of damage and failure can be reduced by physically protecting the life safety rope where it passes over a sharp or rough edge. The risk of damage can be altogether eliminated if the life safety rope can be repositioned away from contact with any sharp or rough edges.

Tools, chemicals and work processes such as welding can sever, abrade, melt, burn or otherwise damage a typical life safety rope. Where such hazards are present, life safety ropes made of wire rope or other material appropriate to the hazard must be used.

Swing fall hazard

Anchor selection and routing of lifelines over and around structures must take into consideration swing fall hazards. Ideally, work should be performed directly below the anchor. The further away a worker is from this ideal position, the greater the potential for the worker to swing as a pendulum into objects if a worker falls (see Figure 9.12).

Figure 9.12 Example of worker falling and swinging like a pendulum into a fixed structure



In situations where swinging cannot be avoided, but where several equally good anchor locations are available, the anchor selected should direct the swing fall away from objects rather than into them. Where there is a choice among anchors, the one offering the least amount of swing should be selected.

Subsection 147(4) One worker per life safety rope

Unless designed for simultaneous use by multiple workers or as part of an engineered fall arrest system on a fixed ladder, only one worker can be attached to a life safety rope at any one time.

Swing drop distance

Subsection 147(2)(e) now includes a 1.2 m (4 ft) swing drop distance based on a requirement appearing in CSA Standard Z259.16. The limitation tries to reduce the potential for injury in a swing fall by limiting how far a worker will drop during the swing. The velocity of a worker that swings into a structure is determined by the height dropped from the start of the swing to the point of contact. Since the worker has the greatest degree of control over the swing fall hazard, this requirement applies to the worker.

Section 148 Adjustable lanyard for work positioning

Once a worker moves to a preferred work location at height, an adjustable lanyard for work positioning is used to secure the worker to a structure to maintain a stable work position. Work positioning lanyards are usually made of rope and are designed to limit movement or to allow hands-free work while in position. Work positioning lanyards may be fixed length or adjustable, and have connecting components at both ends to allow for connection to the side D-rings of a worker's full body harness. Adjustable work positioning lanyards allow a worker to cinch up or adjust the lanyard to optimize the worker's position.

For compliance purposes, adjustable lanyards for work positioning must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the adjustable lanyard has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

The 2009 edition of the *OHS Code* marked the first time that Part 9 accepted fall protection equipment approved to standards from the U.S. and Europe. Fall protection equipment approved to any one of these standards is considered to offer an equivalent level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs. Readers are referred to section 3.1 for information about previous editions of the standards.

Section 148.1 Rope adjustment device for work positioning

To get to a preferred work location at height, a worker may use a rope adjustment device, i.e., a type of descent control device, approved to one of the listed standards. Attached to a life safety rope, the rope adjustment device uses friction within the device to control and alter the worker's position.

For compliance purposes, rope adjustment devices for work positioning must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the rope adjustment device has been approved to the requirements of the Standards. Products bearing a CE mark also comply with this section. The CE mark—Conformité Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. The product also complies with the listed CEN European standard.

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level of worker protection. Employers and workers in Alberta now have access to a broader range of equipment to safely meet their fall protection needs. Readers are referred to section 3.1 for information about previous editions of the standards.

Section 149 Wood pole climbing

CSA Standard Z259.14-01, *Fall Restrict Equipment for Wood Pole Climbing*, specifies the requirements for testing the performance and strength of fall restrict equipment for wood pole climbing. This equipment is for use by a single worker exposed to the hazard of falling when ascending or descending, moving around and working on or from a wood pole. Fall restrict equipment is most commonly used by linepersons in the electrical/utility, telecommunications, and construction sectors.

The main parts of a fall restrict system are a modified pole strap, rigid but articulated frame, and connecting hardware (see Figure 9.13). The fall restrict system allows a worker to remain at his or her work position with both hands free. The system performs a limited fall arrest function when the worker loses contact between his or her spurs and the pole. According to the CSA Standard, a Type A system cannot be used on icy poles; a Type AB system can be used on icy poles.

Figure 9.13 An example of fall restrict equipment used when working on or from a wood pole



Only fall restrict equipment approved to CSA Standard Z259.14-01, *Fall Restrict Equipment for Wood Pole Climbing*, is acceptable. For compliance purposes, the equipment must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the equipment meets the requirements of the Standard. Fall restrict equipment in use before April 30, 2004 does not need to be approved to this standard.

CSA Standard Z259.3-M1978 (R2003), *Lineman's Body Belt and Lineman's Safety Strap*, specifies the minimum strength and safety requirements, sizes, markings, and packaging for body belts and safety straps. The equipment is intended for use by workers in the power and communication utilities.

Only lineman's body belts approved to CSA Standard Z259.3-M1978 (R2003), *Lineman's Body Belt and Lineman's Safety Strap*, are acceptable. For compliance purposes, the body belt must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the equipment meets the requirements of the Standard. This requirement for approval to the Standard does not apply to lineman's body belts in use before April 30, 2004.

Although it may be common practice to wear a lineman's body belt as part of a fall restrict system, a full body harness does a better job of distributing fall arrest forces to a greater portion of the worker's body. Because of this better distribution of forces, many linemen already use full body harnesses for other work-related activities.

This section allows the use of either a full body harness or lineman's body belt while using fall restrict equipment. This recognizes that industry is in the process of making the transition to full body harnesses. Industry is encouraged to continue with this transition and eventually replace all lineman's body belts with full body harnesses.

Section 150 Equipment compatibility

Compatible system components can be safely interconnected, e.g., carabiners and harness D-rings, ropes and ascenders, etc., without compromising equipment function or worker safety. It is also important that components be compatible with the environment in which they are being used, i.e., high heat, corrosive, exposed to welding spatter, etc.

Section 150.1 Inspection and maintenance

It is essential that all load-bearing equipment is inspected before each use to ensure it is in safe condition and operates correctly. The manufacturer's specifications should be consulted to determine the equipment's inspection and maintenance requirements.

Section 150.2 Removal from service

It is important that there is a procedure in place for ensuring that defective or suspect equipment withdrawn from service does not get back into service without inspection and approval by a professional engineer or the manufacturer. Any equipment considered to be defective should be cut up or broken before being disposed of. This ensures that the defective equipment cannot be retrieved and used again.

Section 150.3 Prusik and similar knots

A Prusik sling, using a properly tied prusik knot, creates a sliding hitch knot that can be used in place of a fall arrester. Many other sliding hitch knots can also be made. Because its construction, effectiveness and safe use are so dependent on the user's knowledge and experience, the knots' use is restricted to competent rescue or emergency services personnel, or in an emergency situation to a worker trained in its use and limitations. With the exception of workers involved in tree care operations (see Part 39) and workers involved in work requiring rope access (see Part 41), the use of prusik or similar hitches is prohibited under normal working conditions. A fall arrester meeting the requirements of section 144 must be used.

Section 151 Clearance, maximum arresting force and swing

Subsection 151(1) Clearance distance

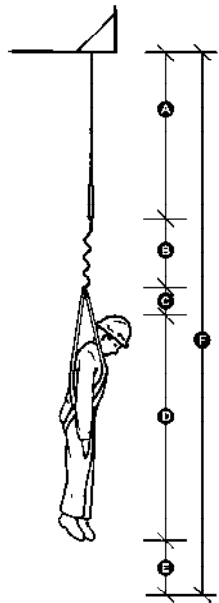
To ensure the safety of a fallen worker, two conditions must be met. The first condition is that the worker's personal fall arrest system is arranged so that the worker cannot hit the ground, an object which poses an unusual possibility of injury, or a level below the work area. The second condition is there must be sufficient clearance distance including a safety factor. Figure 9.14 shows that using a 1.8 metres long (6 feet) lanyard, a worker needs approximately 5.7 metres (18.5 feet) to 6.8 metres (22.1 feet) of clear space below the level of the anchor point.

Clearance distance using a vertical life safety rope

The most important consideration when using vertical life safety ropes to arrest falls is knowing how much clearance is required. In general, vertical life safety ropes require more clearance than self-retracting devices and should therefore only be used when large clearances are available.

The lock-off distance of the fall arrester, lanyard length, stretch of the vertical life safety rope, swing drop, deployment of the shock absorber and the type of harness that the worker is wearing all contribute to the required clearance distance. The following example illustrates how to calculate the required clearance distance below the working platform in accordance with the methods described in CSA Standard Z259.16-04, *Design of Active Fall-Protection Systems*.

Figure 9.14 Clearance distance



Assumptions:

The worker is 1.8 m (6 ft.) tall using a 1.8 m (6 ft.) long lanyard. The combined weight of the worker, clothing, and tool belt is at least 100 kg (220 lbs).

A Length of lanyard—1.8 m (6 ft.)

B Shock absorber pulling apart:
1.1 m (3.6 ft.) CSA E4 or ANSI-compliant shock absorber;
1.75 m (5.7 ft.) CSA E6 or European EN-compliant shock absorber;

C Harness stretch plus D-ring sliding—0.3 m (1 ft.) for normal harness, 0.75 m (2.5 ft.) for stretch webbing harness

D Height of worker—1.8 m (6 ft.)

E Safety factor—clearance below feet of 0.9 m (3 ft.)

F $A+B+C+D+E$

Minimum clearance distance varies between 5.7 m (18.5 ft.) and 6.8 m (22.1 ft.) depending on the components used in the system.

Clearance distance example

A worker uses a Class E4 energy absorbing lanyard that is 1.8 metres long and can deploy up to 1.07 metres at a force of 4 kN. The lanyard connects the dorsal D-ring on the worker's harness to an automatic fall arrester that is known to lock onto the vertical lifeline within 0.3 metres. The automatic fall arrester will initially hang the lanyard length (1.8 metres) below the D-ring on the harness. The rigid anchorage of the vertical lifeline is 29.7 metres above the location of the fall arrester at the onset of the fall. The lifeline is known to stretch 22 percent at 8 kN and 15 percent at 4 kN. The worker is 8.4 metres laterally from the anchor and therefore subject to a swing drop distance of 1.2 metres. The worker is wearing a "comfort" harness that will stretch 0.75 metres at peak fall arrest forces, and may fall from a kneeling position.

The length of lifeline above the fall arrester after it has locked onto the lifeline =
29.7 metres + 0.3 metre lock-off distance for the fall arrester = 30 metres

Clearance calculation:

Free fall = 2 x lanyard length + lock off of the fall arrester = 2 x 1.8 m + 0.3 m	3.90 m
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Stretch of the vertical life safety rope = 15% of the rope length = 15% of 30 m	4.50 m
--	--------

Maximum deployment of the shock absorber	1.07 m
--	--------

Swing Drop	1.20 m
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Stretch of the harness	0.75 m
------------------------	--------

Stretch-out of the worker (falling from a kneeling position)	0.75 m
--	--------

Mandatory Safety Buffer	0.60 m
-------------------------	--------

Total Required Clearance below the working platform	12.77 m
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While the above example is an extreme case, it illustrates how choices of equipment and equipment configuration affect the required clearance distance. It also provides a template for calculating clearances for other configurations and choices of equipment.

Strategies for reducing the required clearance distance include using short lanyards, low stretch life safety rope and conventional harnesses (0.3-metre stretch). Workers can also be trained to manually "park" the fall arrester as high up the rope as possible once they get to their working position. This will help reduce their free fall distance in the event of a fall.

The above methodology will show that approximately 3.0 metres is the minimum achievable clearance when falling from a standing position while using an automatic fall arrester with a 0.3-metre shock absorbing lanyard, even if the vertical life safety rope has negligible stretch and there is no potential for swing falls.

Note that the above calculation assumes full (1.07-metre) deployment of the shock absorber, which is the worst case scenario.

Subsection 151(2)

Situations may arise in which a personal fall arrest system must be used without a shock absorber. The most common circumstances encountered is a lack of adequate clearance distance. All else being equal, eliminating a shock absorber reduces the required clearance distance by up to 1.1 metres (3.5 feet) (see Figure 9.14).

If the shock absorber is removed from the personal fall protection system, then the worker's free fall distance must be limited to 1.2 metres. Even with this fixed distance, employers and workers need to be aware that, depending on the type of lanyard selected, the maximum arresting force of 6 kN stated in subsection 151(3) can be exceeded. To determine the arresting force, the following equation should be used:

$$F = mg \left(1 + \sqrt{1 + \frac{2AE}{mg} \frac{h_{ff}}{ly}} \right)$$

A = cross sectional area of lanyard (in²)

E = rope modulus of elasticity of lanyard, or lifeline (lb/in²)

F = maximum arrest force, MAF (lb)

$f = \frac{h_{ff}}{ly}$, fall factor, the distance the worker falls relative to the lanyard length, $0.1 \leq f \leq 2$

h_{ff} = free fall distance (ft). Defined as the distance from the point where the worker would begin to fall to the point where the fall arrest system would begin to cause deceleration of the fall

ly = lanyard length or active length of lanyard (ft)

mg = weight of worker (lbs)

It is crucial that the employer carefully select the type of lanyard used in such situations and determine the maximum arresting force so that workers are not endangered.

Subsection 151(3) Maximum arresting force

Maximum arresting force is the short-duration (milliseconds to tenths of a second), peak dynamic force acting on a worker's body as the worker's fall is arrested. The maximum arresting force to which a worker can be exposed during fall arrest in Alberta is limited to 6 kN (1350 lbs).

Research studies have shown that the short duration forces that happen during fall arrest are unlikely to cause injury if they act vertically upwards through the buttocks and spine and are limited to no more than 9 kN (2000 lbs). The 6 kN limit is therefore

considered safe, but as was discovered during the studies, is subject to the following conditions:

- (a) the maximum arresting force is applied upwards through the pelvic area;
- (b) the worker's physical condition is sufficient to withstand such a jolt; and
- (c) the duration of the maximum arresting force is limited to a fraction of a second.

A fall arrest system that correctly uses a shock absorber will limit the maximum arresting force under normal circumstances to either 4 kN (900 lbs) or 6 kN (1350 lbs), providing a margin of safety.

Maximum arresting force is determined by the worker's weight, the length of the lanyard, and the ability of the fall arrest system to absorb the energy of the fall. The anchor should be above the work position, the length of the lanyard kept as short as possible (while still permitting the work to be performed safely) and the fall arrest system should almost always include a shock absorber. Readers are referred to the explanation for subsection 151(2) to see the equation often used to calculate the arresting force.

This edition of the *OHS Code* accepts a maximum arresting force (MAF) of 6 kN under normal circumstances because

- (a) the 6 kN MAF value has been successfully used in Europe and other jurisdictions for many years. The 8 kN value previously cited in the *OHS Code* appears to have been a North American phenomenon;
- (b) the lower MAF is technically achievable with today's fall protection equipment; and
- (c) the lower MAF means that workers are exposed to a lower arresting force, reducing the potential for injury.

Subsection 151(3) incorporates this change but includes a condition that reflects the fact that under worst case conditions (a wet and then frozen shock absorber), the MAF can be as great as 8 kN for a type E6 shock absorber. Readers are referred to section 142.3 for a discussion of E4 and E6 shock absorbers.

Subsections 151(4), 151(5) and 151(6)

As required by subsections 151(4) and 151(5), a worker must use the shortest length lanyard that still allows the worker to perform his or her work safely and the lanyard must be attached to an anchor no lower than the worker's shoulder height unless an anchor at shoulder height is not available. When an anchor at shoulder height is not available, the lanyard must be secured to an anchor point as high as reasonably practicable.

Tying to an anchor at foot level is dangerous. A shock absorber approved to the CSA Standard for shock absorbers will safely absorb energy based on a 2-metre fall of a 100-kilogram worker. But tying a 1.8-metre lanyard at foot level can subject the shock absorber to a 3.6-metre free fall. Unless specifically designed for this type of free fall, the

shock absorber's webbing may fully extend without absorbing all the energy of the fall, resulting in a "bounce" at the bottom. The remaining energy (and there could be a great deal of it) goes into the worker, potentially causing serious injury.

Shock absorbers approved to CEN Standard EN 355: 2002 are currently available in the marketplace that will accommodate a 3.6-metre free fall and still limit the maximum arresting force on a 140-kilogram worker to 6 kN. Employers using these products must take into account the extra clearance that these products require. A European shock absorber will elongate up to 1.75 metres (5.75 feet) in a fall.

The problem of securing the lanyard to an anchor at an appropriate height may be solved by using a horizontal lifeline passing across the work area (see Figure 9.15), a hitching post that raises the anchor point, or a self-retracting device attached to an anchor located well above shoulder height. Other solutions may be possible.

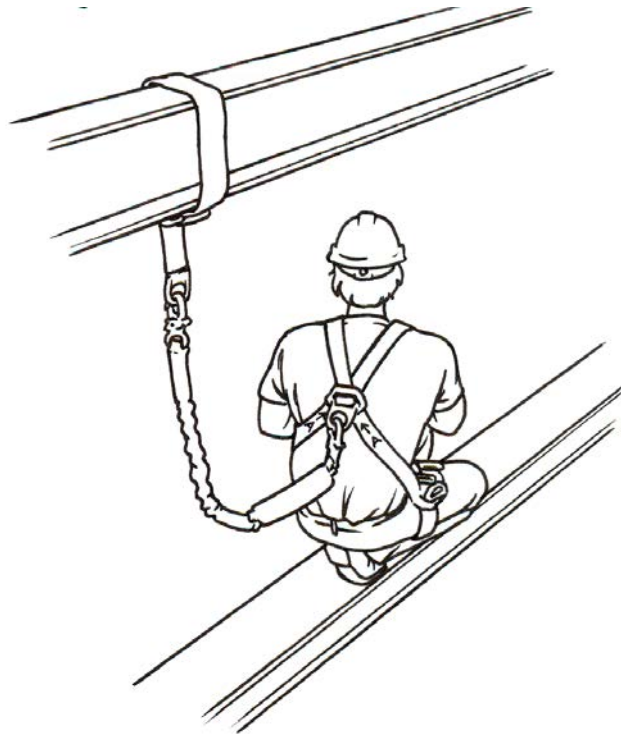
Figure 9.15 Example of using a flexible horizontal lifeline to safely move through a work area



Sections 152 to 152.4 General comments about anchors

Parts of structures located in the vicinity of where a worker is working are often used as improvised anchors (as opposed to engineered anchors) for travel restraint and fall arrest systems (see Figure 9.16). Improvised anchors are not manufactured to any technical standard. Improvised anchors may include a beam, struts of a communication tower, a concrete Jersey barrier, a sizeable tree, a locked out and chocked vehicle, or other similar, robust structures.

Figure 9.16 Example of I-beam used as an anchor point with sling specifically designed for this purpose



Workers required to use fall protection equipment must be trained to understand how to safely protect themselves. These workers must be able to assess an anchor's strength, stability and location.

Workers may tug or reef on a potential anchor as a test to see if it will hold. This "test" is completely inadequate as the force generated during a tug rarely approaches even half the worker's body weight. A better approach might be to imagine a passenger vehicle being supported from the anchor by a lanyard. If the vehicle, having a weight approaching 1600 kilograms (3600 pounds) can be held, then the anchor is a good one. The anchor must be "bomber" or "bomb-proof."

If an anchor is located on a mobile or erected structure such as a bucket truck, manlift or scaffold, the stability of the structure needs to be considered in the event of a fall. The structure must not topple over and create more safety problems.

Swing fall hazards must be considered when selecting an anchor. Ideally, work should be performed directly below the anchor. The further a worker is away from this ideal position, the greater the potential for the worker to swing like a pendulum into objects if the worker falls (see Figure 9.14). In situations where swinging cannot be avoided, but where several equally good anchors are available, the anchor selected should direct the swing fall away from objects rather than into them. Where there is a choice among anchors, the one offering the least amount of swing should be selected.

A drop during a swing may result in the worker impacting the ground or other obstructions. Furthermore, the horizontal speed at the bottom of the swinging arc is exactly the same as the vertical speed if the worker had fallen the height dropped during the swing. For this reason, the CSA Standard Z259.16 recommends establishing anchorage locations so that the swing-drop distance is limited to 1.2 metres or less.

Table 9.1 summarizes the strength requirements of anchors as required by sections 152 and 152.1.

Table 9.1 Summary of anchor strengths required by section 152 and 152.1

Fall Arrest Anchor Strength (temporary or permanent)	Travel Restraint Anchor Strength	
	Temporary	Permanent
16 kN or 2 x Maximum Arresting Force (MAF)	3.5 kN	16 kN or 2 x MAF Since there is no category for “permanent travel restraint anchor,” these anchors default to being fall arrest anchors.

Section 152 Anchor strength—permanent

Anchors used for attachment of a personal fall arrest system must have a minimum breaking strength of

- (a) at least 16 kN (3600 lbs) per worker attached, in any direction required to resist a fall;
or
- (b) two times the maximum arresting force per worker attached, in any direction required to resist a fall.

The required anchor strength required by this edition of the *OHS Code* was reduced from the previous 22.2 kN (5000 lbs) to the present 16 kN (3600 lbs) for the following reasons:

- (a) with today’s equipment, lower forces are readily achievable;
- (b) most jurisdictions in Canada use a lesser value;

- (c) despite the previous requirement for a 22.2 kN anchor strength, any worker using a self-retracting device (SRD) today is effectively being protected by a fall arrest system limited to a maximum strength of approximately 16 kN. This is the strength of the wire rope used in the SRD, which sets the limit for the entire fall arrest system. The wire rope strength is limited to 16 kN as a compromise between safety and minimizing the weight and bulk of the SRD;
- (d) the lesser value of 16 kN is used throughout the countries of Europe, in Australia, and New Zealand. The value is incorporated in the legislated standards of these countries; and
- (e) a lesser value of anchor strength allows for the use of lighter and smaller anchors (without compromising worker safety). The change in required anchor strength potentially increases the variety of fall arrest solutions available to Alberta workers and employers by opening the Alberta market to products that are otherwise currently unavailable.

As pointed out in subsection 152(2), the 16 kN minimum breaking strength requirement does not apply to anchors installed before July 1, 2009. Anchors installed before this date should be rated to 22.2 kN or twice the maximum arresting force that they will experience.

The requirements of this section apply to anchors used in personal fall arrest system; anchors used with horizontal lifeline systems may require greater strengths and must meet the requirements of subsection 153(1).

Two times the maximum arresting force

The two times maximum arresting force approach to rating an anchor, i.e., the 2:1 safety factor approach, is particularly useful in cases where workers must be protected from falling but the structure on or from which they are working, such as a power transmission tower, cannot accommodate the 16 kN minimum breaking strength for anchors. When the two times maximum arresting force criterion is applied using the force limit of 6 kN (1350 lbs) required by subsection 151(3), the required strength of the anchor decreases to 12 kN (2700 lbs).

A fall arrest system using an E4 shock absorber that is approved to the CSA Standard for shock absorbers limits the worker's weight to 115 kilograms (including tools and personal accessories), and restricts the free fall distance to less than 2 metres during certification testing, is capable of limiting the arresting force to 4 kN (900 lbs). The resulting required anchor strength decreases further to 8 kN (1800 lbs).


This "two times maximum arresting force" approach should only be used in accordance with the manufacturer's specifications or under the supervision of a professional engineer who can accurately determine the peak forces and the available anchorage strength. If shock absorbers become wet and frozen, peak impact forces can approach 8 kN (1800 lbs).

Users of this approach must realize that using shock absorber arrest force performance to set anchor strength has several important limitations:

- (1) the 115-kilogram weight limit can easily be exceeded if a large worker is required to wear personal protective equipment, a tool belt, and carry equipment, additional tools or supplies. This worker may be required to use an E6 type shock absorber which limits maximum arresting force under optimal conditions to 6 kN;
- (2) the free fall limit distance of 1.8 metres may not always be practically achieved. Workers often use lanyards having a length of 1.8 metres. Connected to an appropriate anchor located above standing shoulder height, the 2 metre limit can be met. However, if the lanyard is attached at a lower level, the 1.8 metre free fall distance against which the lanyard's performance was verified is exceeded. The lanyard may be unable to limit the fall arrest to 4 kN; and
- (3) fall arrest equipment is used under a variety of environmental conditions. When wet, or frozen after being wet, a shock absorber's maximum arresting force increases. CSA Standard Z259.11 allows the maximum arresting force of an E4 shock absorber, under these conditions to increase to 6 kN (1350 lbs); the maximum arresting force of a wet and frozen E6 shock absorber increases to 8 kN (1800 lbs). This needs to be taken into consideration as a limiting factor if there is a chance that the shock absorber will get wet or freeze after being wet.

Having all anchors comply with the 16 kN per attached worker option is the preferred choice as there is no confusion as to the strength of the anchor. The second option requires the anchor point to be *“designed, installed and used in accordance with the manufacturer's specifications or specifications certified by a professional engineer.”*

For more information

 Sulowski AC. *Fall-Arrest Systems—Practical Essentials*. CSA International, Toronto; 2000.

Section 152.1 Anchor strength—temporary

Subsection 152.1(1) Temporary travel restraint anchor

In temporary applications, travel restraint anchors must be designed to have a minimum breaking strength of 3.5 kN (800 lbs) and be installed, used and removed according to the manufacturer's specifications or specifications certified by a professional engineer.

To prevent a worker from confusing a travel restraint anchor with an anchor intended for fall arrest, the temporary anchor must be permanently marked as being for travel restraint only. Upon completion of the work project or within the time period specified by the manufacturer or professional engineer, the anchor must be removed so it is not forgotten and, over time, permitted to deteriorate to the point that it is unable to provide the expected degree of protection.

Subsection 152.1(2) Temporary fall arrest anchor

Temporary fall arrest anchors such as wire rope slings, synthetic webbing slings, I-beams sliders, I-beam clamps, etc., must have a minimum breaking strength of

- (a) at least 16 kN (3600 lbs) per worker attached, in any direction required to resist a fall, or
- (b) two times the maximum arresting force per worker attached, in any direction required to resist a fall.

Temporary fall arrest anchors must be installed, used and removed according to the manufacturer's specifications or specifications certified by a professional engineer. Upon completion of the work project or within the time period specified by the manufacturer or professional engineer, the anchor must be removed so it is not forgotten and, over time, permitted to deteriorate to the point that it is unable to provide the expected degree of protection.

Section 152.2 Duty to use anchors

To be effective, personal fall arrest and travel restraint systems must be safely secured to an anchor, i.e., lanyard or self-retracting device must be clipped in. Workplace Health and Safety is aware of many instances of workers being equipped with the appropriate fall protection equipment but failing, for whatever reason, to clip in to an anchor. Subsection 152.2(1) requires the worker to clip in to an anchor that meets the requirements of Part 9.

Prior to clipping in, a worker is required to visually inspect the anchor he or she is planning to use to make sure that the anchor is in sound condition and free of damage. The anchor must be securely fastened to its substrate and be free of any damage that could compromise its ability to function properly. If an anchor is damaged, the worker must not use it until the anchor is repaired, replaced or re-certified by the manufacturer or a professional engineer.

Anchorage connectors such as carabiners, snap hooks, quick links, etc., must be appropriate for the work being undertaken. Some connectors will be more suitable than others for a given situation. Size, type and style of connector may need to be considered to avoid sizing mismatches and improve system ease of use.

Section 152.3 Independence of anchors

The anchor to which a personal fall arrest system is attached must not be the same anchor that supports or suspends a platform. Independent anchors are required so that if the anchor supporting or suspending the platform fails, then the worker does not fall along with the platform. Note that it is acceptable to use engineered anchors that have two or more loops on a single device that function independently of one another. A platform can be supported by one loop and a worker by another loop.

Section 152.4 Wire rope sling as anchor

Many industries use wire rope slings to create fall protection anchors by wrapping the slings around substantial structural members and then clipping into one or both of the end terminations depending on how the sling is positioned around the structural member. The requirements of subsection 152.1(2) apply to wire rope slings as slings are generally used as temporary fall arrest anchors. As such, these slings must be rated to a minimum breaking strength of at least 16 kN or two times the maximum arresting force per worker attached.

Wire rope slings used as anchorage connectors must be terminated at both ends with Flemish eye splices rated to at least 90 percent of the wire rope's minimum breaking strength.

Section 153 Flexible and rigid horizontal lifeline systems

A horizontal lifeline (HLL) consists of a synthetic or wire rope rigged between two substantial anchors. These lifeline systems allow a worker to move horizontally while safely secured to a fall arrest system. Synthetic rope HLLs should be considered temporary because they are usually subject to deterioration resulting from use, exposure to the elements, and exposure to other potentially damaging hazards. Wire rope HLLs may be either temporary or permanent. Rigid rail horizontal fall protection systems are almost always permanent (see Figures 9.17 and 9.18).

Figure 9.17 Example of wire rope used as horizontal lifeline

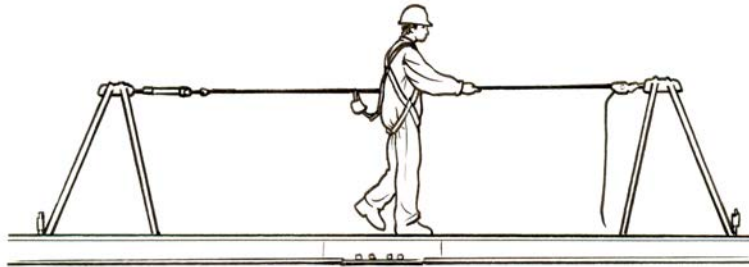


Figure 9.18 Example of rigid rail



Because of their complex performance characteristics, flexible horizontal lifeline systems must meet the requirements of CSA Standard Z259.13-04, *Flexible Horizontal Lifeline Systems*, or the applicable requirements of CSA Standard Z259.16-04, *Design of Active Fall-Protection Systems*.

CSA Standard Z259.13-04, *Flexible Horizontal Lifeline Systems*, specifies requirements related to the performance, design, testing, labeling, and provision of pre-engineered flexible horizontal lifeline systems for the attachment of personal fall protection systems. The Standard states design limitations that are necessary for safe and durable service. It also specifies strength requirements for lifeline system anchorages but not strength-testing requirements for these anchorages.

CSA Standard Z259.16-04, *Design of Active Fall-Protection Systems*, is intended for professional engineers with expertise in designing fall protection systems. The standard specifies requirements for the design and performance of complete active fall protection systems, including travel restraint and vertical and horizontal fall arrest systems.

The performance characteristics of rigid horizontal fall protection systems are less complex than those of flexible horizontal lifeline systems. Such systems must be designed, installed and used in accordance with

- (a) the manufacturer's specifications; or
- (b) specifications certified by a professional engineer.

Manufacturers and designers may wish to refer to Standard Z259.16-04, *Design of Active Fall-Protection Systems* for helpful advice.

Section 153.1 Installation of horizontal lifeline systems

A vital aspect of the safe use of horizontal lifeline systems is that they be installed properly. This section requires that before the horizontal lifeline system is used, it is certified in writing as having been properly installed according to the manufacturer's specifications or the certified specifications of a professional engineer. This certification of the installation can be performed by a professional engineer, a competent person authorized by the professional engineer, the manufacturer, or a competent person authorized by the manufacturer. This competent person could be one of the employer's workers, trained and authorized by the lifeline manufacturer to certify the installation.

Often overlooked by employers and installers of horizontal lifeline systems is whether or not there is sufficient clearance below the installed system. If there is any doubt, employers should contact the equipment manufacturer or involve a professional engineer who can assess the available clearance in accordance with the requirements of CSA Standard Z259.16.

Section 154 Fixed ladders and climbable structures

For the purposes of subsection 154(1), a worker ascending or descending a fixed ladder is not actually “working from or on a fixed ladder” and thus fall protection is not required. If a worker stops on the ladder to, for example take measurements, operate a valve, open a hatch, paint a surface, etc., and can fall a distance of 3 metres or more, a fall protection system must be used.

A ladder cage is a permanent structure attached to a ladder to provide a barrier between the worker and the surrounding space. It serves to support a worker if the worker needs to rest against a barrier. A ladder cage is *not* a type of fall protection.

A climbable structure is an engineered or architectural work where the primary method of accessing the structure is by climbing the structure with the principle means of support being the climber’s hands and feet. Examples of climbable structures include power transmission towers, communication towers, large units of powered mobile equipment such as dump trucks, cranes and crane booms, etc. Due to the variety of structure climbing access techniques and the associated hazards, it is essential that a worker be given sufficient instruction to perform the required skills that are needed to safely access a structure and be compliant with this Part.

A worker climbing, working, resting, transitioning between work and rest positions, or transferring from one distinct structure to another on a climbable structure needs to use an appropriate fall protection system that provides the worker with continuous fall protection.

Section 155 Fall protection on vehicles and loads

This section recognizes that it is not always reasonably practicable for an employer to provide a “hard” fall protection system that uses guardrails, a harness-lanyard-anchor combination or some other approach. Despite the employer taking steps to eliminate or reduce the need for a worker to climb onto a vehicle or its load, a worker may still need to go up on a vehicle or load. In such cases, the employer is allowed to use procedures in place of fall protection equipment as long as the load is secured against movement before a worker climbs onto the load. The procedures must meet the requirements of section 159.

Readers should note that the use of procedures in place of fall protection equipment is based on the employer determining that it is not reasonably practicable to provide a fall protection system for use by workers. The justification as to why it is not reasonably practicable, particularly when the employer’s work site has structures to which a fall protection system could be added or has the space to install a permanent or temporary system, should be noted.

Section 156 Elevated work platforms, aerial devices, personnel baskets

Subsection 156(1) Boom-supported work platforms

Experiences at Alberta workplaces involving ejections has resulted in this subsection explicitly requiring that workers use a personal fall arrest system when working from a boom-supported elevating work platform, boom-supported aerial device or forklift truck work platform, e.g., telescopic fork handler (see Figures 9.19 and 9.20). Since ejections can happen at any height, particularly when the boom is in its stowed condition and the unit is moving or being loaded or unloaded off a trailer, the requirements apply even though the worker's position above grade may be less than 3 metres in height.

Figure 9.19 Example of an articulated boom-supported aerial device (insulated or non-insulated)

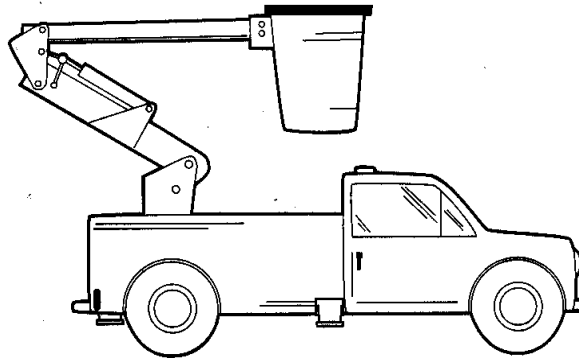
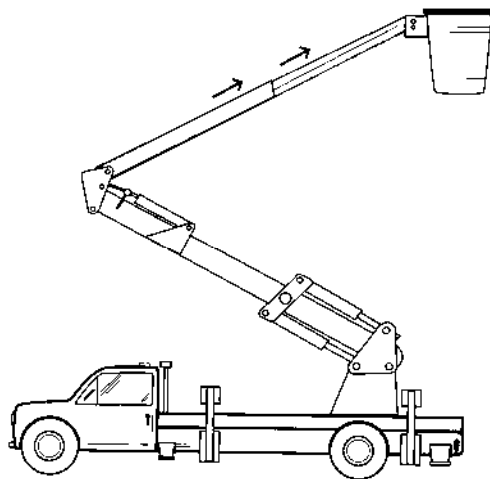


Figure 9.20 Example of a hybrid aerial device—articulated aerial device with extendible (telescopic) boom



To reduce the likelihood of a worker being ejected from the work platform, the worker's personal fall arrest system must be connected to an anchor point. If the work platform manufacturer does not provide an anchor point (usually because the unit is very old), then an anchor point certified by a professional engineer must be used. While this could mean having to add an engineered "hard" anchor point to the boom, anchor slings designed for use with booms are also available. If such an anchor sling is used, a professional engineer is still required to specify the limits under which that anchor sling can be safely used without affecting the stability of the machine.

The worker's lanyard, if reasonably practicable, needs to be short enough to prevent the worker from being ejected yet be long enough to allow the worker to perform his or her work. Work platforms come in square and rectangular shapes. Because of the physical shape of the work platform, the location of the anchor points, and the need for workers to be able to move about the entire platform, it may be *impossible* to both limit the length of the lanyard and still allow a worker to perform his or her work unimpeded. The result may be a compromise.

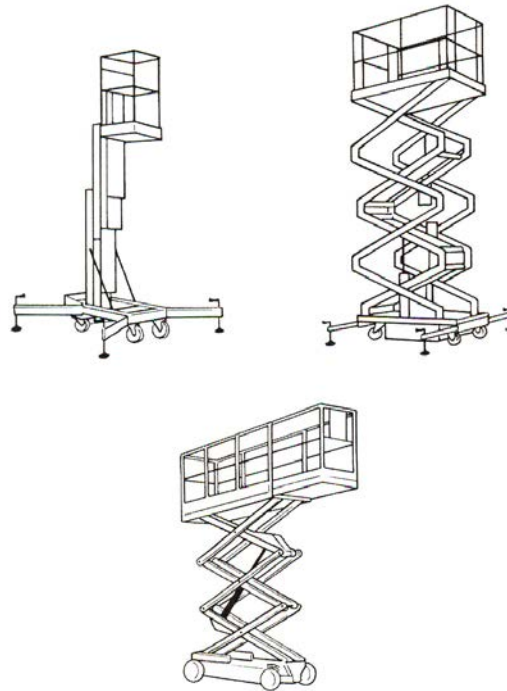
The required personal fall arrest system, which must include a shock absorber as required by subsection 142.3(2), can function as a travel restraint system preventing the worker from being ejected. However, if the lanyard is too long to prevent ejection, then the shock absorber will help limit arrest forces on both the worker and the platform's anchor point in the event of an ejection and fall.

The referenced CSA Standard Z259.16-04, *Design of Active Fall-Protection Systems*, specifies requirements for the design and performance of complete active fall protection systems. It is intended for professional engineers with expertise in designing fall protection systems.

Subsections 156(2) and 156(3) Scissor lifts and similar work platforms

Almost all modern scissor lifts (see Figure 9.21) are equipped with anchor points. Some manufacturers recommend that a travel restraint system (consisting of a full body harness and lanyard) or a personal fall arrest system be used by workers on the scissor lift, connected to the anchor points provided. Other manufacturers recognize that when a scissor lift is correctly set up and sited, guardrails offer appropriate work protection.

Figure 9.21 Examples of scissor lifts and a similar vertical aerial platform



Some older model scissor lifts may not be equipped with anchor points. These units will very likely, in their manufacturer specifications, indicate that the unit's guardrails provide worker fall protection. Subsection (3) then applies.

Subsections (2) and (3) must be read together. Subsection (3) overrides the travel restraint system requirement of subsection (2) by recognizing that the scissor lift manufacturer may allow the worker to work from the work platform and rely on the guardrails to provide protection against falling. The manufacturer's instructions for use must state that the use of the scissor lift's guardrails as a means of fall protection is acceptable. Occupational Health and Safety agrees with this assessment.

This approach has several benefits:

- (a) it defaults to the use of a full body harness and lanyard for travel restraint, which can only be overridden by the manufacturer;
- (b) it reflects what may be a future trend in the aerial work platform industry without conflicting with that trend;
- (c) from a compliance perspective, any worker on a scissor lift should be using a full body harness and lanyard connected to an anchor point. If the worker is not, then the employer can be requested to produce a copy of the manufacturer's operating manual and show where in the manual the manufacturer allows guardrails alone to be used. This ensures that manuals are available and initial compliance is a simple visual check to confirm that a harness and lanyard are being used; and

- (d) despite warnings to the contrary, workers continue to stand on midrails (and top rails) to complete work tasks. If a worker is wearing a correctly selected and adjusted travel restraint system, there is less chance that he or she will be able to stand on the rails. As a rule of thumb, if a worker can stand on the midrail while using the travel restraint system, then he or she can fall off the platform.

Scissor lifts and similar vertical aerial platforms are generally more stable than a work platform supported by a boom. Reflecting this higher level of safety, a worker need not use a full body harness and lanyard connected to an anchor point if the scissor lift or similar vertical aerial platform is operated on a firm, substantially level surface with all of the manufacturer's guardrails and chains in place. However, if the manufacturer's specifications require the use of a travel restraint or fall arrest system when the vertical aerial platform is being used, then the manufacturer's specifications take precedence and must be followed.

Research studies

In a 2007 study of aerial lift fatalities in the U.S. for the period 1992–2003, there were 306 deaths—228 involving boom lifts and 78 involving scissor lifts. Table 9.2 summarizes these deaths by manner of fall and the activity being performed at the time of the event.

Table 9.2 Aerial lift deaths by manner of fall and activity, 1992–2003

Activity	Fall from	Tipover/ Collapse	Ejection	Total
<i>Boom Lifts</i>				
Construction and repairing	27	38	31	96
Logging, trimming and pruning	18	23	19	60
Vehicular and transportation operations	5	22	16	43
Other activities	8	18	—	29
Boom Lift Total	58	101	69	228
<i>Scissor Lifts</i>				
Constructing and repairing	19	18	—	39
Vehicular and transportation operations	—	17	—	22
Painting and cleaning	7	6	—	13
Other activities	—	—	—	17
Scissor Lift Total	31	44	—	78

Source: U.S. Bureau of Labor Statistics Census of Fatal Occupational Injuries (CFO) Research File

As shown in Table 9.2, tipovers/collapses were involved in 46 percent of the fall deaths associated with boom lifts and 56 percent of fall deaths associated with scissor lifts. Failure to use a harness or belt and lanyard to tie off while performing tasks was reported in 42 of the 228 (18 percent) boom lift fatalities. In 25 deaths involving 23 boom

lift ejection or tipover/collapse events, the lift was struck by a vehicle, train or crane. In nine boom lift ejections the worker or lift was struck by a falling tree. Other contributing causes to boom lift deaths included open platform doors or defective latches.

Major contributing factors for scissor lift falls included surface conditions and scissor lift motion. In six tipover events (14 percent of 44 scissor lift tipovers), uneven or sloped ground or driving on/off a flatbed truck was a factor, and in seven tipover events (16 percent) driving into holes or over a sidewalk or similar edge was a factor.

Results from this study indicated that for a significant percentage (82 percent of falls involving a different fatality database) of incidents involving a fall from height, existing fall prevention systems such as guardrails, chains, gates/doors, belts, and harnesses with or without lanyards were not being used at the time of the incident.

Source: *Pan CS, Hoskin A, McCann M, Lin ML, Fearn K, Keane P. Aerial lift fall injuries: A surveillance and evaluation approach for targeting prevention activities. Journal of safety research 2007; 38(6): 617-25.*

In a different study of deaths involving aerial work platforms used in the U.S. construction industry between 1992 and 1999, it was determined that boom-suspended work platforms accounted for almost 70 percent of deaths involving aerial work platforms. The study reported that:

- (a) half of all falls from boom-supported work platforms involved being ejected from the bucket or platform after being struck by vehicles, cranes, or crane loads, or by falling objects, or when the work platform suddenly jerked; and
- (b) two-thirds of the deaths from tipovers/collapses of boom-supported work platforms occurred when the bucket cable or boom broke or the bucket fell. Almost one-third of the deaths were due to tipovers.

This same study found that scissor lifts accounted for over 25 percent of the aerial lift deaths. The study reported that

- (a) the causes of scissor lift falls were unknown for over half of the fall deaths;
- (b) in one-fifth of the falls, the worker was ejected from the scissor lift, mostly when an object struck the scissor lift. The rest of the fall deaths occurred after removal of chains or guardrails, or while standing on or leaning over railings;
- (c) three-quarters of the tipovers of scissor lifts resulted in fall deaths. For the rest, workers died from being struck by the falling scissor lift; and
- (d) about two-fifths of the tipovers occurred when the scissor lift was extended more than 5.5 metres (15 feet), mostly while driving the lift.

For more information



Deaths from Aerial Lifts, The Centre to Protect Worker's Rights, 2001

Subsection 156(4) Movement not adequately restricted

In some cases, the travel restraint system used on a scissor lift or elevating platform with similar characteristics cannot adequately restrict a worker's movement in all directions, perhaps because of its rectangular shape. If this is the case, then a personal fall arrest system must be used.

The required personal fall arrest system must include a shock absorber as required by subsection 142.3(2). If a worker does fall off the platform then the shock absorber will help limit arrest forces on both the worker and the platform's anchor point.

Section 157 Water danger

Some work situations involve working above water where a fall into the water exposes a worker to the hazard of drowning. In such circumstances, workers must wear a life jacket or personal flotation device. If the fall protection system prevents a fall into the water, then the life jacket or personal flotation device is not required. For example, if a worker uses a safety net or personal fall protection system that arrests the fall and prevents the worker from making contact with the water, then a life jacket or personal flotation device need not be worn.

Section 158 Leading edge

Leading edge fall protection—fabric or netting panels

General

Some types of roofs are constructed using metal rolls, decking panels, or some other methods that involve "leading edges." A leading edge is the edge of a floor, roof, or formwork for a floor or deck or other walking or working surface that changes location as additional sections are placed, formed or built. A leading edge is dangerous even if workers are not actively adding materials. Workers must be protected if they are accessing those areas.

Falls may happen at unprotected edges of the metal decking, from openings in the deck, from the skeleton structure, and from access equipment such as ladders and scaffolds. Falls may occur during any of the operations connected with unloading, deck laying or fastening and when material, tools and equipment are being moved on to or off of a deck already installed. Workers should not approach the leading edge unless they are pushing a sheet of decking material in front of them.

Sides and edges are considered "unprotected" when there is no wall or guardrail system at least 920 millimetres (36 inches) high (as required by section 315 for a guardrail). This does not apply to entrances, exits and points of access.

Fabric or netting panels

A relatively new approach to providing fall protection at a leading edge is the use of fabric or netting panels specifically designed for this purpose. At present, these panels usually cover a roof's secondary open steel structural members and offer leading edge fall protection while workers apply insulation and other roof coverings.

These panels are *not* safety nets and the requirements for safety nets do not apply to them.

If an employer wishes to use a leading edge fall protection consisting of fabric or netting panels, all of the following conditions must be met:

- (a) the system can only be used to provide leading edge fall protection. The system cannot be used to provide fall protection for workers at heights above the plane or level in which the system is being installed;
- (b) the system must be used and installed according to the manufacturer's specifications, respecting any limitations that the manufacturer may impose on the system during installation and use;
- (c) a copy of the manufacturer's specifications for the system must be available to workers at the work site at which the system is being used;
- (d) the fabric or netting product must be
 - (i) drop-tested at the work site as described in 29 CFR Section 1926.502 (C)(4)(i) published by the Occupational Safety and Health Administration (OSHA), i.e., a 182 kg mass (400 lbs) dropped from a height of 107 cm (42 in) onto the fabric or netting, or
 - (ii) certified as safe for use by a professional engineer; and
- (e) all workers using the system must be trained in its use and limitations.

Section 159 Procedures in place of fall protection equipment

This section recognizes that it is not always reasonably practicable for an employer to provide a "hard" fall protection system that uses guardrails, a harness-lanyard-anchor combination or another fall protection system described in this Part. The use of procedures in place of fall protection equipment is based on the employer determining that it is not reasonably practicable to provide a fall protection system for use by workers. The justification as to why it is not reasonably practicable should be noted.

If the use of a fall protection system is practicable, it must be used, e.g., if anchor points are available or a fall protection system can be rigged without exposing workers to a greater hazard, then a fall protection system must be used. The option of using an administrative procedure is not intended to allow an employer or worker to avoid using a fall protection system or some type of elevated work platform just because doing so may be inconvenient or take more time than using an administrative procedure.

A procedure-based fall protection system can only be used in the following situations:

- (1) *installation or removal of fall protection equipment (first person up/last person down)*—typical examples may involve installing a fall arrest anchor at the peak of a roof, installing a perimeter guardrail system on a flat roof, installing a portable fall arrest post at height, etc.;
- (2) *roof inspection*—applies to both flat and sloped roofs. Roof inspection includes school staff checking for and retrieving items that have been thrown on a school roof. If it is not possible to remain at least 2 metres from the edge of the roof while retrieving the object or toy, then a procedure-based approach can be used as long as the conditions listed below are met;
- (3) *emergency repairs*—this does not include normal maintenance and service tasks;
- (4) *at-height transfers between equipment and structures if allowed by the manufacturer's specifications*—examples include transferring to and from a structure from some type of elevating work platform, an electric utility lineman transferring from a helicopter to a high voltage transmission line, etc.; and
- (5) *situations in which a worker must work on top of a vehicle or load*—section 155 applies in this case.

Workers engaged in these five types of activities at height are exposed to fall hazards for very short periods of time, if at all, since they may be able to accomplish their work without going near a danger zone, i.e., within 2 metres of the edge in the case of roofs. Workers engaged in such work are not continually or routinely exposed to fall hazards. As a result, they tend to be very focused on their footing, alert and aware of the hazards associated with falling, i.e., more aware of their position than, for example, a roofer who is moving backwards while operating a felt laying machine, or a plumber whose attention is on an overhead pipe and not on the floor edge.

If an employer wishes to use a procedure in place of fall protection equipment, all of the following conditions must be met:

- (a) *written hazard assessment*—a written hazard assessment specific to the work site and work being performed must be completed before work at height begins. This reinforces the requirements of Part 2 for hazard assessment;
- (b) *written procedures*—the procedures to be followed by workers while performing the work must be in writing and available to workers before the work begins. Workers must understand the activity that they are about to undertake. The procedures must be part of the fall protection plan required by section 140;
- (c) *limit number of workers exposed to fall hazard*—the work must be carried out in such a way that minimizes the number of workers exposed to the fall hazard while work is performed;
- (d) *the work must be limited to light duty tasks of limited duration*—the work must be a “light duty task” such as inspection, estimating, or simple emergency repairs, e.g., membrane repair on a flat roof (the repair of insulation below the waterproofing membrane is not a light duty task), etc. The work done at each work area within the work site must be less than approximately 15 minutes in duration. While doing the

task, the worker should not turn his or her back to the edge and should keep the edge in sight;

- (e) *worker competency*—the worker performing the work must be competent to do so;
- (f) *use of procedures during inspection, investigation or assessment activities*—if procedures are used for inspections, investigations or assessment activities, the activities must take place prior to the actual start of work or after work has been completed. If the activities take place while work is going on, e.g., during construction of a roof or structure, the fall protection requirements of Part 9 apply to *all* workers exposed to a fall hazard. The use of procedures in these circumstances recognizes that before work begins, or after all work has been completed and workers have left the area, there may be a need for building inspectors, owners, etc., to inspect the area and/or the work. All fall protection equipment, such as perimeter guardrail systems or safety nets, may have been removed following completion of the work. The systems need not be reinstalled a second time for inspectors; and
- (g) *limit worker exposure to additional hazards*—the use of a procedure must not expose a worker to additional hazards. Working at height has inherent risks. Exposing a worker to additional hazards and therefore greater potential harm is not an acceptable practice, e.g., having a worker free climb a severely sloped metal clad roof to install an anchor at the peak, having a worker inspect a difficult-to-access equipment location that could be inspected from another location using other means, i.e., elevating work platform or nearby structure using optical equipment.

Subsection 159(1)(a)

For farming and ranching operations, an employer or worker may use procedures in place of fall protection when the use of fall protection is not reasonably practical. For example, when working from a storage bin which lacks the structural integrity to withstand the stresses imposed upon it through the proper use of fall protection.

There may be numerous locations on the work site where the use of fall protection may not be reasonably practical and work at these locations may occur daily. In recognition of this, the employer must identify these locations and develop safe work procedures to be used in place of fall protection.

Section 160 Work positioning

A work positioning system is a system of components attached to a vertical life safety rope and includes a full body harness, descent controllers and positioning lanyards used to support or suspend a worker at a work position. A work positioning system allows a worker to work at height supported in *tension*, part or all of the worker's mass being supported by the work positioning system and the remainder by the surface on which the worker is standing. The worker relies on both the tension provided by the anchor and his or her feet to maintain the work position. The worker may use an adjustable work positioning lanyard to further secure his or her work position. Work positioning

can be used in occupational settings such as tree climbing, residential wood frame construction, residential roofing, high rise window cleaning, Christmas light installation, snow clearing on sloped roofs, etc.

If a work positioning system is used as a means of holding a worker in position at the work location, the worker should select and use a fall protection system based on the work surface slope characteristics described in Table 9.3. If the hazard assessment required by Part 2 indicates that the work surface presents a slipping or tripping hazard because of its state or condition, the employer must ensure that an appropriate fall protection system is used that takes into account the state or condition of the surface.

When a worker uses a work positioning system, tension is maintained at all times in the life safety rope(s) to which the worker is attached and slack in positioning lanyards is kept to a minimum at all times. Doing so helps ensure that the worker's vertical free fall distance, in the event of a fall, is restricted by the positioning system to 600 millimetres or less.

Table 9.3 Selection of fall protection system to be used with work positioning, based on work surface and slope

Class	Work surface and slope characteristics	Required back-up fall protection system
I	Flat—with a slope of no more than 4 degrees	None, unless the worker's centre of gravity extends beyond the edge, in which case a back-up fall arrest system is required.
II	Slight elevation gain or loss—slope angle varies from 4 to 8 degrees	None, unless the worker's centre of gravity extends beyond the edge, in which case a back-up fall arrest system is required.
III	Sloping sharply enough that a person needs to touch a hand for balance	None, unless the worker's centre of gravity extends beyond the edge, in which case a back-up fall arrest system is required.
IV	Hands and feet or the work positioning system is required to maintain the work position on a sloping surface	Travel restraint system unless the worker's centre of gravity extends beyond the edge, in which case a back-up fall arrest system is required.
V	Vertical surface. Worker is suspended	Fall arrest system.

Figures 9.22, 9.23 and 9.24 show workers using work positioning systems in various applications.

Figure 9.22 Worker on communication tower using tower climbing harness and work positioning system

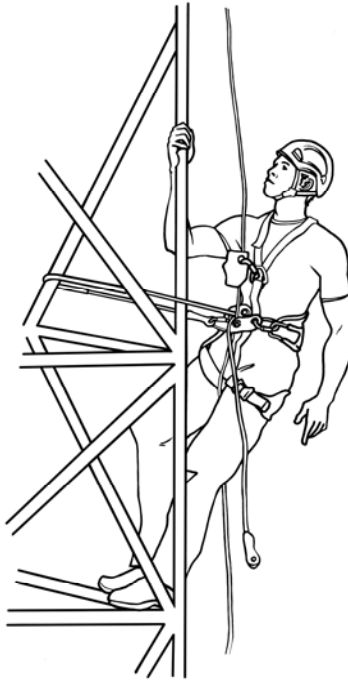


Figure 9.23 Worker repairing roof structure while using work positioning system

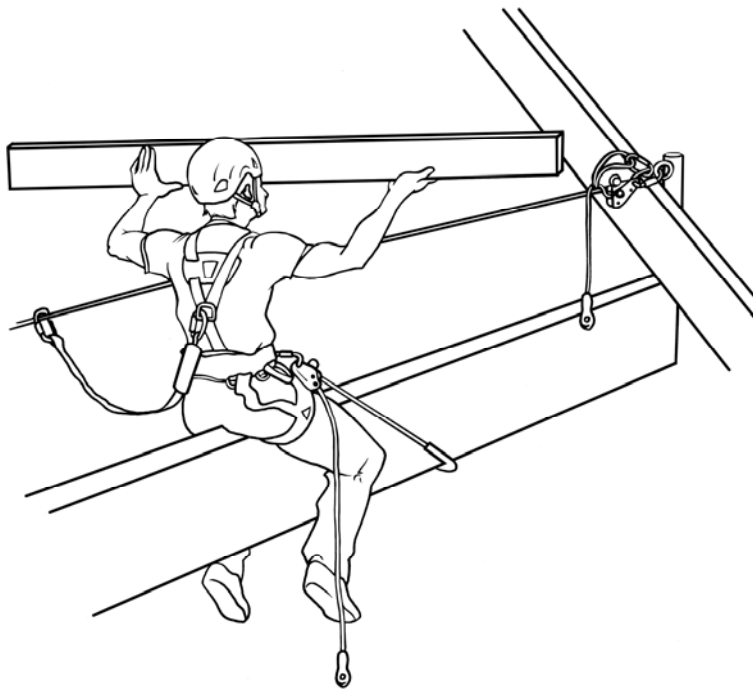
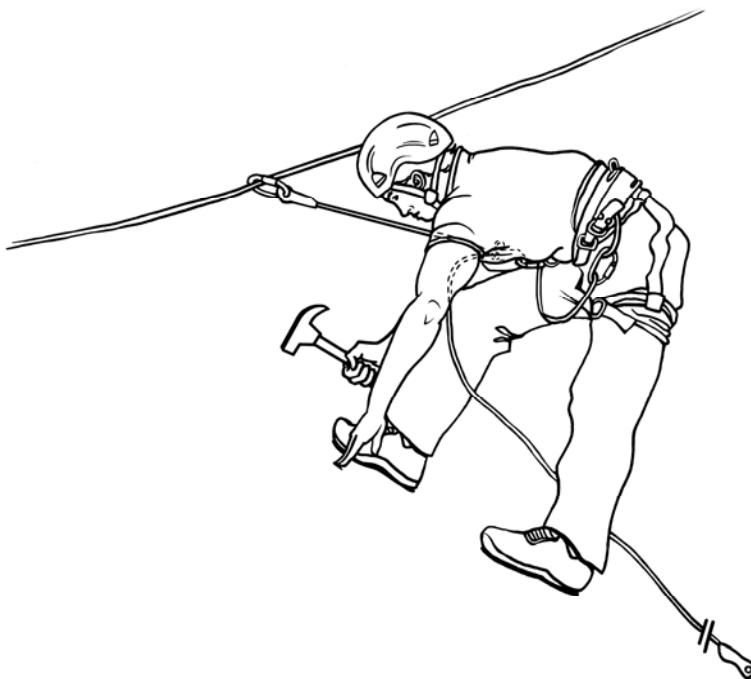


Figure 9.24 Worker using work positioning system for travel restraint on a roof



Section 161 Control zones

The use of a control zone is an approach to fall protection that places special requirements on workers and work being performed on a nearly level working surface within 2 metres of an unguarded edge from which a worker could fall. Control zones can be used on surfaces having a slope of up to 4 degrees measured from the horizontal.

If a worker works within 2 metres of the control zone, i.e., within 4 metres of the unguarded edge, a raised warning line or equally effective means is required. If a worker works within the control zone, then a travel restraint system must be used.

A control zone cannot be used if the level working surface on which work is being performed is less than 4 metres wide. In such circumstances, one of the other methods of fall protection required by the *OHS Code* must be used.

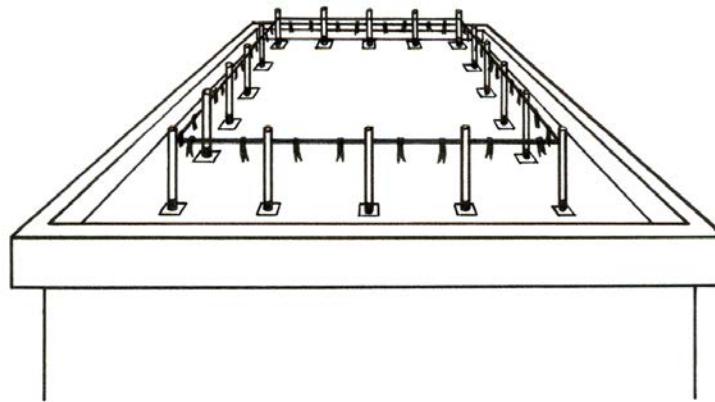
Work away from unguarded edge

Situations may arise where, on a large flat roof for example, work is performed at a significant distance away from an unguarded edge, e.g., at a penthouse near the centre of the roof. With the exception of when workers enter or leave the work area at an unguarded edge, workers have no contact with the edge. Upon accessing the roof, workers must proceed directly to their work area. Under such circumstances, a line defining a control zone is unnecessary, as are the remaining requirements for fall protection that would normally apply at the unguarded edge.

Line defining the control zone

If a worker works within 2 metres of the control zone, i.e., within 4 metres of the unguarded edge, a raised warning line or equally effective means of alerting the worker to the unguarded edge is required (see Figure 9.25). The raised warning line or other equally effective means such as barricades must be placed at least 2 metres from the edge. The warning method provides a visual and physical reminder of the presence of the hazard.

Figure 9.25 Example of control zone marked out on flat roof



For compliance purposes, a raised warning line can consist of ropes, wires or chains, and supporting stanchions, and should be

- (a) flagged or marked with highly visible materials at intervals that do not exceed 2 metres (6.5 feet);
- (b) rigged and supported so that the lowest point (including sag) is not less than 0.9 metres (34 inches) from the walking or working surface and its highest point is not more than 1.2 metres (45 inches) from the walking or working surface;
- (c) attached to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over; and
- (d) the rope, wire or chain must have a minimum tensile strength of 2.2 kN (500 lbs).

An “equally effective method” might be a substantial barrier, e.g., pile of materials or supplies, tall parapet, building system pipes and ducts, etc., that is positioned between the worker and the unguarded edge, preventing the worker from getting to the edge. Since this substantial barrier is acting as a guardrail, it must at all time be at least 920 millimetres (36 inches) tall while the protected worker is using it.

Work within the control zone


If a worker works within the control zone, then a travel restraint system or equally effective means that prevents the worker from getting to the unguarded edge must be

used. A travel restraint system is always preferred but may not be appropriate or possible in all circumstances.

An “equally effective method” might be a substantial barrier, e.g., pile of materials or supplies, tall parapet, building system pipes and ducts, etc., that is positioned between the worker and the unguarded edge, preventing the worker from getting to the edge. Since this substantial barrier is acting as a guardrail, it must at all time be at least 920 millimetres (36 inches) tall while the protected worker is using it.

A control zone cannot be used if the level working surface on which work is being performed is less than 4 metres wide. In such circumstances, one of the other methods of fall protection required by the *OHS Code* must be used.

For more information

 Ellis, NJ. *Introduction to Fall Protection*, 2nd edition. American Society of Safety Engineers, Des Plaines, IL; 1993.

Part 10 Fire and Explosion Hazards

Highlights

- For the purposes of this section, *Canadian Electric Code* means CSA Standard C22.1-06, *Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations*.
- Section 162 prohibits a person from entering or working in a work area if the atmosphere contains more than 20 percent of the lower explosive limit of a flammable or explosive substance.
- Section 162.1 requires employers to ensure that locations are classified according to the classification method described in the *Canada Electrical Code* (CEC) if a hazard assessment determines that the area is a “hazardous location” as defined in the *OHS Code*.
- Section 165 describes protective measures required in defined hazardous locations.
- Section 166 places limits on where and how an internal combustion engine can be used. The employer is responsible for ensuring the limits are observed.
- Section 169 lists requirements for, and limits on, the conditions under which hot work can be performed. The employer is responsible for ensuring the limits are observed.
- Section 170 lists requirements applicable to hot tap work, including the requirement that hot tap procedures are written into a hot tap plan.
- Section 170.1 describes requirements for spray operations.
- Sections 171.1 and 171.2 describe general welding requirements.
- Sections 172 through 174 list requirements applicable to welding services that are provided from vehicles.

Requirements

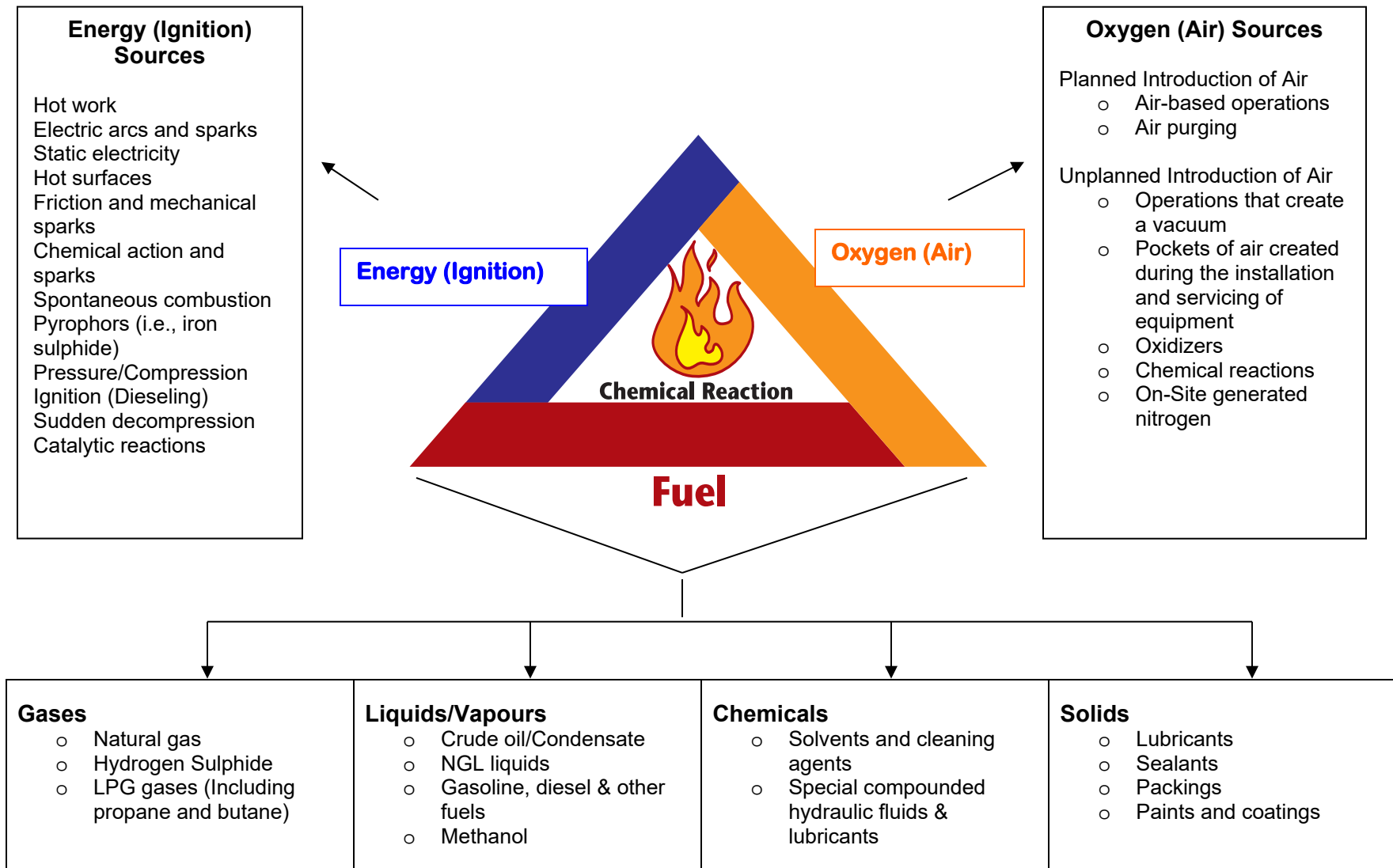
For a fire to occur, three elements must come together at the same time and in the right proportions fuel, heat and oxygen. This is commonly known as the “fire or explosion triangle” (see Figure 10.1). Fuels may be flammable or combustible materials and can be gases, liquids or solids. Heat is the ignition source and can include open flames and sparks as well as chemical reactions that create heat. The most common source of oxygen is air, but oxygen can also come from chemicals called oxidizers, e.g., chlorine, potassium permanganate, potassium chlorate, etc., and from membrane-generated nitrogen.

Fire prevention consists of making sure that the three legs of the fire triangle do not occur at the same time. It is important to note that even when all three sides co-exist, there is not always a 100 percent certainty that a fire will start. The three elements need to be present in the right amount and near one another. Important factors include

- upper/lower explosive limits—the concentration range of a flammable gas or vapour in air that will form an ignitable mixture;
- ignition source energy—a source of energy that will produce enough heat to ignite a flammable concentration of gas or vapour in air;
- mixture—mixing compounds with different chemical properties can result in unique substances with significantly different explosive limits and/or ignition temperatures; and
- flash point—the minimum temperature of a liquid at which sufficient vapour is given off to form an ignitable mixture with air, near the surface of the liquid. Materials such as diesel fuel, lubricating oils and solvents that are used below their flash points will not form an ignitable mixture in air. However, when liquids are released in the form of a mist the mist may be ignitable below the liquid’s flash point.

Figure 10.1

Fire or Explosion Triangle



Source: Industry Recommended Practice # 18, Enform

General Protection and Prevention

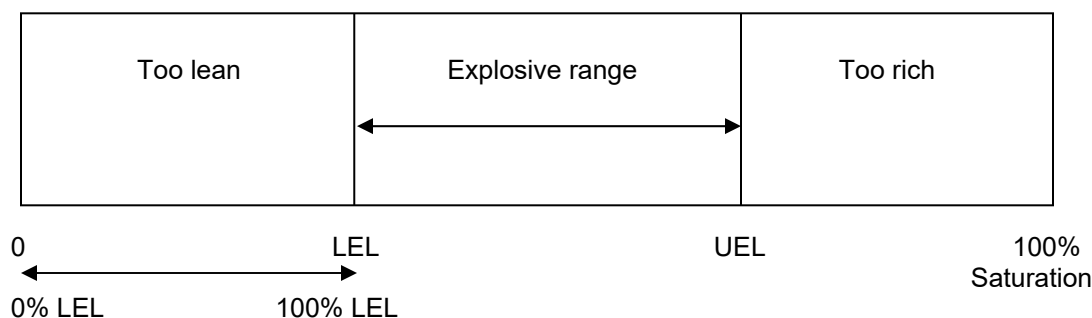
Section 162 Prohibitions

Subsections 162(1) and 162(2)

Employers must ensure that flammable and combustible substances at the workplace do not ignite and harm workers or damage equipment. No worker, other than a competent worker responding in an emergency, must enter or work at a work area in which the atmosphere exceeds 20 percent of a substance's lower explosive limit (LEL). Before performing work involving an atmosphere that may contain an explosive gas, the atmosphere may need to be tested to determine if a flammable mixture is present. Where atmospheric testing is required, it must be done before work begins and may be required at regular intervals while work continues. The use of electronic gas detection equipment is recommended because it allows for the continuous monitoring of gas or vapour concentration in air. The most common unit of measurement is the percentage of the lower explosive limit (% LEL).

The LEL is the minimum amount of fuel that must be present in air to ignite. If the air/fuel mixture is below the LEL, it is considered too lean and will not ignite. The upper explosive limit (UEL) is the maximum amount of fuel that can be present in air for ignition to occur. If air/fuel mixture is above the UEL, it is considered too rich and will not ignite (see Figure 10.2). In this situation there is insufficient oxygen to support combustion. The wider the explosive range, the more difficult it is to manage the potential of an ignition resulting in a fire or explosion.

Figure 10.2 Graphic explanation of LEL and UEL



Using methane as an example, a 5 percent mixture of methane in air is the minimum concentration that will ignite and explode in the presence of an ignition source. When the concentration of methane in air reaches its LEL of 5 percent, a gas monitor calibrated for methane will read 100 percent LEL. If the concentration of methane in the air is 0.5 percent, the instrument will read 10 percent LEL. Table 10.1 shows LEL and UEL limits for selected hydrocarbon gases and liquids.

Table 10.1 LEL and UEL limits for selected hydrocarbon gases and liquids

Flammable substance	Lower Explosive Limit (LEL)	Upper Explosive Limit (UEL)
Methane	5.0%	15%
Ethane	3.0%	12.5%
Propane	2.3%	9.5%
Butane	1.9%	8.5%
Hydrogen sulphide	4.0%	46%
Toluene	1.27%	7.0%
Gasoline	1.3%	6.0%
Cutter oil	1.1%	6.0%
Envirovert (drilling fluid)	0.7%	6.0%
Crude oil	1.0%	7.0%

To ensure the health and safety of workers, gas monitor readings in work areas should not exceed 20 percent of the LEL for the following reasons:

- (a) gas monitors may be calibrated for a flammable gas or vapour other than the one being tested for;
- (b) the atmosphere being tested may contain a mixture of unknown flammable gases or vapours;
- (c) the gas monitor's correction factors may be inaccurate or unreliable;
- (d) worker sampling techniques may not be the best, e.g., it may be difficult to get to the bottom of a vessel where gases that are heavier than air can pool; and
- (e) to provide an added safety factor that reduces the likelihood of an explosion.

For more information



Use of Combustible Gas Meters at the Worksite

<https://ohs-pubstore.labour.alberta.ca/combustible-gas-meters>

Subsections 162(3) and 162(3.1)

Smoking materials and open flames are a potential source of ignition. They may not be present during the storing, handling or processing of a flammable substance. If open flames are unavoidable during these activities, the hot work requirements of section 169 must be met.

Subsections 162(4) and 162(5)

Exposing flammable or combustible liquids which are at a temperature at or above their flash point to the air can result in explosive mixtures in the air. Equipment in the area that is not designed to prevent it from becoming an ignition source could cause an explosion or fire.

Flammable liquids are those that flash at temperatures below 37.8°C (100°F), while combustible liquids flash at temperatures above 37.8°C (100°F). Different liquids flash at

different temperatures. Some flammable liquids, such as gasoline (flash point approximately -46°C), flash at very low temperatures and should be considered flammable at all temperatures.

Safety Data Sheets (SDSs) provide information such as a particular liquid's flash point. SDSs also describe any precautions that need to be taken when handling the liquid.

A flammable or combustible liquid at a temperature above its flash point presents a potential fire and explosion hazard, particularly if a potential source of ignition is present. The restrictions on mixing, washing, cleaning, and other uses of a flammable or combustible liquid at a temperature at or above its flash point are intended to prevent a fire or explosion.

Subsection 162(6)

Rags contaminated with flammable or combustible substances can heat up and burst into flames under the right conditions. Such rags must therefore be stored in containers with a lid that keeps out air. Without air, a fire quickly smothers itself. Temporary storage containers should be emptied frequently and used as recommended by the manufacturer. The container must be clearly labelled as being for the storage of contaminated rags (see Figure 10.3).

Figure 10.3 Example of temporary storage container for contaminated rags



Section 162.1 Classification of work sites

The hazard assessment required by Part 2 of the *OHS Code* will help an employer to determine if there are one or more locations at a work site where there exists or where there is the potential for an explosive atmosphere to exist. If such locations are present, they are considered to be hazardous locations.

A hazardous location is further described in Part 1 of the CEC. According to the CEC, a hazardous location is a premises, building, or parts thereof, in which

- (a) an explosive gas atmosphere is present, or may be present, in the air in quantities that require special precautions for the construction, installation and use of electrical equipment;
- (b) combustible dusts are present, or may be present, in the form of clouds or layers in quantities to require special precautions for the construction, installation, and operation of electrical equipment; or
- (c) combustible fibres or flyings are manufactured, handled or stored in a manner that will require special precautions for the construction, installation, and operation of electrical equipment.

An explosive atmosphere is a mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, or mist in which, after ignition, combustion spreads throughout the unconsumed mixture.

Explosive concentrations of gas, vapour or dust might be present temporarily as a result of flammable materials being brought into an area. As a result, the area might not be classified under this section. Special precautions, including the features, design and installation of electrical equipment must still be taken in these areas to ensure that ignition of the flammable gas, vapour or dust is prevented [see section 169(1)(b)]. An example of one of these situations would be the use of a solvent, near or above its flash point, in an enclosed area.

Flammable gases and vapours, and flammable or combustible liquids, can burn and explode. Some dusts can also burn and explode. Examples include grain dust, sugar dust, cardboard dust, and metal dust.

If a flammable or combustible dust (or ignitable fibres) is suspended in air at a high enough concentration, a source of ignition such as a spark, open flame, or hot surface can trigger a fire and explosion. The minimum concentration in air of suspended dust that can burn and explode is approximately 50,000 milligrams/cubic metre (0.05 ounces/cubic foot). This amount is 5,000 times greater than the occupational exposure limit permitted for nuisance dusts. The exact concentration varies from substance to substance and depends on factors such as particle size and oxygen concentration.

While most dust clouds with a sufficiently high concentration of particles occur within process equipment, dust clouds can be formed by the mechanical disturbance of an accumulated layer of dust. Often the mechanical impact that disturbs the dust also creates an incendive spark resulting in an explosion that raises more dust, thereby creating a series of violent explosions. In areas where the fine dust particles accumulate, the frequency of cleaning may determine whether or not the area is classified as a hazardous location.

Ignitable fibres and flyings are materials cast off into the air that normally fall to the ground because of their size and weight. By example, small particles of sawdust that remain suspended in the air are dust. Wood chips created by a chain saw or planer are flyings. While fibres are not generally a threat to cause an explosion, fibres collecting on heat-producing equipment can be the source of serious fires.

Electrical equipment has three recognized sources of ignition:

- (1) arcs and sparks—produced by normal equipment operation. Motor starters, contactors, and switches can ignite a hazardous location atmosphere;
- (2) high temperatures—equipment such as lamps and lighting fixtures can produce heat. If this heat exceeds the ignition temperature of the hazardous material that is present, a flammable atmosphere can be ignited; and
- (3) electrical equipment failure—the shorting of an electrical terminal, set of contacts, or failure of a motor winding or power cable could create a spark that ignites an explosive atmosphere.

Electrical equipment used in hazardous locations is specially designed and constructed. The type of equipment allowed in each class is based on the frequency and duration of the occurrence of explosive concentrations of gas or vapour in the area. The *OHS Code* requires the employer to ensure a professional engineer or a competent person divides and classifies the work site in accordance with the CEC.

For more information on how to classify hazardous locations under the CEC, users should refer directly to the standard.

Section 163 Procedures and precautions

Subsection 163(1)

Repealed

Subsection 163(2)

A hazardous location is by definition a location where a fire or explosion hazard may exist. If the hazard assessment required by section 7 determines that the potential for such a hazard does not exist, then the location is not a hazardous location. To ensure that this state continues, certain site requirements must be met:

- (a) The quantity of flammable substance stored or used at the site must not be such that, if inadvertently released into the atmosphere, an explosive atmosphere (as defined) will be created. This quantity is dependent on such things as the type of substance, its explosive limits and other explosive properties, expected concentration if released, site environmental conditions, etc.
- (b) Flammable substances must be prevented from unintentionally flowing into underground shafts. The 30-metre storage distance is intended to keep the substances far enough away to prevent this from happening.
- (c) Flammable substances can give off vapours under the right conditions. If the substances are stored too close to the intake(s) of a ventilation system, vapours may be drawn into the air supply. This contamination could be harmful to workers or, under worst-case conditions, create an explosive atmosphere.

If flammable vapours enter an internal combustion engine, the engine runs faster, overheats, and can explode. A flashback from the engine could ignite the flammable substance outside the engine. Flammable vapours entering the firebox of a fired heater or furnace could similarly cause the equipment to overheat and explode.

- (d) Only approved containers may be used to store portable quantities of flammable liquids. Containers manufactured on or after July 1, 2009 must be approved to
 - (i) CSA Standard B376-M1980 (R2008), *Portable Containers for Gasoline and Other Petroleum Fuels*,
 - (ii) NFPA Standard 30, *Flammable and Combustible Liquids Code*, 2006 edition, or
 - (iii) ULC Standard C30-1995, *Containers Safety*.

Such containers are specially designed for this purpose and bear the mark or label of a nationally accredited testing organization such as CSA, ULC, UL, etc. Liquids stored in these containers are unlikely to leak vapours into the air. Unapproved containers may not prevent leaks. Particular care must be taken when liquids are stored at temperatures above their flash point.

Containers manufactured prior to July 1, 2009 are acceptable if they were approved to an earlier edition of one of these referenced standards.

Subsection 163(2.1)

When transferred into or out of containers, flammable liquids can cause a static charge to build up on the container. This charge could create a difference in voltage potential between the containers, creating the possibility of an incendive spark igniting the vapours from the liquid. Effective control of static electricity can include actions such as grounding and bonding.

Metallic or conductive containers or vessels used to contain flammable or combustible liquid can be electrically bonded to one another and electrically grounded during the

transfer of their contents. Bonding and grounding techniques prevent sparks from being created. Sparks are a potential source of ignition.

Making a low resistance electrical connection between two or more conductive containers is called bonding. Bonding ensures that the containers have the same electrical potential relative to one another. Without a difference in charge or electrical potential, a spark cannot be created that jumps from one container to another.

A container is grounded when a low resistance electrical connection is made between it and the earth (hence the term earthing or grounding). This ensures that the container has the same electrical charge as the earth. As with bonding, without a potential difference, no spark can be created. Figures 10.4 and 10.5 show examples of bonding and grounding situations.

Figure 10.4 Bonding and grounding during the transfer of flammable fluid from one conductive container to another

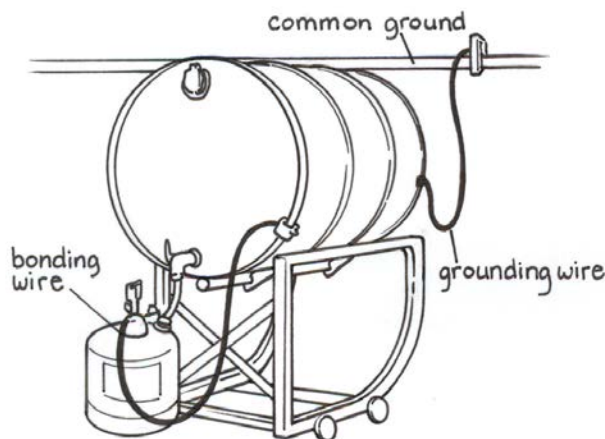
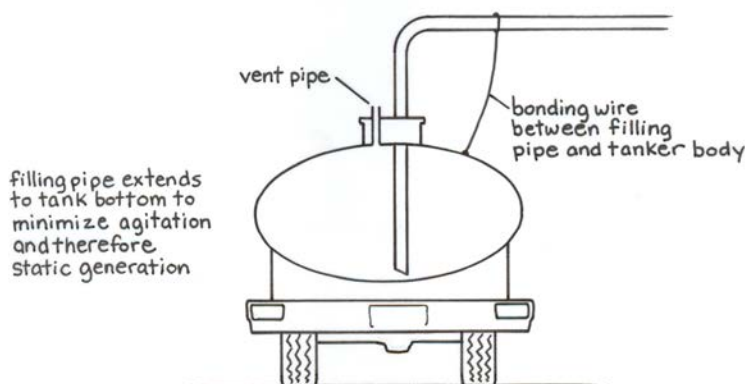


Figure 10.5 Filling a tanker with a flammable liquid



For proper electrical connections to be made, bonding and grounding conductors and the containers involved must all be conductive. This permits electrical charges to flow and disperse instead of building up and then jumping as a spark from one container to another. The use of non-conductive plastic containers to hold flammable liquids can be dangerous. When transferred into or out of such containers, flammable liquids can cause a static charge to build up on the container. This charge may result in a spark being created that ignites the liquid or its vapours.

Section 164 Contaminated clothing and skin

Clothing contaminated with a flammable or combustible substance can be dangerous to the wearer. A spark, open flame, or other ignition source can easily ignite the clothing. A person wearing contaminated clothing must avoid any activity where a spark may be created. Contaminated clothing must be removed at the earliest possible time. Even flame resistant fabrics may burn if soaked with a flammable or combustible substance.

Flammable and combustible substances are often harmful to the skin. These substances can remove the natural layer of protective oil from a person's skin, resulting in dry, cracked skin. This skin condition is known as dermatitis.

Section 165 Protective procedures and precautions in hazardous locations

Subsections 165(1) and 165(2)

Repealed

Subsection 165(3)

Static electricity is always present in the industrial setting. Examples of typical situations likely to produce static electricity are

- (a) the use of conveyor belts in which non-conductive materials move over or between pulleys and rollers;
- (b) pulverized materials or dusts passing through chutes or being conveyed pneumatically;
- (c) the flow of fluids through pipes or conduits, or from orifices into tanks or containers;
- (d) the flow of gases from orifices; and
- (e) the general accumulation of static charge on workers at the workplace, particularly when they wear overalls made of synthetic materials.

When transferred into or out of containers, flammable liquids can cause a static charge to build up on the container. This charge may result in a spark being created that ignites the liquid or its vapours. Effective control of static electricity can include actions such as grounding and bonding.

Subsection 165(4)

If a hazardous location (as defined) is a particular work area at a work site, the boundaries of the hazardous location must be

- (a) clearly identified to warn workers of the nature of the hazards associated with the presence of the flammable substance in that work area. Effective signage that warns workers of the hazards as they approach the work area is one way of meeting the requirement; or
- (b) fenced off to prevent workers or equipment entering the area without authorization.

Subsections 165(5) and 165(6)

Subsections 165(5) and 165(6) are to be taken together. The condition if reasonably practicable of subsection 165(5) is understood to apply to the prevention of an inadvertent release of a flammable substance or oxygen gas. The written procedures and precautionary measures are a required element of subsection 165(5). It is always practicable to develop the required procedures and precautionary measures.

In those cases where it is not reasonably practicable to prevent an inadvertent release of a flammable substance or oxygen gas, an employer must comply with the requirements of subsection 165(6).

Subsection 165(6) acknowledges that a release has happened and requires the employer to prevent an explosive atmosphere from igniting.

Section 166 Internal combustion engines

Subsections 166(1) through 166(4)

Flammable substances can give off vapours under the right conditions. If flammable vapours enter the intake of an internal combustion engine, the engine may run uncontrollably and fail to shut down when the normal fuel source is removed. A flashback from the engine cylinders could ignite the gas or vapour in the air. Whenever possible, the internal combustion engines driving stationary equipment should be located outside the hazardous location.

Except for a vehicle powered by an internal combustion engine [see subsection 166(4)], an internal combustion engine used in a hazardous location must have a combustion air intake and exhaust discharge that are equipped with a flame arresting device or the air intake and exhaust discharge must be located outside the boundaries of the area classified under section 162.1. Flame arresting devices prevent a flame front from leaving the engine and igniting the atmosphere in the hazardous location.

If an internal combustion engine is present in a hazardous location, the temperature of all its surfaces exposed to the atmosphere in that location must be lower than the

temperature at which the flammable substance(s) present in the hazardous location will ignite. This requirement does not apply to a vehicle that is powered by an internal combustion engine as the engine in the vehicle must be considered a source of ignition. Instead, the requirements of section 169 involving hot work apply.

Subsection 166(5)

An internal combustion engine cannot be located in a hazardous location classified as Zone 0 as explosive concentrations of gas or vapour are present for long periods in these areas.

Subsection 166(6)

While a hazardous location classified under Section 162.1 as Class I, Zone 1 or Class I, Division 1 will have explosive concentrations of gas present for shorter periods than a Zone 0 hazardous location, explosive concentrations of gas or vapour may be present for relatively long periods. An internal combustion engine located in a Zone 1 hazardous location must have a combustible gas detection system and controls in accordance with Rule 18-070 of the CEC. This Rule requires that

- (a) if the gas concentration in the air reaches 20% LEL, an alarm must be activated and additional ventilation must be activated; and
- (b) if the gas concentration reaches 40% LEL the engine must be shut down.

Subsection 166(7)

Internal combustion engines are not allowed in Class II or Class III, Division 1 hazardous locations due to the high risk of igniting dust or fibres in those areas.

Section 167 Flare stacks, flare pits and flares

Open flames from flare stacks, flare pits and flares are a potential source of ignition. Open flames from these sources must be located at least 25 metres beyond the boundary of a hazardous location.

Section 168 Industrial furnaces and fired heaters

Subsections 168(1) and 168(2)

The employer must take measures to ensure that gas and oil-fired furnaces do not explode. If a furnace is being used to heat a flammable substance other than its fuel, the fuel supplying the furnace's heating system must not mix with the flammable substance that is being heated. The two systems must function independently—inserted blinds or double block and bleed systems are not acceptable methods of isolation.

Subsection 168(3)

No explanation required.

Subsections 168(4) and 168(5)

While prohibited outright for Division 1, Zone 0 or Zone 1 classified areas, a furnace or fired heater may be located and operated in a Division 2 or Zone 2 classified area if

- (a) the combustion mechanism of a furnace or heater is located within an enclosure that completely separates it from the external environment. Only the air intake and the exhaust discharge may protrude but there should be an adequate seal placed around these to prevent the return of stray emissions. This helps prevent stray emissions of explosive substances from reaching the ignition component of the furnace or heater;
- (b) flammable substances are prevented from igniting on any surface of the furnace or heater that may be exposed to atmosphere. This can be accomplished by
 - (i) ensuring that the furnace or heater is operated in such a way that the temperature of the exposed surface is *below* the ignition temperature range of the flammable substances that may be on the site,
 - (ii) preventing contact by placing barriers or blanketing material between the surface and the flammable substance;
- (c) a flame arrestor is placed in the air intake *and* the discharge of the furnace or the heater, or, alternatively, the intake and discharge mechanisms are extended beyond the boundaries of the hazardous location.

Subsection 168(6)

If it is not reasonably practicable to ensure that flammable substances do not ignite on the surface of the furnace or heater [in accordance with subsection 168(5)], other effective means must be used to prevent ignition.

Section 169 Hot work

Subsection 169(1)

Section 1 of the *OHS Code* defines hot work as work in which a flame is used or sparks or other sources of ignition may be produced. This includes

- (a) cutting, welding, burning, air gouging, riveting, drilling, grinding, and chipping;
- (b) using electrical equipment not classified for use in a hazardous location; and
- (c) introducing a combustion engine to a work process.

Work activities that meet the definition of hot work must be carried out in accordance with the requirements of this section when

- (a) they are carried out in a work area that is itself a hazardous location (as defined);

- (b) they are carried out in a work area (defined as part of a work site) that is *not* a defined hazardous location (normally) but is one where an explosive atmosphere exists temporarily because
 - (i) a flammable substance is or may be in the atmosphere of the work area;
 - (ii) a flammable substance stored, handled, processed or used in the location may be released into the air in flammable concentrations during the work process;
 - (iii) the hot work is on or in an installation or item of equipment that contains a flammable substance or its residue; or
 - (iv) the hot work is on a vessel that contains residue that may release a flammable gas or vapour when exposed to heat.

Subsections 169(2) and 169(3)

The employer must ensure that hot work is not started until

- (a) a hot work permit is issued in accordance with the employer's permit system (see Figure 10.6 for an example of a hot work permit). This permit must indicate the nature of the hazard considering
 - (i) the presence of flammable materials;
 - (ii) the presence of combustible materials that burn or give off flammable vapours when heated; and
 - (iii) the presence of a flammable gas in the atmosphere, or gas entering from an adjacent area, such as a sewer that has not been properly protected. (Portable detectors for detecting the presence of combustible gases can be placed in the area to warn workers of the entry of these gases);
- (b) any combustible material that is close enough to be ignited by sparks or heat from the work process is cleared from the work location or shielded or otherwise isolated from potential ignition;
- (c) procedures are implemented that make sure that the hot work is done safely. Section 14(7) of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one;
- (d) testing shows that the atmosphere does not contain
 - (i) a flammable substance, in a mixture with air, in an amount exceeding 20 percent of that substance's lower explosive limit (LEL) for gas or vapours; or
 - (ii) more than 20 percent of the minimum ignitable concentration of dust in air or more than moderate accumulations of dust on surrounding surfaces.
Accumulations of dust can be considered moderate if the colour of the surface beneath the surface is visible through the dust layer.

Figure 10.6 Example of hot work permit

SAFE WORK PERMIT FOR HOT WORK NO WORK IS ALLOWED EXCEPT THAT WHICH IS SHOWN ON THE PERMIT			
DATE OF ISSUE _____ TIME OF ISSUE _____ EXPIRES _____ LOCATION OF WORK _____ DEPARTMENT DOING WORK _____ DESCRIPTION OF WORK TO BE DONE _____			
NAME MATERIALS ONLY _____ TOXIC _____ CORROSIVE _____ FLAMMABLE _____ OTHER _____			
	N/A	NO	YES
(1) Has an inspection been made of the unit/equipment to be worked on?			
(2) Where inspected, was it found to be free of the above materials?			
(3) Is an adequate supply of fresh air assured?			
(4) Do unit and atmospheric conditions permit safe work?			
(5) Equipment has been cleaned by (Specify) _____			
(6) The necessary equipment has been adequately protected by (Specify) _____			
(7) Have electrical switches been locked out and tagged? Signature for Process: _____ Electrical: _____ Mechanical: _____ Other: _____			
(8) Have combustible waste materials been removed from the area?			
(9) Have nearby sewers been properly protected?			
(10) Is fire protection required? (Specify) _____			
(11) (a) May underground obstructions be encountered? (b) May underground or overhead electrical power lines be encountered? (c) Signature of electrical supervisor or designate: _____			
(12) Have precautions been taken against radioactive sources?			
(13) Is permit receiver aware of material safety data sheets pertaining to this job?			
(14) Is there a need to review a special procedure such as handling asbestos, pyrophoric materials, confined space entry, Hydrofluoric Acid Area, etc.?			
(15) Are gas tests required during the job?			
(16) Has the confined space or vessel been prepared for safe entry and entry signs installed?			
(17) Is it permissible to use (a) Electrical equipment? (b) Diesel, gasoline & propane driven equipment?			
(18) Is welding permitted?			
TYPES OF GAS TESTS REQUIRED & RESULTS OBTAINED (Check Where Required) I examined the above equipment at _____ AM/PM & observed the reading to be : Combustible: _____% Hydrogen Sulphide: _____ ppm Oxygen: _____ % Other: (Name): _____ ppm Gas Tester's Signature: _____			
What additional protective equipment is required? (Specify) _____			
PRECAUTIONS TO BE FOLLOWED OTHER THAN THOSE LISTED ABOVE			
AGREEMENT: I HAVE CHECKED BOTH THE PERMIT AND THE JOB. I UNDERSTAND THE NATURE AND EXTENT OF THE WORK AND THE PRECAUTIONS TO BE FOLLOWED IN COMPLETING THE WORK.			
Permit Issued by: _____ Job Title: _____ Time: _____ Received by: _____ Job Title: _____ Time: _____			
Permit Work Complete: _____ Job Title: _____ Time: _____ Sign For Permit Issuer: _____ Job Title: _____ Time: _____ Off Work Not Complete: _____ Job Title: _____ Time: _____			
All Safe Work Permits must be signed by both the Permit Receiver and Permit Issuer before work is started and after it is completed.			Permit No: _____

The LEL is the minimum concentration of gas or vapour that must be present in order for ignition to occur. Below that concentration, the air/fuel mixture is too “lean” and will not ignite. A limit of 20% LEL provides a safety factor to account for the delay in response of gas detectors or the variation of the gas or vapour concentration over the area of the hot work.

Test instruments must be calibrated and used according to the manufacturer’s specifications. Workers using test instruments must be made aware through training that the reading on the instrument depends on the chemical used to calibrate the instrument. For example, a test instrument calibrated using methane will read correctly for atmospheres containing methane, but may not give correct readings for atmospheres containing a flammable substance that is not methane.

Sometimes manufacturers publish correction factors that can be used when working with different flammable substances. Test instruments may sometimes give a “false” reading if the atmosphere being tested is deficient in oxygen. Many combustible gas sensors need a minimum percentage of atmospheric oxygen to function properly. The employer must ensure that workers are trained in how to correctly use the test instrument, including understanding the instrument’s limitations.

While hot work is being done, atmospheric tests must be repeated at regular intervals appropriate to the hazard associated with the work being done. Regular testing confirms that a flammable or explosive atmosphere, capable of causing a fire or explosion, has not built up over time. Continuous monitoring is often required to accomplish this. Recent improvements in portable electronic combustible gas detection systems make continuous monitoring more practical. Use of the older manual sampling systems is not recommended.

For more information



Safe Work Permits

<http://work.alberta.ca/documents/WHS-PUB-SH013.pdf>



Use of Combustible Gas Meters at the Work Site

http://work.alberta.ca/documents/WHS-PUB_ch038.pdf

Section 170 Hot taps

Section 1 of the *OHS Code* defines a hot tap as a process of penetrating through the pressure-containing barrier of a pipeline, line, piping system, tank, vessel, pump casing, compressor casing or similar facility that has not been totally isolated, depressurized, purged and cleaned.

Before hot tap work begins on an enclosure containing a flammable substance, the employer must develop procedures in a hot tap plan specific to the type or class of hot

tap work that will be done. A unique hot tap plan is not required for each hot tap the plan must be specific to the type or class of hot tap work. If a variety of hot taps all involve the same hazards, and all the hot tap equipment and procedures are identical, a single hot tap plan applicable to all the hot taps is acceptable. In the event of a unique work situation arising a new or amended hot tap plan is required. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

The hot tap plan must include

- (a) a site hazard analysis;
- (b) a description of the sequence of events;
- (c) safety precautions to address the hazards; and
- (d) an emergency response plan.

Workers performing hot tap work must be competent and trained in the procedures of the hot tap plan. The point in the pressure-containing barrier to be hot tapped must be strong enough to allow the hot tap to be done safely. There must be enough room to work safely, with exit routes available and their locations known to workers involved in the work.

Workers must wear appropriate personal protective equipment and there must be a method of shutting off material being supplied to the equipment being hot tapped if an emergency arises. The machine and fittings used to do the tapping must be of adequate design and capability, and the pressure within the equipment being hot tapped must be reduced to as low as practical during the hot tap operation.

Section 170.1 Spray operations

The fire and explosion hazards of spray application of flammable and combustible materials vary depending on the arrangement and operation of the particular process and on the nature of the material being sprayed. Properly designed, constructed, and ventilated spray areas are able to confine and control combustible residues, dusts, or deposits and to remove vapours and mists from the spray area and discharge them to a safe location, thus reducing the likelihood of fire or explosion. Likewise, accumulations of overspray residues, some of which are not only highly combustible but also subject to spontaneous ignition, can be controlled.

The control of sources of ignition in spray areas and in areas where flammable and combustible liquids or powders are handled, together with constant supervision and maintenance, are essential to safe spray application operations.

- (1) Adequate ventilation to remove flammable vapours, mists or powders should be provided at all times, particularly when spray application is conducted in relatively

small rooms or enclosures. For enclosed operations, Part 26 of the *OHS Code* provides design requirements and guidelines for ventilation systems. In addition, the spraying equipment must be interlocked with the ventilation system so that it cannot be used if the ventilation system is not operating.

- (2) Spray application should not be conducted in the vicinity of open flames or other sources of ignition. Either the spray operation should be relocated or the source of ignition removed or turned off. Electrical equipment is governed by area classification requirements.

Other considerations include the following:

- containers of coating materials, thinners, or other hazardous materials should be kept tightly closed when not actually being used; and
- oily or coating-laden rags or waste should be disposed of promptly and in a safe manner at the end of each day's operations due to the potential for spontaneous ignition.

If the spray operation takes place indoors but in other than a specifically designed and constructed spray booth, the requirements of Section 5.4 of the *Alberta Fire Code* (1997) require that:

The operation of any process involving the use of flammable liquids or combustible liquids shall conform to NFPA 33 "Spray Application Using Flammable and Combustible Materials."

NFPA Standard 33 requires, in general, that:

Each spray area shall be provided with mechanical ventilation that is capable of confining and removing vapors and mists to a safe location and is capable of confining and controlling combustible residues, dusts and deposits. The concentration of the vapors and mists in the exhaust stream of the ventilation system shall not exceed 25 percent of the lower flammable limit.

In addition, anything that might obstruct ventilation must be at least 6 metres from the spraying location. If it is not reasonably practicable to maintain the 6-metre separation, the spraying area must be ventilated to remove vapours, mists, or powders. Part 26 of the *OHS Code* provides design and construction requirements for ventilation systems.

In this case, all sources of ignition located within an envelope measuring 2 metres above and 6 metres in all other directions from the spraying location must be effectively isolated from the spraying location. One way this can be accomplished is by providing barrier shielding between the ignition source and the spraying operation. Electrical equipment is governed by area classification requirements.

If the spraying operation takes place outdoors, then anything that might obstruct ventilation must be at least 6 metres from the spraying location. If it is not reasonably practicable to maintain the 6-metre separation, the spraying area must be ventilated to

remove vapours, mists or powders. Part 26 of the *OHS Code* provides design and construction requirements for ventilation systems.

Also in this case, all sources of ignition located within an envelope measuring 2 metres above and 6 metres in all other directions from the spraying location, must be effectively isolated from the spraying location. One way this can be accomplished is by providing barrier shielding between the ignition source and the spraying operation. Electrical equipment is governed by area classification requirements.

Section 171 Compressed and liquefied gas

Subsections 171(1) through 171(3) and subsections 171(5) through 171(8)

Compressed and liquefied gas containers and systems must be protected against damage and dislodgment that could result in a fire or explosion. The manufacturer's specifications must always be followed.

Cylinders that have their valve stem break off can become rocket-like projectiles. Oxygen cylinders, for example, can explode if grease or oil is permitted to enter the cylinder or its regulator.

Acetylene cylinders contain acetone (a flammable liquid) in the bottom of the cylinder to help hold the acetylene. If the cylinder is on its side, the acetone may escape, causing the cylinder to explode. Acetylene cylinders must always be secured in their upright position.

Subsection 171(1)(b)

A cylinder of compressed flammable gas cannot be stored in the same room as a cylinder of compressed oxygen unless specific requirements of the *Alberta Fire Code* are met. This subsection is understood to apply to the *indoor* storage of compressed gas within a building.

Subsection 171(4)

Each hose of an oxygen-fuel system, e.g., oxyacetylene torch system that uses acetylene and oxygen gases, must have

- (a) a flashback device installed at either the torch end or the regulator end, and
- (b) a back-flow prevention device installed at the torch end.

Flashbacks are the unintentional and uncontrolled burning of gas back into an oxygen-fuel system, resulting in possible damage to the equipment. This can range from carbon being deposited within the torch tip, valves and hose, which affects their operation, to substantial and expensive damage to the regulator and possibly the cylinder. A flashback may cause the torch and hoses to explode.

A flashback arrestor is a device designed to prevent the flashback of a flame through the torch into the hoses and regulator by quenching the flame. Most flashback arrestors available today also contain check valves intended to prevent the backflow of gases in addition to providing protection against flashbacks.

A backflow preventer is sometimes called a reverse flow valve or check valve. It is designed to prevent gases coming from the torch from mixing and flowing back into the hose lines. A backflow preventer will not always stop a flashback from reaching the hoses, regulator and cylinders.

Since flashback arrestors and backflow preventers serve different safety functions, a combination of both devices is required. Flashbacks can occur due to

- (a) excessive or incorrect pressures. The gas at the higher pressure flows into the lower pressure line. This can occur if incorrect pressures are used or if incompatible equipment is connected together;
- (b) a leak from a regulator, hose or connection that results in a drop in pressure, and gas from the higher pressure line back-feeds into the other line;
- (c) leaking valves that allow gas to mix when the equipment is not in use;
- (d) lighting up with both torch valves open, but one cylinder closed; and
- (e) nozzle blockage or faulty equipment.

Flashback arrestors and backflow prevention devices are intended to enhance safety on oxygen-fuel systems where there is a potential for the unwanted and hazardous creation of flammable or explosive mixtures within hose lines.

Such mixtures can inadvertently be created through improper operating procedures or equipment malfunction. Oxygen, at higher pressure than the fuel gas, can back up into the fuel gas line due to a plugged tip orifice, or fuel gas can back up into the oxygen line if, for example, the oxygen cylinder goes empty while cutting.

Where there is no oxygen being supplied, and there is only one line supplying the fuel gas to the torch and nozzle, there is no possibility of reverse flow that could produce a hazardous gas mixture. It is therefore not necessary to install flashback arrestors in such systems, e.g., such torches and nozzles are commonly used in the plumbing and HVAC industries, as well as for heating and brazing applications in industrial settings.

Section 171.1 Welding—General

Subsection 171.1(1)

The employer must ensure that welding activities comply with CSA Standard W117.2-06, *Safety in Welding, Cutting and Allied Processes*. The Standard provides minimum requirements and recommendations to protect persons who work in an environment affected by welding, cutting, and allied processes. It is also intended to prevent damage

to property arising from the installation, operation and maintenance of equipment used in such processes.

The Standard identifies the requirements for the operation of cutting and welding equipment, and equipment of related processes. In doing so, the Standard addresses specifically the operator of such equipment, the supervisor, and the employer under whose authority such operations are carried out.

The Standard identifies the health and safety hazards that may be encountered when such equipment is operated. It provides two options to the employer on how to implement the necessary health and safety measures by

- (a) following procedural guidelines identified in the Standard; or
- (b) implementing a health and safety program.

Subsection 171.1(2)

No explanation required.

Subsection 171.1(3)

Employers must ensure that before welding starts, an inspection of a reasonable area surrounding the welding operation is carried out and that combustible, flammable and explosive material, dust, gases, or vapours that are present or likely to be present in the work location are identified. Steps must be taken to ensure that such materials are not exposed to ignition by taking one or more of the following actions:

- (a) have the combustible, flammable and explosive material, dust, gas, or vapour, or the sources of these, moved a safe distance from the work location;
- (b) have the combustible, flammable and explosive material, dust, gas or vapour properly shielded against ignition;
- (c) have the work moved to a location free from combustible, flammable and explosive material, dust, gas, or vapour;
- (d) schedule the welding operation so that such combustible, flammable and explosive material, dust, gas, or vapour is not exposed during welding and cutting operations;
- (e) other effective methods that will render the area safe.

Subsection 171.1(4)

In addition to barrier protection from such hazards as falling tools or materials, other people in the work area should also be protected from the intense light of the welding arc, heat, and hot spatter.

Subsection 171.1(5)

When not in use, electrodes must be removed from holders to eliminate danger of electrical contact with persons or conducting objects. When not in use, electrode holders should be placed so that they cannot make electrical contact with persons, conducting

objects such as metal or wet earth, flammable liquids, or compressed gas cylinders. When not in use, guns of semiautomatic welding machines should be placed so that the gun switch cannot be operated accidentally.

Subsection 171.1(6)

The work lead and the ground lead are not the same. The work lead should not be referred to as the grounding lead. It is preferable to connect the work lead directly to the work. The work clamp should never be stored by clamping it to any part of the grounded power source frame. Grounding of electrical systems and circuit conductors is done to limit voltages due to lightning, line voltage surges, or unintentional contact with higher voltage lines, and to stabilize voltage to ground during normal operations. Grounding of work pieces, equipment housings, metal cabinets and frames, or other conductive material that form part of the equipment is done to limit the voltage to ground on these items. Limiting the voltage by grounding helps to prevent accidental shocks when equipment is misconnected or insulation fails.

After assembling any connection to the machine, each assembled connection should be checked before starting operations to ensure that it is properly made. In addition, the work lead should be firmly attached to the work. Clean and tight connections are necessary to prevent local heating. Properly insulated and dry connections are necessary to prevent stray electrical currents and possible shock or short circuits.

Coiled welding cable should be kept to a minimum and any excess is to be spread out before use to avoid overheating and damage to insulation. Jobs alternately requiring long and short cables should be equipped with insulated connectors so that idle lengths can be disconnected when not needed.

Section 171.2 Gas welding or allied processes

Subsection 171.2(1)

Connections must be checked for leaks after assembly and before lighting the torch. Flames must not be used. Leak test solutions for use on oxygen connections are commercially available and their use is recommended. Leak testing should be repeated after the equipment has been used in a manner that could cause leaks.

Subsection 171.2(2)

No explanation required.

For more information



Welder's Guide to the Hazards of Welding Gases and Fumes

http://work.alberta.ca/documents/WHS-PUB_ch032.pdf

Welding Services from Vehicles

Section 172 Storage compartments

Subsection 172(1)

The employer must ensure that welding services provided from vehicles comply with CSA Standard W117.2-06, *Safety in Welding, Cutting and Allied Processes*. Readers are referred to section 171.1(1) for a complete explanation of this standard.

Subsection 172(2)

This subsection applies to solid-walled storage compartments in which compressed gas cylinders are stored. If one or more of the external walls (the top and bottom of the compartment are not considered to be walls) of the compartment is made of expanded metal, then the compartment is not considered to be solid-walled and the requirements do not apply. The expanded metal used must be at least 80 percent open space to provide an acceptable level of passive flow-through ventilation. Louvres are not an acceptable alternative to expanded metal as they do not provide the same degree of passive flow-through ventilation.

The design of the compartment must permit passive flow-through ventilation. To do this, vents must provide 0.18 square metres (2 square feet) of free area for every 0.42 cubic metres (15 cubic feet) of compartment volume. The free area of the vents must be divided equally between the top surface and bottom surface of the storage compartment. Additional vents exceeding the specified 2 square feet: 15 cubic feet ratio may be added to the storage compartment.

Vents must remain unobstructed under all conditions of use, e.g., free of ice and snow build-up during winter operating conditions and free of mud and other debris at all times.

Subsection 172(3)

The gas cylinder storage compartment must be fabricated and assembled in such a way that gases or vapours arising in the compartment cannot flow to, and accumulate in, adjoining compartments.

Subsection 172(4)

Latching and locking hardware used on compartment doors must be made of non-sparking materials to minimize the possibility of creating a spark.

Electrical components such as wiring harnesses, cables, lights and switches should not be located within gas cylinder storage compartments. However, if present, they must be designed for use in an explosive atmosphere. Products approved as suitable for use in the appropriately classified hazardous location must bear the mark or label of a nationally accredited testing organization such as CSA, ULC, UL, etc.

Subsection 172(5)

No explanation required.

Section 173 Horizontal cylinder storage

The uncontrolled storage of compressed gas cylinders in the horizontal position can result in leaks or damage during transport. Hazards can be created when a cylinder is subject to impact from a vehicle accident, when a cylinder is not properly secured in a vehicle or when the product being transported is released and exposes workers to hazardous materials.

Issues of particular concern are

- (a) preventing the cylinder from becoming a horizontal projectile if the valve stem is damaged—the bottom of the cylinder must be in direct contact with a back stop strong enough to prevent the cylinder from passing through it. Direct contact prevents the cylinder from accelerating and gaining momentum;
- (b) scoring of a cylinder during insertion and removal from its horizontal location can create weak spots that may result in cylinder failure; and
- (c) cylinders handled by their valve or valve protection cap can result in uncontrolled venting of the cylinder contents.

To ensure all these concerns are addressed, a professional engineer must certify horizontal storage compartments on vehicles.

Section 174 Handling cylinders

Subsections (3) and (4) make a distinction between a welding service vehicles being not in service versus a welding service vehicle that is not in use. Examples of when a welding service vehicle is not in service include:

- (a) the vehicle is in a maintenance shop for repairs;
- (b) the vehicle stands idle while the operator is on holidays; and
- (c) the vehicle is being used for purposes other than providing welding services.

When this is the case, the worker must close compressed gas cylinder valves, remove regulators if they are not integral to the cylinder, and put on and secure the valve protection caps or plugs.

Examples of when a welding service vehicle is not in use include:

- (a) welding activities are completed for the shift, day, etc., but will soon resume;
- (b) while driving on public or private roads; and
- (c) when the vehicle is parked unattended and at the end of the shift.

When this is the case, the worker must shut off the cylinder valve and release the pressure in the hose(s).

Part 11 First Aid

Highlights

- If a person or agency wants to provide first aid training to workers under the *Occupational Health and Safety (OHS) Code*, section 177 requires the person or agency to enter into a formal agreement with a Director of Medical Services. This applies even if the person or agency is already approved to teach workplace first aid in another Canadian jurisdiction.
- Valid, unexpired workplace first aid certificates from other provinces and territories in Canada are recognized in Alberta, if both the workplace first aid course (s) and training agency were approved by the OHS regulator in another jurisdiction when the worker completed his/her first aid training. Workplace first aiders in Alberta must understand their legal requirements under Part 11 of the *OHS Code*, regardless of where they completed their training.
- First aid services, supplies and equipment, and a first aid room (if required) must meet the requirements of the Tables presented in Schedule 2.
- The first aid requirements that an employer and/or prime contractor must meet are based on a combination of three factors—how hazardous the work is, the time taken to travel from the work site to a health care facility (a measure of the remoteness of the work site), and the number of workers present on the work site for each shift.
- Section 179 requires first aid services, equipment and supplies (and if required, first aid room) to be located at or near the work site they are intended to serve, and be available and accessible during all working hours.
- Section 180 requires employers to ensure that transportation is available for transporting injured or ill workers to a health care facility when needed.
- If an acute illness or injury occurs at the work site, section 182 requires the affected worker(s) to report the illness or injury to the employer, as soon as practical. Reporting to a supervisor meets this requirement. Section 183 requires that a written record be kept of every illness or injury reported.
- Section 184 establishes limits on who has access to records of first aid.

Requirements

Section 177 Training standards

The employer is responsible for ensuring that individuals designated to provide first aid services to workers at a work site are appropriately trained. Workers successfully completing an approved first aid course are issued a workplace first aid certificate by an approved training agency. This card should be shown to the employer when individuals are asked to provide proof of their first aid qualifications. Workplace first aid certificates issued in Alberta since November 1, 2018 include: the name of the certified individual, name of the Agency, date of expiry, name of the course, and level of First Aid Training (Emergency First Aid, Standard First Aid or Advanced First Aid).

The first aid certificate is only acceptable if it is provided by a training agency approved by a Director of Medical Services. A Director of Medical Services is a member of the staff of Alberta Labour appointed by the Minister under section 42 of the *OHS Act*. A list of approved courses is available at <https://www.alberta.ca/assets/documents/ohs-approved-first-aid-training-courses.pdf>.

For more information

 *Workplace First Aiders and Legal Requirements*, Alberta Labour, June 2018

Training Agency Approval

Training agencies approved by a Director of Medical Services must enter into a written agreement before they begin teaching workplace first aid courses in Alberta. Workplace first aid training standards in Alberta are set by a Director of Medical Services in consultation with the Joint First Aid Training Standards Board, which includes representatives selected from among the national first aid training standard setting agencies.


Information on Alberta's first aid approval process can be found online at <https://www.alberta.ca/first-aid-training.aspx>. Alberta's first aid approval process incorporates CSA Standard Z1210-17 *First aid training for the workplace – Curriculum and quality management for training agencies*.

To become an approved training agency, an agency must submit an application in writing to a Director of Medical Services. The application must include the "Application for Approval" form available at <https://ohs-pubstore.labour.alberta.ca/li030-1>.

Applications can be submitted by email to lbr.ohsaccept@gov.ab.ca or by mail to:

Attn: Director of Medical Services
Alberta Labour
OHS Specialized Services
8th Floor, Labour Building
10808 99 Avenue
Edmonton, AB T5K 0G5

For more information

 *Applying for an occupational health and safety (OHS) approval*, Alberta Labour, July 2018

Out-of-province first aid certificates

The provincial and territorial governments across Canada have taken steps to enable labour mobility across jurisdictions within Canada. As of July 1, 2017, the Canadian Free Trade Agreement (CFTA), which was signed by the federal government and all provinces and territories in Canada, governs trade and investment in Canada.

These agreements affect employers and workplace first aiders who work in more than one province or territory. They apply to a worker who has workplace first aid certification from an approved agency in one jurisdiction and who works in or moves to another jurisdiction within the time period that the certification is valid.

A worker's first aid certification, if recognized in one jurisdiction, is automatically recognized in the new jurisdiction as long as the workplace first aider is competent in applying the new jurisdiction's specific legal requirements for first aid. The publication *Workplace First Aiders and Legal Requirements*, contains more information about those requirements in Alberta.

Both the workplace first aider who moves and the employer in the jurisdiction to which the worker moves have responsibilities. Workers, as first aiders, are responsible for being competent in meeting the legal requirements for workplace first aid. Employers are responsible for ensuring that workers are competent in administering first aid and are familiar with the legal requirements for the jurisdiction they are working in.

Section 178 Providing services, supplies, equipment

Subsection 178(1)

The *OHS Act* requires employers and prime contractors to protect the health and safety of workers performing work for them, as well as the health and safety of others present at the work site where the work is being performed. In fulfilling this obligation, employers and prime contractors are responsible for ensuring that first aid services, supplies and equipment are available at the work site. An employer may use a service

provider to supply first aiders, supplies or equipment at a work site. For some work sites, a first aid room must also be provided.

If a service provider provides first aid services at a work site, the service provider is required under section 7 of the *OHS Act* to ensure that the services they provide comply with the *OHS Act, Regulation* and *Code*, and that their first aiders have the appropriate training and competencies to carry out their work.

The type of first aid services an employer must provide is based on three criteria:

- (1) how hazardous the work is;
- (2) the time taken to travel from the work site to a health care facility (a measure of the remoteness of the work site); and
- (3) the number of workers on each shift.

To determine if the work performed is low, medium, or high hazard work, refer to Tables 1 and 2 of Schedule 2 found in the *OHS Code*. Work that is neither categorized as being low hazard nor high hazard is classified as medium hazard work.

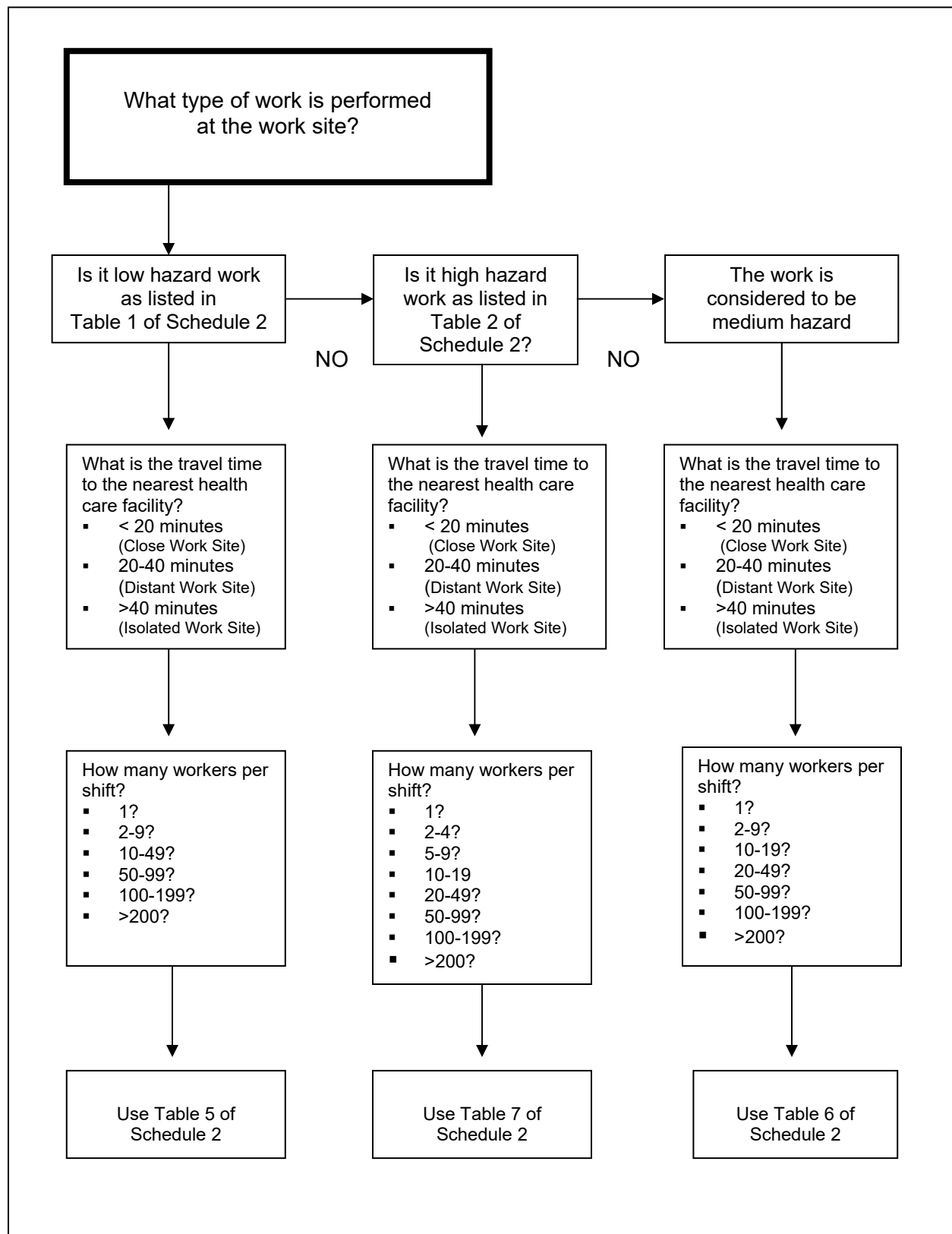
For the purposes of this Part, work sites are classified based on the length of time required to get an ill or injured worker from the work site to a health care facility under normal travel conditions. In most situations, “normal travel” involves the use of a vehicle on some type of roadway under weather and road conditions that are usually and frequently experienced at that work site. In some situations, however, “normal travel” may involve the use of a boat, aircraft, or helicopter, as might be the case at a remote work camp.

When determining the classification of a work site, consider the means of transportation usually available. If a road-accessible work site is serviced by a helicopter once every few days, then the travel time to the health care facility should be based on the time taken by a vehicle to travel the distance, as the helicopter is not usually available for the transport of an ill or injured worker. Classifying a work site as being close, distant, or isolated helps establish the first aid services, equipment and supplies that are required at the work site. The required services, equipment and supplies are listed in Tables 5, 6 and 7 of Schedule 2.

The final criterion for establishing the type and level of first aid services to be provided is the number of workers on each shift. Tables 5, 6 and 7 provide this information.

Figure 11.1 presents a flow chart for determining the type of first aid services that must be provided at a work site.

Figure 11.1 Determining first aid requirements



Application for acceptance

A Director of Medical Services has discretionary authority under the *OHS Act* to grant an acceptance for an alternative first aid service or alternative first aid supplies/equipment than that outlined in the *OHS Code*, as long as the proposed alternate first aid services, first aid supplies, or first aid equipment provide a level of worker protection that is *equal to or greater than* what is already required by this Part.

Employers, prime contractors, contractors, a self-employed person, suppliers, service providers, owners or a group of one or more of these parties can apply in writing to a Director of Medical Services for an acceptance for an alternative to one or more of the requirements of this Part of the *OHS Code*.

An OHS bulletin *Applying for an occupational health and safety (OHS) acceptance* is available at <https://ohs-pubstore.labour.alberta.ca/li030>. This provides more information about the criteria for acceptances, and application requirements. An “Application for Acceptance” form is available at <https://ohs-pubstore.labour.alberta.ca/li030tmp> and must be used to request an acceptance.

Applications can be submitted by email to lbr.ohsaccept@gov.ab.ca or by mail to:

Attn: Director of Medical Services
Alberta Labour
OHS Specialized Services
8th Floor, Labour Building
10808 99 Avenue
Edmonton, AB T5K 0G5

Subsection 178(2)


According to the *OHS Act*, every construction and oil and gas work site or a work site or class of work site designated by a Director must have a prime contractor, if there are two or more employers or self-employed persons, or one or more employers and one or more self-employed persons involved in work at the work site. The person in control of the work site shall designate in writing a person as the prime contractor at the work site. This prime contractor is responsible for making sure that appropriate first aid services, supplies and equipment are available at the work site as required by this Part. The services, supplies and equipment must be available and accessible during all working hours as required by section 179(a)(ii) of this Part.

Educational Institutions

Educational institutions are responsible for providing first aid services, supplies and equipment for workers as required by Table 6 of Schedule 2 for the number of teachers, support staff, maintenance personnel and other workers at the work site.

For the purposes of this Part, students taking training at grade schools, technical colleges and universities are not considered workers. However, a university student working as a teacher's assistant is a worker, and therefore must be included in the total number of workers.

For more information

 *Are Students and Volunteers Workers?* Alberta Labour, August 2008

Subsection 178(3)

This subsection allows employers and the prime contractor at a project to jointly supply first aid services, supplies and equipment to the work site. Such a sharing of responsibilities and resources must be described in a written agreement and must be based on the total number of workers at the work site.

Example: Construction company ABC has 100 workers working at a work site. According to Table 2 of Schedule 2, construction is high hazard work. Assuming the work is performed at a close work site, then according to Table 7 of Schedule 2, the employer must provide two emergency first aiders, two standard first aiders and one advanced first aider.

If construction company XLR has 100 workers and also begins working at the same work site, then the site requires a prime contractor and the first aid requirements for the site are based on having a total of 200 workers per shift. According to Table 7 of Schedule 2, the prime contractor must ensure that two emergency first aiders, two standard first aiders and either one nurse or one advanced care paramedic are available. In addition, a first aid room must be present. By cooperating on their responsibilities, the two employers can share resources, avoid duplication of first aid services and maintain the required first aid coverage.

Subsection 178(4)

Table 4 of Schedule 2 lists the requirements for a permanent first aid room. A first aid room that is temporary or mobile must also meet the requirements of Table 4 of Schedule 2, except that, if it is not practical to have hot water, a supply of cold potable water is acceptable.

Section 179 Location of first aid

The employer and prime contractor are responsible for ensuring that first aid services, equipment and supplies are available at the work site. A first aid room need only be provided in cases where

- (a) there are 200 or more workers per shift performing medium hazard work (see Table 6 of Schedule 2); or

- (b) there are 100 or more workers per shift performing high hazard work (see Table 7 of Schedule 2).

Equipment and Supplies

First aid services, equipment and supplies must be quickly and easily accessible during all working hours. First aid equipment and supplies must be ready for use and protected from the elements so that their usefulness is not affected by exposure to heat, cold, wind and/or moisture. The equipment and supplies, or more often the containers in which they are stored, must be clearly marked to indicate that they are intended for first aid.

Informing Workers

If signs are posted at the work site to indicate the location of first aid services, equipment, and supplies, the signs should be visible, easy to understand and appropriate to the workforce. Where signs are not practicable, workers must be informed of the location of the services, equipment and supplies by other means such as printed materials or verbal instructions.

If members of the workforce have difficulty reading or understanding English, signs and printed materials (if they are used) should use easily understood symbols or include translations. Verbal instructions should be provided to workers in the language they understand, perhaps through a co-worker acting as interpreter.

Emergency Communication System

Employers are required to have an emergency communication system in place, so that first aid services can be summoned to an ill or injured worker. The type of system or approach to providing emergency communication is at the discretion of the employer. It may involve the use of telephones, cellular telephones, satellite telephones, portable two-way radios, or other means that are equally effective. The intent of the requirement is to make sure that ill or injured workers can access first aid services quickly and reliably.

Section 180 Emergency transportation

This section requires employers to ensure that transportation is available for transporting injured or ill workers to a health care facility when needed. This section applies to all work sites, regardless of any service, supply or equipment requirements specified elsewhere in this Part.

Subsection 180(1) Arrangements

This subsection requires employers to ensure that transportation arrangements are in place for transporting injured or ill workers from a work site to the nearest health care facility. For the purposes of this Part, “arrangements” are considered to be a plan that

includes procedures for transporting injured or ill workers. Section 14 of the *OHS Act* requires the plan and procedures to be in writing and available to workers.

Transportation arrangements must be in place before an employer sends workers to any work site or work begins. This condition applies at all times while work is being performed at the worksite. Guidance on what to consider when developing the arrangements and what an officer will look for during the review is presented under the heading “Transportation Plan.”

Subsections 180(2) and 180(3) Transportation requirements

Subsections 180(2) and 180(3) offer employers two potential options when deciding on the type of transportation to have available for injured or ill workers. An employer can use a provincially licensed ambulance service under the *Emergency Health Services Act*. It is recommended that the service be capable of arriving at the work site within 40 minutes of being called. If this is not possible, the second option available to employers is to have a means of transportation from the work site that meets all the requirements listed in subsection 180(3), namely:

- (a) it must suit the distance to be travelled and the types of injuries or illnesses that may occur. The means of transportation must make transport of the ill or injured worker safe and comfortable. It should be clean, and if serious injuries are likely to occur, as in high hazard work, then the means of transportation needs to accommodate a seriously injured worker in a manner that prevents additional injuries and provides timely transport;
- (b) the available transportation must protect the injured worker and an accompanying person from the weather. If workers are at an isolated work site and work is done during cold, wet or inclement weather, then the means of transportation should be enclosed or covered and provide sufficient heat to keep both individuals warm;
- (c) the means of transportation must be equipped with a means of communication that allows occupants to communicate with the health care facility to which the injured or ill worker is being taken. This could be a cellular telephone, vehicle-based two-way radio or whatever is most practicable as long as it permits communication with the health care facility; and
- (d) the means of transportation must be large enough to accommodate a stretcher and accompanying person. Many stretchers are 200 or more centimetres long so the available space must accommodate this. Stretchers must be secured during transport to protect the safety of the injured worker and the accompanying person.

If a provincially licensed ambulance service is not available, the employer may decide to provide an emergency conveyance vehicle. It is recommended that this vehicle be able to arrive at any work site it is intended to serve within 40 minutes of being called.

Otherwise, there must be a means of transportation from the work site that meets the four requirements listed above. This means of transportation should be maintained in a clean condition and be available to respond when called. The vehicle could be a van, truck, boat, aircraft or any other means that meets all the requirements.

Some employers may choose to provide a mobile treatment centre ((MTC) to transport injured or ill workers. MTCs are pick-up trucks that carry a unit that slides into the bed of the truck and are set up to be mobile first aid rooms to meet *OHS Code* requirements. Alberta Transportation may issue an exemption under the *Traffic Safety Act* allowing a mobile treatment centre to transport injured or ill workers and first aid attendants on a highway, in the rear of a mobile treatment centre. The exemption is done in the form of a permit. Transport within a mobile treatment centre may only occur when the vehicle is being used to fulfill the emergency transport requirements under the *OHS Code*. Before transport in a mobile treatment centre is undertaken, emergency dispatch must be contacted and a rendezvous with a licensed ambulance must be arranged. Injured or ill workers are to be transported in a mobile treatment centre only when an ambulance is not immediately available. Such transport in a mobile treatment centre is to be minimized and is not meant to replace transport by a licensed ambulance when available.

Subsection 180(4) Means of communication

The employer must have a means of communication in place at the work site that allows an ambulance or other means of transportation to be summoned. The particular means of communication provided is at the employer's discretion but it must be capable of summoning an ambulance or transportation service quickly and reliably.

Communication may be through the use of a telephone, cellular telephone, satellite telephone, portable two-way radio or any other means that is effective.

Subsections 180(5) and 180(6) Accompaniment

If a worker is acutely injured or ill, or needs to be accompanied during transport to a health care facility, the worker must be accompanied by at least one first aider, other than the operator of the means of transportation. This requirement does not apply if there are three or fewer workers at the work site.

The accompanying person must be a first aider, but the level of first aid training required of this first aider is not stipulated. To determine which first aider should accompany the injured worker, consider the level or type of injury or illness, the distance to be travelled, the mode of transportation used and the level of first aid services that must continue to be offered at the work site.

Transportation Plan

Factors to consider

When developing the transportation arrangements, employers must consider the need to get injured workers to medical care as quickly as possible, keeping in mind the “golden hour.” As it pertains to life-threatening injuries, the golden hour is the first hour after a person is injured. This hour is golden because, if a seriously injured worker makes it to a health care facility within this hour, the chances of survival are greatly increased.

The employer’s transportation plan must consider the following factors, many of which are the same as those considered when developing the complete First Aid Program:

- (a) the types of injuries or illnesses likely to occur given the hazards inherent to the work and the ages and limitations of the workers;
- (b) the number of workers at the work site;
- (c) the distance to be travelled from the work site to the health care facility;
- (d) the availability of a provincially licensed ambulance service;
- (e) ambulance or emergency vehicle response times;
- (f) the time(s) of day that the work site is in operation;
- (g) the means of transportation needed to get to the work site;
- (h) transportation routes;
- (i) seasonal or weather changes that may affect the means or routes of transportation; and
- (j) travel times.

When developing a plan, prospective provincially licensed ambulance services should be contacted in advance to find out the processes involved in responding to a call and the expected response times. Response times at isolated work sites may vary considerably depending on the type of day, the weather and other factors. If a work site’s plan involves calling an emergency response centre that dispatches local air ambulances, for example, consider that local helicopter services may not have the equipment to navigate after dark and may not be able to accommodate a stretcher. Also, if a call centre is used as an emergency contact number and the call is re-routed to a local ambulance service, then the service must determine the location of the work site, resulting in a possible response delay that may exceed the 40 minute recommended time.

Ask specific questions of the emergency services provider being considered when developing a plan, e.g., service capabilities and likely response times. Employers should find out whether the service provider will dispatch a helicopter or ground ambulance. If the work site is accessible by road, it is reasonable to expect that a ground ambulance will service it and this may add considerable time to the response.

Once all factors particular to the industry and the work site have been considered, the plan must be written out, finalized and communicated to the workers it applies to.

The written plan must be available to occupational health and safety officers upon request, and should contain the following information:

- (1) *Who to call*—a list of the transportation providers that are to be used to transport injured or ill workers. The plan must specify whether a provincially licensed ambulance service is used, whether a transportation provider is summoned from a different location or whether on-site transportation is available.
- (2) *How to call*—how the transportation provider will be summoned should be clearly stated. List telephone numbers or radio channels as appropriate. The employer must ensure that telephone numbers are current and correct.
- (3) *Who makes the call*—the plan should clearly outline who is responsible for summoning the transportation provider.
- (4) *What to say*—a listing of the information that the caller must give to the transportation provider so that the service can respond quickly. Location coordinates for example may be important when trying to reach a work site in an isolated area.
- (5) *What to expect*—a description of what will happen in the event that
 - (a) the transportation cannot arrive at the work site within 40 minutes. If this is the case, it is recommended that other transportation be available that meets the transportation requirements of section 180; and/or
 - (b) another worker becomes injured while the first one is being transported to a health care facility. Workers and first aiders remaining at the work site must know what to do and who to call if work continues and another worker becomes injured.
- (6) *Communication of the plan*—evidence that the plan has been communicated to workers, including all designated first aiders.
- (7) *Date of plan completion and frequency of review*—the plan should be dated to show when it was completed and how current it is. Additionally, the plan should indicate how often it is to be reviewed.

Section 181 First aid providers

Subsection 181(1)

For the purposes of Schedule 2, Table 6 and 7, a nurse must also hold a certificate in advanced first aid (as defined in Part 1 of the *OHS Code*).

Subsection 181(2)

An employer must ensure that the first aiders at a work site have successfully completed an approved first aid training course. The first aid certificate must be valid for the entire duration that a worker is a designated first aider.

Subsection 181(3) Location of first aid providers

This subsection requires the work site's advanced first aider, nurse or advanced care paramedic (ACP) to either be based at or near the first aid room (if such a room is required by this Part), or be easy to contact or notify if that person is away from the first aid room and their services are needed.

Subsections 181(4) and 181(5) Fit and clean

The work assigned to an advanced first aider, nurse or ACP must not conflict with their responsibility to provide first aid. The work must also allow providers to remain fit and clean so they can administer first aid at any time. A mechanic working on equipment 90 per cent of the time would not always be fit and clean to administer first aid. It would be more appropriate to designate someone else as the first aider.

Subsection 181(6) Record of first aid providers

The employer is required to maintain a record of workers who are first aiders. This allows the employer to verify compliance with this Part by ensuring that the correct number of appropriately qualified first aiders are available at the work site. This record may also allow the employer to keep track of qualification expiry dates and those members of the workforce who are qualified first aiders but who may not be working as first aiders.

Section 182 Duty to report injury or illness

Workers are required to report any work-related physical injury or sudden occurrence of illness experienced while at work as soon as practicable. The employer should establish to whom the report is made, e.g., first aider, foreman, nurse, supervisor, safety person or some other individual. Prompt reporting ensures complete and accurate information and allows the injury or illness to be assessed and treated as necessary. Such information is also useful in injury surveillance. Similar, recurrent injuries reported by several workers may suggest the need to change some aspect of the work site or the tasks performed by workers.

Section 183 Record of injury or illness

Written record

The employer is required to create and maintain an accurate written record of all work-related injuries or sudden occurrences of illness that workers experience while at work.

If the cause of the illness or injury is unknown at the time treatment is provided, every effort should be made to determine the cause within a reasonable period of time and add this information to the illness or injury record. Even if no first aid is administered, an illness or injury reported by a worker must be recorded.

Illness and injury records

Employers may implement their own system of keeping and tracking illness and injury records as long as the system complies with this Part.

The first aid record should contain the information required in this section and not personal health or medical information.

Blank first aid treatment forms are often kept in kits to which all persons at the work site have access. Completed forms should be sent to an individual designated by the employer as the keeper of all completed first aid records and retained for a minimum of three years from the date on which the injury or illness occurred. Completed records must not be kept in the first aid kit.

For more information

 *First Aid Records*, Alberta Labour, February 2017

Section 184 First aid records access

A person with custody of first aid records must ensure that access to the first aid records is limited to the worker unless the person is allowed to release the information under privacy and access to information laws passed by the Government of Alberta or the Government of Canada. Such privacy and access to information laws may authorize or require the disclosure of information such as first aid records.

Section 48 of Alberta's *Occupational Health and Safety Act* allows access to first aid records upon written request by a Director of Medical Services, Alberta Labour, or an officer who has written authorization from a Director of Medical Services.

Other legislation such as the *Workers' Compensation Act*, the *Health Information Act (HIA)*, the *Personal Information Act (PIPA)* and *Canada's Personal Information and Electronic*

Documents Act may also have provisions authorizing access, use and disclosure of personal information.

A worker can allow his or her first aid record to be made available to other persons but permission must be in writing specifying the information that can be released, the name of the person to whom the information is to be released, the date of consent and the worker's signature.

Employers that conduct incident investigations need to know the name of the worker, the date of the incident, the date the incident was reported and when first aid was given. Details of the injuries and first aid should be limited.

Persons with access to first aid records must keep the information confidential except when disclosing the information as required by Section 48 of the *OHS Act*.

Posting first aid records with the information contained in subsection 183(2) on notice boards or distributing them throughout the company is not allowed. General information that does not identify workers or contain any specifics can be distributed to workers and other work sites to increase safety awareness.

An employer must provide the worker with a copy of their first aid record upon request.

At work sites where owners have entered into an agreement with the prime contractor to provide first aid services and the prime contractor's first aiders are used, the worker can request a copy of his or her first aid record from the first aider. The prime contractor or employer is responsible for ensuring that the worker receives a copy of the first aid record when one is requested.

If the worker requests the first aid record sometime after the injury, the worker should request the record from the employer. If the employer is no longer in business, the worker should direct his or her request to the prime contractor. It is recommended that prime contractors and employers develop a procedure for handling workers' requests.

Tables 1 and 2 of Schedule 2 Low hazard work, high hazard work

Degree of hazard

One of the criteria used when determining the type of first aid services, equipment and supplies that an employer must provide is the degree to which the work is hazardous. Hazard assessment is a method of estimating the potential for a worker to be injured or become ill while performing his or her work. The hazard assessment should include the following elements:

- (a) assessing the likelihood, type and severity of work related injuries and illnesses.
- (b) determining the required first aid services, supplies and equipment.

- (c) conducting a hazard assessment and reviewing the first aid requirements on a regular basis or as circumstances change.

Tables 1 and 2 of Schedule 2 are used to determine if the work performed is low, medium or high hazard work. Work that is neither low nor high hazard is classified as medium hazard work. As the hazard level increases, so do the requirements for first aid services in terms of the number and qualifications of first aid providers and the types and quantities of first aid equipment and supplies.

Low hazard work

Low hazard work is typically clerical or administrative type work. Dispersal sites are classified as low hazard because few workers are normally present there during working hours. Workers usually report to a dispersal site and then move on to the location where work is actually performed.

Low, medium, and high hazard at the same time

Situations commonly arise in which a work site consists of work areas having different hazard classifications. Where work being performed with different hazard classification cannot be separated, employers should classify the entire work site at the highest hazard classification level. Where work can be separated physically or administratively (e.g. the administrative sites have workers completing clerical or administrative duties, these sites are separated from higher-hazard portions of the worksite, the employer has separate first aid plans for the two sites, etc.), the employer may choose to have different hazard classifications at a work site. For example, where there is a work site with low and high hazard work areas separated from one another, the employer must meet the first aid requirements for low hazard and high hazard work respectively, based on the number of workers at each respective portion of the work site. Completion of a hazard assessment may aid in the determination of how to classify work areas.

Industrial process facilities not elsewhere specified

Subsection (b)(xi) of Table 2 refers to “industrial process facilities not elsewhere specified.” For the purposes of the *OHS Code*, an industrial process facility is taken to mean a structure within which, or a location at which, an industrial process is carried out. An industrial process is a procedure involving chemical or mechanical operations that normally process raw materials into a finished product that is usually offered for sale. Industrial processes are often carried out on a very large scale.

Industrial process facilities are of concern because large scale processes can be complex, involving complicated and extensive interactions between workers and materials, machines and processes. These interactions can lead to unexpected consequences that might result in a worker requiring first aid.

Workers at an industrial process facility may be exposed to a variety of hazards. For the purpose of defining the required first aid equipment, supplies and trained staff required at such a facility, the presence of the following hazards should result in the facility being classified as “high hazard work”:

- (a) working in the presence of a biohazardous material, toxic substance or chemical, which, if released, would result in workers needing immediate medical treatment as a result of inhalation or eye or skin contact;
- (b) working in the presence of equipment or machinery containing substances under high pressure, substances that may explode or catch fire, or substances that may react dangerously when combined with another process material;
- (c) using tools, equipment, or machinery for high-speed grinding, cutting, chipping, or drilling;
- (d) working near mobile equipment where there is a possibility of a worker being struck;
- (e) working at elevations;
- (f) entering confined spaces where toxic atmospheres may exist or develop; and
- (g) working where there are other hazard factors that may expose workers to risk of serious injury or occupational disease.

Table 3 of Schedule 2 First aid equipment and supplies

Barrier devices and gloves

Table 3 of Schedule 2 lists the contents of the four types of kits required by this Part. Disposable surgical gloves and resuscitation barrier devices are intended to be used to prevent accidental contact with blood or body fluids. Surgical gloves do not need to be sterile.

Recommended practices

First aid kits should not contain any prescription or non-prescription drugs. Medication administration is beyond the scope of first aid training. The inclusion of over-the-counter medication(s) in first aid kits is not recommended. If an employer determines that it is necessary to provide over-the-counter medication(s) in a first aid kit, a physician should be asked to prepare a policy and procedures to cover their use. Health care professionals should then be designated to give medications. If there are medications at the work site, it is important that there are quality assurance measures to manage the presence of medications (e.g. that there is a regular process to check that the medications have been properly stored, are not expired, etc.).

For more information

 *Medication in First Aid Kits*, Alberta Labour, December 2017


 *Naloxone in the workplace*, Alberta Labour, August 2017

Table 4 of Schedule 2 First aid room requirements

First aid room

Table 4 of Schedule 2 lists the characteristics of a permanent first aid room and the first aid supplies to be contained in that room. First aiders, first aid supplies and first aid equipment need to be readily accessible and located near the work area. A first aid room need only be provided in cases where there are 200 or more workers per shift performing medium hazard work (see Table 6 of Schedule 2), or where there are 100 or more workers per shift performing high hazard work (see Table 7 of Schedule 2).

Supervision of first aid room

When a first aid room is required, the most highly qualified first aid person is in charge of it. In the case of high hazard work involving 100-199 workers per shift at close, distant, or isolated work sites (see Table 7 of Schedule 2), the first aid person in charge should be at least an advanced first aider.

Oxygen cylinders should be hydrostatically tested every five years and the test date marked on the cylinder. Oxygen tank labels should include a Drug Identification Number (DIN) and the fabricator's name and address. Only suppliers licensed to refill oxygen bottles should do so.

Tables 5, 6, and 7 of Schedule 2 First aid requirements for work

First Aid Qualification Levels

The Tables state *minimum* levels to which first aid personnel must be trained for various work site situations. In all cases, these minimum levels can be exceeded. For example, a nurse or advanced care paramedic can replace an advanced, standard or emergency first aider; an advanced first aider can replace a standard or emergency first aider; and a standard first aider can replace an emergency first aider. Table 11.1 summarizes this relationship.

Table 11.1 Comparison of qualification levels

Most Qualified	Nurse or Advanced Care Paramedic (ACP)
	Primary Care Paramedic
	Emergency Medical Responder
	Advanced First Aider
	Standard First Aider
Least Qualified	Emergency First Aider

Blankets

Where reference is made to “3 blankets” in these Tables, at least one of these blankets should be of a woven fabric such as wool, polyester or other material. In addition to providing warmth, such blankets can also be used for positioning or immobilizing the limbs or head during care and treatment. Depending on the work site, one or more of the remaining blankets might be a space blanket used for keeping an ill or injured worker warm.

One worker per shift

As part of the first aid services provided, an adequate number of appropriately qualified first aid personnel as listed in Tables 5, 6 and/or 7 (as appropriate) of Schedule 2 must be available at the work site to respond to any acute illness or injury that might reasonably be expected to occur. Although first aid training is recommended, the *OHS Code* does not require that a worker be trained in first aid if they are the only worker on a shift.

Numbers of first aid personnel required—examples

First aid personnel must be available and accessible during all working hours as required by section 179. When establishing the number of personnel required for work sites involving large numbers of workers, consider the following examples:

Example 1: Low hazard work, close work site, 201 workers at the work site per shift.

Referring to Table 5 of Schedule 2, the employer would require one emergency first aider, two standard first aiders, PLUS one standard first aider for each additional

increment of one to 100 workers above 200 workers. In this case, the employer would therefore be required to provide one emergency first aider and three standard first aiders.

Example 2: Medium hazard work, distant work site, 201 workers at the work site per shift.

Referring to Table 6 of Schedule 2, the employer would require two emergency first aiders, two standard first aiders, either one nurse or one ACP, PLUS one standard first aider for each additional increment of one to 100 workers in excess of 200 workers. In this case, the employer would therefore be required to provide two emergency first aiders, three standard first aiders, and either one nurse or one ACP.

Example 3: High hazard work, isolated work site, 201 workers at the work site per shift.

Referring to Table 7 of Schedule 2, the employer would require four standard first aiders, one advanced first aider, either one nurse or one ACP, PLUS one standard first aider for each additional increment of one to 100 workers in excess of 200 workers. In this case, the employer would therefore be required to provide five standard first aiders, one advanced first aider, and either one nurse or one ACP.

These are minimum requirements and the employer is free to have additional trained first aiders.

Part 12 General Safety Precautions

Highlights


This Part contains sections dealing with restraining hoses and piping, securing equipment and materials, skeleton structures, signallers, tire servicing, vehicle traffic control and working on ice.

Requirements

Section 185 Housekeeping

Slipping and tripping are common workplace hazards. Employers are responsible for making sure that the work site, and in particular entry and exit routes at a work site, are free of waste, materials and equipment. Obstructed entry and exit routes can pose a serious hazard to workers having to leave a work site quickly, as might be required during an emergency. Obstructions may reduce visibility at a work site and may also present a tripping hazard.

Additional information on this topic can be found in the following publication:

 *Slips, Trips and Falls*, Government of Alberta, February 2017.

Section 186 Lighting

Subsection 186(1)

The *OHS Code* does not specify minimum lighting levels. Employers must determine if lighting at the work site is adequate for the tasks being performed and the conditions at the site. Tasks requiring the ability to distinguish detail, such as an electrician working on live circuits at a panel board or a sewing machine operator stitching a fall protection full body harness, will, for example, need to be provided with more lighting than a labourer performing housekeeping duties.

Employers should consider the following factors when establishing lighting levels:

- (a) the type of activity or task being performed;
- (b) the importance of speed and accuracy in performing the visual task; and
- (c) the worker's needs.

Employers and workers interested in recommended types of lighting and minimum lighting levels under various conditions should refer to the *Lighting Handbook - Reference and Application (9th Edition)*, published by the Illuminating Engineering Society of North America (IESNA).

Subsection 186(2)

The employer is responsible for protecting light sources above a working or walking surface against damage. Such damage may result in the partial or total loss of light at the work site or a work area, may expose workers to contact with energized electrical components, or may expose workers to the sharp debris or surfaces of broken bulbs. Each of these examples presents a safety hazard that can be prevented by protecting the light source against damage.

Subsections 186(3) and 186(4)

Emergency lighting must be available if workers are in danger if the normal lighting system fails. Natural daytime lighting cannot be relied upon as a dependable source of emergency lighting.

The employer is responsible for ensuring that an emergency lighting system provides sufficient light to allow workers to safely leave the work site, start any necessary emergency shutdown procedures or restore normal lighting. Where appropriate, emergency lighting must meet the requirements of the *Alberta Building Code*.

Section 187 Pallets and storage racks

All goods, materials and equipment at work sites must be stacked, stored, and secured in such a way that they do not flow, move, roll or collapse. Workers responsible for stacking, storing, or securing goods, materials, and equipment must be trained in the safe methods for doing so (see Part 14 of the *OHS Code*).

Pallets and storage racks are commonly used in storage and warehousing applications. Pallets and storage racks may support heavy loads that have the potential to injure workers and damage equipment if the pallets and racks fail and loads fall. Storage racks in particular must remain structurally sound.

Incidents involving pallets occur for five main reasons:

- (1) poor pallet design;
- (2) poor pallet construction;
- (3) inappropriate use of a pallet for the load or storage method;
- (4) continued use of a damaged pallet(s); and
- (5) poor handling.

The leading causes of storage rack system failure, acting alone or in combination, are:

- (1) poor storage rack design—the rack is inherently unsafe;
- (2) incorrect installation and assembly;
- (3) using the wrong material handling equipment to load and unload the storage system;
- (4) operator error when using material handling equipment; and

- (5) structural problems with the floors or walls of the storage area—supporting structures may be overloaded, floors may not be sufficiently level.

Stacks, shelving and other fixtures for holding or storing materials should be laid out and designed so that there is sufficient access for safe loading and unloading. Storage areas should be specifically designated and be clearly marked. Aisles should be wide enough for the type of storage, and be kept free of obstacles and waste materials. Stacks should not block aisles, walkways, and doors and exists.

Suitable racks should be provided for materials capable of rolling such as steel tubes, bars and piping. Large diameter tubes or pipes can be stored on their sides as drums might be stored (see Figures 12.1 and 12.2).

Figure 12.1 Example of drum rack

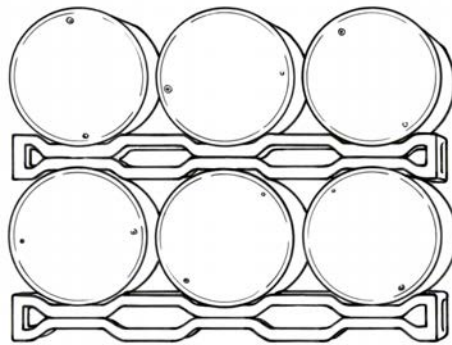
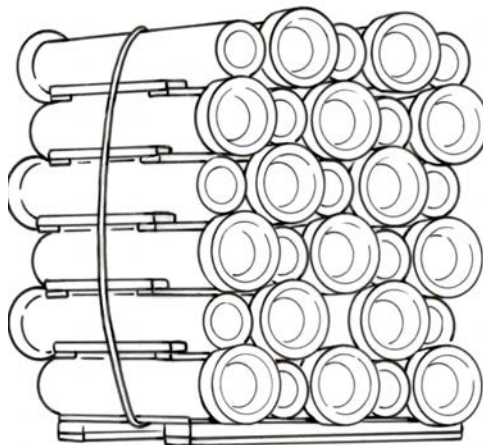


Figure 12.2 Example of pipe storage



Wedges, chocks, stakes or other means should be used to restrain the bottom tier of round objects that are stacked or tiered and that could cause the stack to collapse by rolling or moving.

Racks, shelving, fixtures, etc., should be regularly inspected for damage and other defects that might cause loss of strength or result in injury or damage. Workers must

report to their employer any damage to storage racks as soon as is practical. It is expected that the employer will assess the damage and based on that assessment, may have the damage repaired or the rack replaced.

Additional information on this topic can be found in the following publication:

 *Grocery Warehousing Ergonomics*, United States Department of Labour—OSHA.

Section 187.1 Placement of roofing materials

Roofing materials are typically placed on a roof by the workers of a material supplier, often using a mechanical lift or conveyor. Roofing materials such as bundles of shingles must be placed at least 2 metres away from the roof edge. This reduces the possibility of workers coming too close to the roof edge and falling off. The materials must also be evenly distributed over the roof surface. This ensures that the weight of the material is not concentrated in a single spot that may not be strong enough to support it. Bracing must be installed if there is a chance that the material might slide due to the roof's steepness, weather conditions, etc. (see section 189). If it is necessary for the supplier's workers to be on the roof, they must be protected from falling.

Section 188 Restraining hoses and piping

Hazards associated with hoses or piping and their connections operating under pressure are mainly the result of failures caused by leaks, pulsation, vibration, and excessive pressure. Besides the damage resulting from the release of high-pressure gases or liquids when a vessel or pipe ruptures, fatal injuries can result from the blowout of gauges and valves, and the uncontrolled whipping actions of pipes, tubing, and hoses.

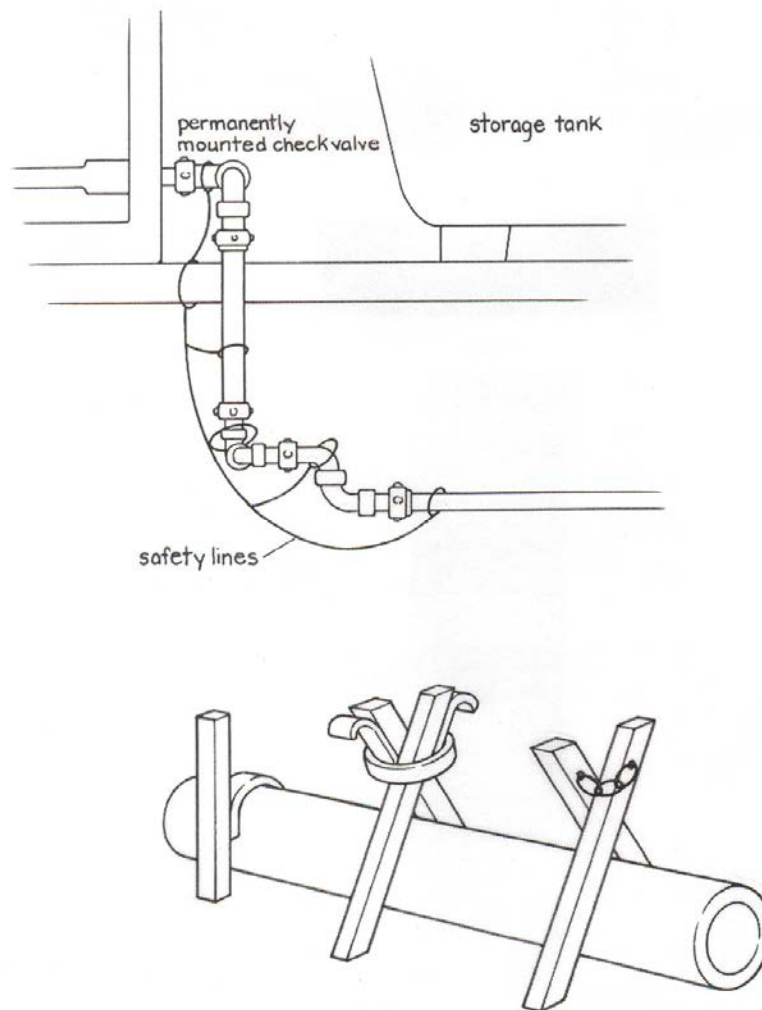
In those cases where failure or disconnection could cause movement that endangers workers, the hoses or piping and their connections must be restrained (see Figure 12.3). Methods of restraint include wiring together hose connections, clamping or bracketing pipe sections, and securing restraint cables at the ends of hoses or pipe that function as loading spouts.

For hoses or piping systems and their connections operating at working pressures of 2000 kilopascals (290 pounds/square inch) or more, an alternative practice is permitted. This alternative requires the employer to ensure that the hoses or piping and their connections are designed, installed, used, inspected and maintained in accordance with the manufacturer's specifications or specifications certified by a professional engineer.

In cases where this provision is used, the employer will be expected to have a copy of the appropriate set of specifications readily available at the work site for inspection by workers or an officer. Inspection and maintenance instructions are expected to include pass/fail criteria for the particular part or function inspected, as well as inspection and

maintenance intervals. The employer should be prepared to provide workers and officers with documentation showing that the inspections and required maintenance were performed as required and that any substandard conditions were corrected.

Figure 12.3 Examples of how to restrain hoses and piping



Section 189 Securing equipment and materials

This section applies to both equipment and materials that may endanger a worker because of dislodgment, movement, spillage or damage. Bags, containers, bundles, etc., stored in tiers must be stacked, blocked, interlocked and limited in height to prevent sliding or collapse. Loads must be secured by tie-downs, bulkheads, or blocking. Rolling equipment, when parked, should have wheels chocked to prevent unintentional movement.

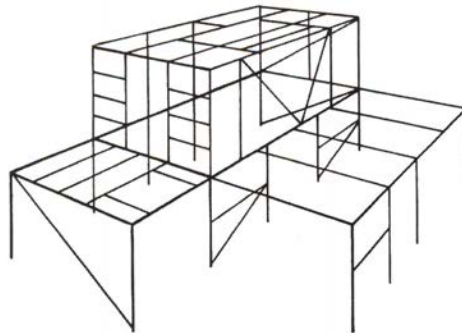
Section 190 Skeleton structures

A structure is anything that is built or constructed, composed of parts joined together in some definite manner. A structural member is an essential or load-carrying part of the structure. A skeleton structure is therefore a supportive arrangement or framework of essential members.

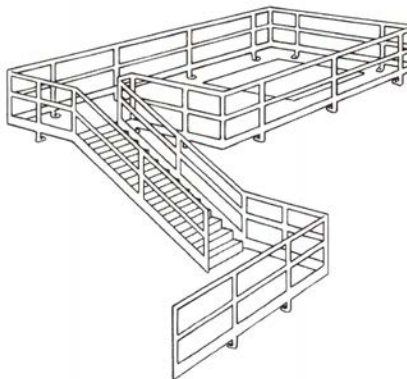
This means that structural members of a skeleton structure are the essential or load-bearing parts of a supportive arrangement or framework of parts that give a structure stand-alone support and stability when erected. This means those columns and beams that are intended to support the remaining parts of the building, including joists and trusses. This does not include “accessory” components such as stairs, guardrails, gratings, platforms, material handling systems and sheeting for floors, walls and roofs. Figure 12.4 shows the difference between skeleton structures and accessory components. Skeleton structures can be built of steel, wood, or any other material considered appropriate for the structure.

Figure 12.4 Examples of skeleton structures and accessory components

12.4 (a) Example of a skeleton structure



12.4(b) Example of accessory components



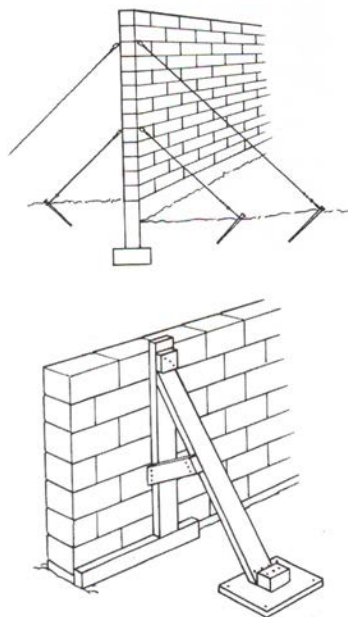
Section 191 Signallers

These general requirements highlight the importance of using and sending signals effectively. Specific requirements appear elsewhere in the *OHS Code* describing specified duties or actions of signallers.

Section 192 Stabilizing a masonry wall

Figure 12.5 shows two acceptable methods of supporting a masonry wall during its erection.

Figure 12.5 Examples of how to support a masonry wall



Section 193 Tire servicing

This section is intended to prevent worker injury caused by the explosion or violent separation of parts of multi-component wheel assemblies. Blowoffs, the sudden, violent springing of tire lock rings, rims or flanges from tires being assembled, are the main hazard. Blowoffs usually happen when tires have just been mounted on their rims and are being inflated. The cause is generally incorrect positioning of tire fastenings but may also include out-of-true rims and defective component parts. Blowouts involving the sudden rupture of a tire or tube may be due to overinflation.

The employer must make sure that the tire manufacturer's inspection and servicing requirements are followed. Truck tire servicing manuals and videos are available from

most manufacturers. The manuals must be kept on hand and readily available so that all workers can access the service manuals.

Only competent workers are permitted to service, inspect, disassemble and reassemble tire and wheel assemblies. If a worker is not competent to perform this work, the worker must be under the direct supervision of a worker who is competent. All of this work must be performed according to the manufacturer's specifications or instructions. Workers performing this work must be trained and understand how to properly inspect and safely service tire and wheel assemblies.

Tires mounted on a split-rim or locking ring wheel (see Figure 12.6) must be inflated in a safety cage as shown in Figure 12.7 or be suitably restrained to contain flying parts in the event of tire rupture or component failure. Some manufacturers recommend partial inflation in a safety cage and full inflation once the tire and wheel assembly is mounted on the vehicle axle.

Figure 12.6 Example of locking ring rim

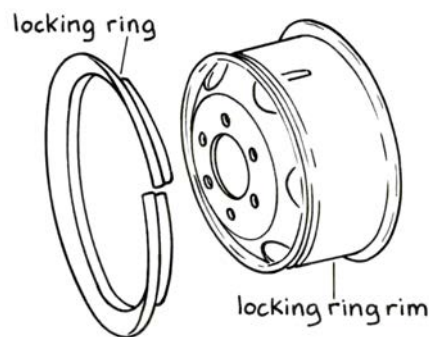
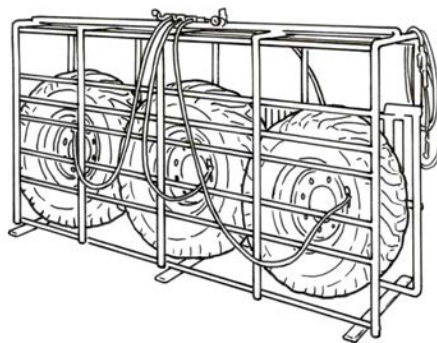
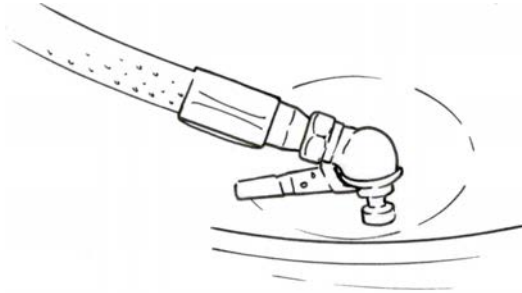


Figure 12.7 Example of cage used to restrain split rim wheel assemblies



When inflating split rim and locking ring wheels, only a clamp-on type connector is allowed. A clamp-on type connector attaches securely to the valve stem and does not require the worker to hold it in place against the valve during inflation (see Figure 12.8). This permits the worker to inflate the tire while standing a safe distance away from the tire.

Figure 12.8 Clamp-on connector

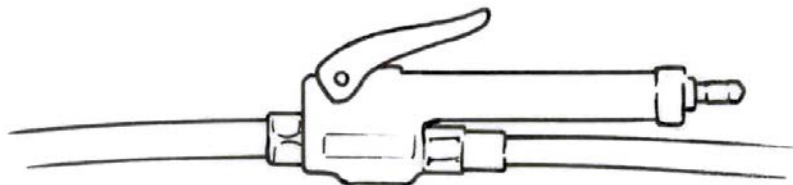


Other types of inflation devices usually require the worker to forcibly hold them against the tire's valve stem, requiring the worker to stand immediately next to the wheel. Such inflation devices are unacceptable because their use places the worker at risk of serious injury in the event of a blowoff or other tire failure.

When a clamp-on air connector is used to inflate a tire, the inflation hose to which it is attached must

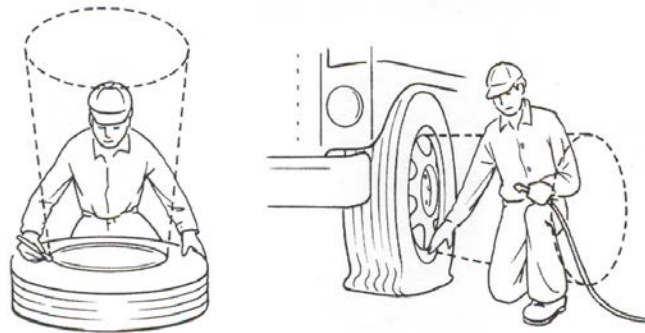
- (a) *permit the use of an in-line pressure gauge*—this eliminates the need for the worker to approach the tire to take a pressure reading with a pencil-type pressure gauge. The pressure gauge can be built directly into the inflation control or the control may have a check valve that permits pressures to be taken using a pencil-type pressure gauge (see Figure 12.9). The worker must be able to monitor tire pressure at a safe distance away from the tire being inflated; and
- (b) *be under positive pressure control by the worker filling the tire*—air can only be delivered to the tire while the worker squeezes or depresses a control. The flow of air must stop immediately upon the worker releasing the control.

Figure 12.9 In-line valve and gauge



The worker is responsible for staying in a safe position while inflating the tire. Figure 12.10 shows examples of the trajectories a wheel assembly might take if it should separate. The hose should be long enough between the clamp-on connector and the in-line valve to allow the worker to stand in a safe position.

Figure 12.10 Examples of trajectories and dangerous work positions



Additional information on this topic can be found in the following publication:



Servicing Tires Safely, Government of Alberta OHS Bulletin, August 2004.

Section 194 Vehicle traffic control


Traffic hazards

This section addresses the importance of protecting workers from traffic hazards. As examples, it applies to

- (a) workers at a construction site assisting with the positioning, loading or unloading of dump trucks;
- (b) workers grading lumber at a sawmill yard where forklifts or front end loaders are used to move logs or lumber;
- (c) workers collecting shopping carts in a parking lot;
- (d) a police officer speaking with a motorist at a roadside location that is not protected from moving traffic by barricades or other effective traffic control; and
- (e) workers at a road construction project where work takes place within an area protected from “public” traffic by barricades.

When determining the presence and degree of danger from traffic to workers, the employer should consider the speed of the moving vehicles and the duties and work location of workers relative to vehicles and powered mobile equipment. Subsection 194(7) lists numerous traffic control devices. Published by the Transportation Association of Canada, the *Manual of Uniform Traffic Control Devices for Canada* presents optimum standards and preferred methods in the design, dimensions and application of traffic control devices.

Additional information on this topic can be found in the following publication:

 *Manual of Uniform Traffic Control Devices for Canada: Sixth Edition*, Transportation Association of Canada.

High visibility apparel

The risk of injury from traffic hazards should first be controlled or eliminated through the use of engineering or administrative controls. Highly visible apparel should be considered to be a second line of defense against such hazards. Environmental conditions such as lighting, rain, fog, snow, smoke and dust can significantly affect the visibility of apparel.

Workers on foot and exposed to the hazards of moving vehicles are required to wear highly visible apparel that is clearly distinguishable. Depending upon conditions at the work site, highly visible apparel may be fluorescent, retroreflective, or a combination of both. A fluorescent material is one that absorbs ultraviolet light in daylight conditions and then emits it as visible light. This property allows the material to radiate more visible light than actually falls on it, making it appear brighter than a non-fluorescent material under the same conditions.

A retroreflective material is one that reflects light back in the direction of the source of the light. Retroreflective materials are preferred over bright colours under dark conditions. The *OHS Code* does not require fluorescent or retroreflective materials used on apparel be of a particular colour or size.

Apparel is considered to be clearly distinguishable if it is of a colour that contrasts with the surroundings in which it is worn. The greater the contrast between the background and workers' apparel, the more distinguishable the workers. Brighter colours are more distinguishable than duller colours under daylight conditions, while bright colours are less effective than fluorescent colours under low light conditions.

Visibility enhancing trim often has both fluorescent and retroreflective properties. Stripes on the arms and legs of apparel can indicate the motion and nature of the object they cover. Such apparel can be more easily distinguished than apparel without stripes.

For optimal performance, apparel should be kept clean and worn as intended — done up properly around the body with no loose or dangling parts, and worn in a way that ensures that no other clothing or equipment obscures the high visibility materials.

Additional information and guidance can be obtained from CSA Standard CAN/CSA Z96-09, *High-visibility safety apparel*.

Section 195 Working on ice

This section makes the employer responsible for performing tests on the ice to make sure it can support the loads that will be placed on it.

Additional information on this topic can be found in the following publication:



Best Practice for Building and Working Safely on Ice Covers in Alberta, Government of Alberta, January 2013.

Part 13 Health and Safety Committees and Representatives

Highlights

- This part applies to any work site that is required to establish a health and safety committee (HSC) or appoint a health and safety representative (HS representative), under section 16 or 17 of the *Occupational Health and Safety (OHS) Act*.
- Section 29(1) and (2) of the *OHS Act* requires an employer or prime contractor to provide training to the joint work site health or safety committee co-chairs or a work site health and safety representative on their duties and functions.
- Section 83 of the *OHS Act* permits the Minister to designate training organizations to provide training to HSC co-chairs and HS representatives. According to s.201 of the *OHS Code*, an employer or prime contractor must use an organization designated by the Minister to provide co-chair, members of the joint work site health and safety committee, and health and safety representative training.
- Section 44 of the *OHS Regulation* allows the Minister to establish criteria for organizations providing training to HSC co-chairs and HS representatives.
- Section 45 of the *OHS Regulation* requires the Minister to establish criteria which must be included in the curriculum for training the co-chairs of a joint work site health and safety committee and health and safety representatives under section 29(1) and (2) of the *OHS Act*.

Requirements

Section 196 Application of this Part

This part applies to any work site which is required to establish an HSC or appoint an HS representative under section 16 or 17 of the *OHS Act*.

For more information, please refer the following documents found at the OHS Resource Portal: <https://ohs-pubstore.labour.alberta.ca/>

LI037—*Do I need a joint work site health & safety committee or a health & safety representative? OHS information for workers, employers, and prime contractors*

LI030-2—*Applying for a joint work site health and safety committee (HSC) or health and safety representative (HS rep) approval—OHS information for workers, employers, and prime contractors*

Section 197 Terms of Reference

Note: This section applies to joint work site health and safety committees only.

This section requires the HSC to establish a terms of reference for their committee.

A “terms of reference” is a document used to outline the committees’ purpose, structure and processes. Under this section, the committee must establish a terms of reference:

- (a) *that ensure, to the extent practicable and subject to section 22(1) of the Act, that the committee’s membership provides appropriate representation of all relevant occupational health and safety concerns at the work sites that the committee relates to,*

Under section 22(1) of the *OHS Act*, no more than half of the committee’s membership can be associated with the management of the work site.

Workers who have authority over other workers, or who are in control of the activities at the work site would not be eligible to sit on the committee as worker representatives. Often, due to the nature of their roles, managers and supervisors would not be able to act as worker committee reps. However, there are instances in which a worker may have the term “manager” or “supervisor” as part of their title without holding any managerial function.

Another consideration in meeting the intent of this subsection, is that the HSC’s membership should, to the extent practicable, be reflective of the hazards encountered by different worker groups at the work site.

Example 1: A Hospital

A hospital should have HSC members representing

- Nurses and physicians;
- Custodians;
- Cafeteria workers;
- Administrative workers; and
- Maintenance staff.

Example 2: A Welding Fabrication Shop

A welding fabrication shop should have HSC members representing

- Administrative workers (human resource assistants, inside sales representatives, payroll clerks, etc.);
- Shipper/receivers;
- Welders;
- Sandblasters;
- Painters; and
- Material handlers.

Using the welding shop example presented in Example 2, the employer would have to ensure that, to the extent practicable, administrative personnel were represented on the HSC;

- (b) *that establish a process for replacing a member of the committee during the member's term of office,*

This requirement is in place to ensure that the committee is able to continue to carry out its functions in the event the committee loses a member.

Committee members might not fulfill their term for various reasons:

- leave to pursue other career opportunities;
- are relocated to another work site;
- retire;
- decide to step down after fulfilling their term, or
- have been terminated by the employer.

In unionized work environments these processes may be laid out in the union's constitution or through an agreement established between unions, if there is more than one operating at the work site.

In non-unionized workplaces the HSC can meet this requirement by having a reserve list of standby members they can draw upon in the event that a new member is needed. The employer could also establish a larger committee than required under the *OHS Act*, so that the loss of a member will still permit the committee to function until such time a new member is appointed. In any case, the HSC would have to develop a process for selecting new members to the committee. This process might specify how soon a selection must take place after a member has left the committee, any onboarding and training considerations and how soon a committee would meet after a new appointment is made.

- (c) *that establish a dispute resolution process to be used in cases where the committee has failed to reach consensus about making a recommendation under section 19(f) of the Act,*

The *OHS Act* sets the making of recommendations as one of the committee's duties, and a dispute-resolution process helps ensure that it can fulfill this duty.

Disputes may arise when the committee members have opposing views on which recommendations they would like to propose. This is more likely to occur when the committee has an even number of members sitting on the committee. The committee needs to establish a process for resolving these disputes.

- (d) *that establishes a process for coordinating with other joint work site health and safety committees established by the same employer or prime contractor, if there is one.*

An employer or prime contractor may have multiple HSCs (or a mix of HSCs and HS representatives) in place when they own or control multiple worksites. They may also voluntarily establish additional HSCs at a large work site or a Director of Inspections may order the employer or prime contractor to establish more than one committee at a particular worksite. In these cases, the committee must develop a process for coordinating with other HSCs.

Section 198 Additional Duties of Health and Safety Committees

Note: This section applies to joint work site health and safety committees only.

Under this section the HSC is required to conduct a general work site inspection at least once prior to each quarterly meeting. It is best practice to carry out inspections prior to each meeting, if the committee is meeting more frequently than each quarter, but it is not required under the legislation. These inspections allow the committee to identify health and safety hazards at the work site that may not have been previously controlled and to identify areas of improvement within the employer's existing OHS program.

Section 199 Disclosure of Personal Information

This section prohibits the HSC, its individual members or a HS representative from disclosing a worker's personal health information or any other personal information related to a worker unless it is required by law (e.g., cooperating with law enforcement in relation to a criminal investigation, needed to ensure health and safety [workplace violence threat], required to be disclosed to an OHS Officer in the course of an inspection or investigation).

Section 200 Duties of Employers, Contractors and Prime Contractors

200(1) *The employer, contractor and prime contractor, if there is one, must:*

- (a) *consult and cooperate with all joint work site health and safety committees and all health and safety representatives for their work sites to develop policies, procedures and codes of practice required by the Act, regulations and this Code,*
- (b) *provide members of all joint work site health and safety committees and all health and safety representatives for their work sites with reasonable opportunity to inform workers on matters affecting occupational health and safety,*
- (c) *ensure that members of all joint work site health and safety committees and all health and safety representatives for their work sites are allowed to examine records, policies, plans, procedures, codes of practice, reports or manufacturer specifications that must be maintained under the Act, regulations and this Code, and*
- (d) *distribute to all joint work site health and safety committees and all health and safety representatives for their work sites any information or documents addressed to the committee*

or representative as soon as reasonably practicable after the information or document is received by the employer, contractor or prime contractor, if there is one.

200(2) *Subsection 1(d) does not apply to a report referred to in section 36 of the Act.*

The purpose of this section is to ensure that the work site HSC or the HS representative is consulted, informed, and able to discuss health and safety matters with affected workers. The employer or prime contractor must support the HSC or HS representative in carrying out its functions.

This section requires the employer or prime contractor to do the following.

- Work with the HSC or HS representative in the development of the work site's policies, procedures and codes of practice. The HSC or HS representative must be able to provide their input into the developmental process and they must be able to review and provide feedback on any proposed policies, procedures or codes of practice.
- The HSC or HS representative must be provided with a reasonable amount of time to discuss health and safety matters that affect workers at the work site.
- The employer or prime contractor must make all records, policies, plans, procedures, codes of practice, reports or manufacturer specifications that must be maintained under the *Act*, regulations and this *OHS Code* available to the HSC or HS representative.
- The employer or prime contractor must provide the HSC or the HS representative with any information or documents addressed to the committee or representative as soon as it is reasonably practical to do. The employer or prime contractor cannot withhold this information from the committee or representative.

However, section 200(2) of the *OHS Act* excludes the employer from having to provide the committee or a health and safety representative with a copy of a report related to a discriminatory action complaint, as outlined under section 36 of the *OHS Act*.

Section 201 Training Standards

This section requires the employer or prime contractor to use an organization designated by the Minister under section 83 of the *OHS Act* to provide training to the HSC co-chairs, members of the HSC, and HS representatives. Section 44 of the *OHS Regulation* allows the Minister to establish criteria for organizations providing the training. Section 45 of the *OHS Regulation* requires the Minister to establish criteria that must be included in a curriculum for training co-chairs or HS Reps under s. 29(1) and (2) of the *OHS Act*.

The curriculum for training under section 29(3) of the *OHS Act* is not prescribed by the Minister.

Section 202 Inspection of Work Site with an Officer

This section requires, where feasible, an OHS Officer to request that a HSC co-chair representing the workers, or their designate, or a HS representative accompany the officer during their inspection. When an OHS Officer makes this request the employer must allow the person time away from work duties to attend the inspection with the officer. As per s.30(2) of the *OHS Act*, the person is entitled to be paid during this time away at the person's applicable rate of pay.

For more information

[LI036](#)—*Joint work site health & safety committees—OHS information for workers, employers, and prime contractors*

[LI040](#)—*Health & safety representatives—OHS information for workers, employers, and prime contractor*

[LI041](#)—*Worker participation in health & safety—OHS information for workers, employers, and prime contractors without health and safety committees or representatives*

Part 14 Lifting and Handling Loads

Highlights

- Section 208 requires employers to provide, where reasonably practicable, appropriate equipment for lifting, lowering, pushing, pulling, carrying, handling or transporting heavy or awkward loads. The intent of this section is to reduce or eliminate the manual handling of materials, and therefore the possibility of injury.
- Section 209 requires that, when it is not reasonably practicable to provide such equipment, loads be adapted to facilitate handling or that manual handling be otherwise minimized.
- Section 209.1 requires that patient handling equipment be incorporated into the design and construction of health care facilities.
- Section 209.2 requires employers to develop and implement a patient handling program if workers are required to lift, transfer or reposition patients.
- Section 210 requires employers to implement hazard assessments of manual materials-handling activities.
- Section 211 requires employers to investigate and take corrective measures (if indicated) whenever workers report symptoms of musculoskeletal injuries they believe to be work related.
- Section 211.1 requires that workers exposed to the possibility of musculoskeletal injury be trained in how to eliminate or reduce that possibility.

Requirements

Section 208 Equipment

Subsection 208(1)

The lifting and handling of loads, usually called manual materials handling, is often physically demanding work. Lifting and handling involves the activities of lifting, pushing, pulling, carrying, handling or transporting loads. The intent of this subsection is for employers to reduce the amount and type of manual handling that workers must do. By doing so, workers and employers may experience a reduction in the number of worker injuries (fewer sprains, strains, back injuries), a reduction in the number of lost-time claims, increases in efficiency and productivity, and fewer product losses through damage.

To accomplish this, employers must provide, where reasonably practicable, appropriate equipment that will help workers lift, lower, push, pull, carry, handle or transport heavy or awkward loads. In many cases the equipment will cost little; in others a meaningful investment may be necessary.

Figures 14.1 through 14.38 show examples of the type of equipment that can be used to eliminate or minimize the lifting and handling of loads.

Subsections 208(2) and 208(3)

The employer is responsible for making sure that workers use the equipment provided. Further, as required by section 15 of the *OHS Regulation*, workers must be trained in the safe operation of the equipment they are required to operate. Worker training must include the following:

- (a) the selection of the appropriate equipment;
- (b) the limitations of the equipment;
- (c) an operator's pre-use inspection;
- (d) the use of the equipment;
- (e) the operator skills required by the manufacturer's specifications for the equipment;
- (f) the basic mechanical and maintenance requirements of the equipment;
- (g) loading and unloading the equipment if doing so is a job requirement; and
- (h) the hazards specific to the operation of the equipment at the work site.

Workers must use the equipment provided and must apply the training that they have received.

Subsection 208(4)

For the purposes of section 208, a heavy or awkward load includes equipment, goods, supplies, persons and animals. As a result, this section applies not only to industrial settings where objects are handled, but also to workplaces such as hospitals, long term care facilities, veterinary clinics, pet stores and zoos where persons and animals are handled.

The lifting and handling of persons and animals presents its own set of challenges because of unpredictable movements, lack of appropriate lifting "handles," and the possibility that the person or animal resists being lifted and handled.

For more information


General manual materials handling



Manual Handling in the Manufacturing Industry, Department of Labour New Zealand, August 1991.



Code of Practice for Manual Handling, Department of Labour New Zealand, June 2001.

 *Manual Handling at Work—A brief guide, Health and Safety Executive United Kingdom, November 2012.*


 *The Learning Zone—Manual Handling.*

Figure 14.1 Lever to lift and transport heavy objects

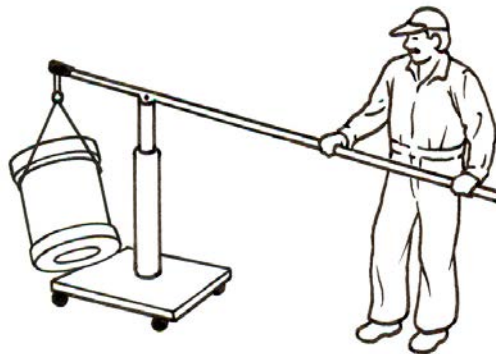


Figure 14.2 Two-wheeled trolley for moving doors and windows

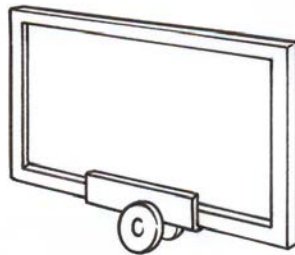


Figure 14.3 Scissor lift to raise load at loading dock

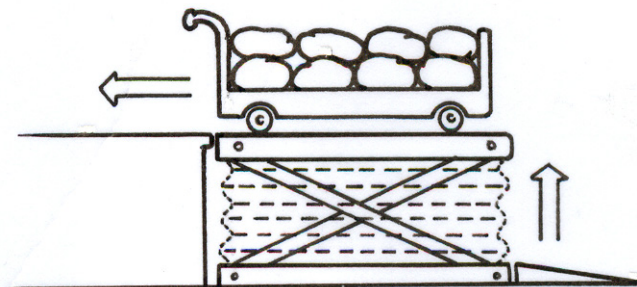


Figure 14.4 Rollers in floor of cargo truck

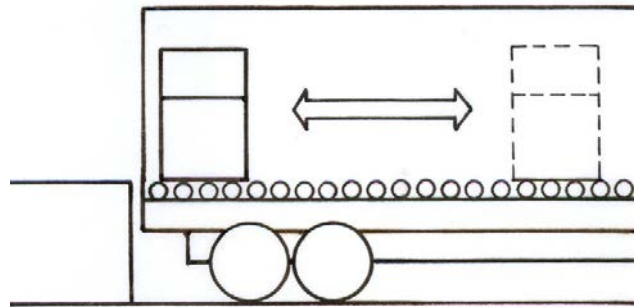


Figure 14.5 Cart modified as tool caddy

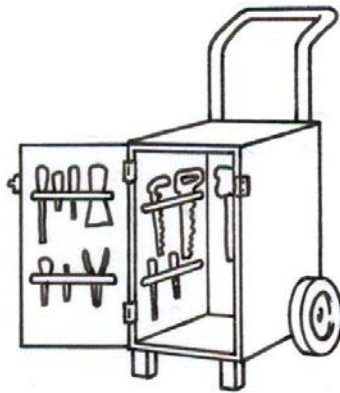


Figure 14.6 Hand truck with loads raised off the floor

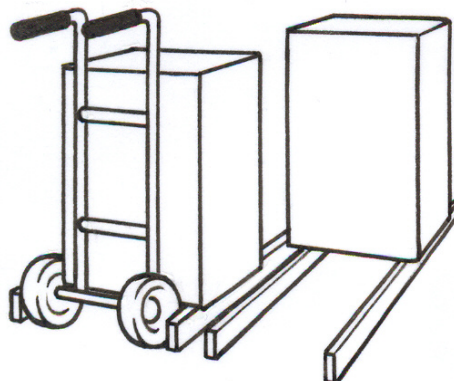


Figure 14.7 Hand trolley for bagged materials



Figure 14.8 Oversized box modified for two-person lifting

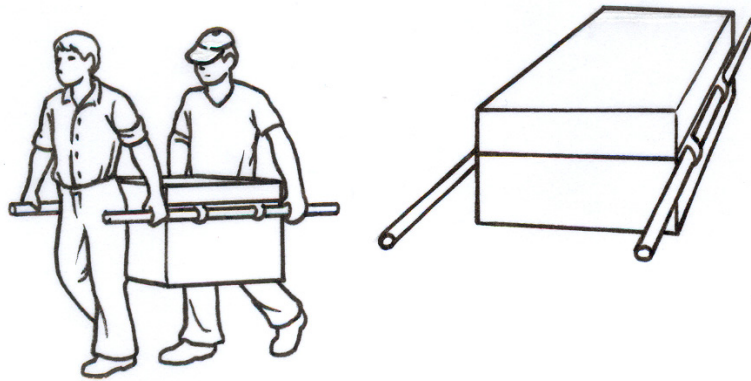


Figure 14.9 Specialized hand truck for moving spooled wire

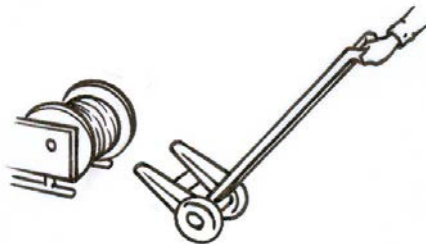


Figure 14.10 Wheeled dolly for awkward access



Figure 14.11 Jig for holding and securing work piece

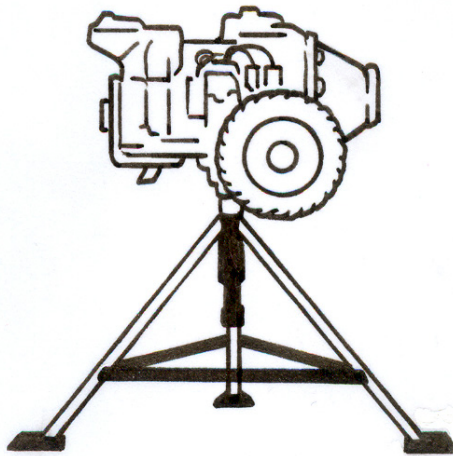


Figure 14.12 Drum lifter for pouring liquids

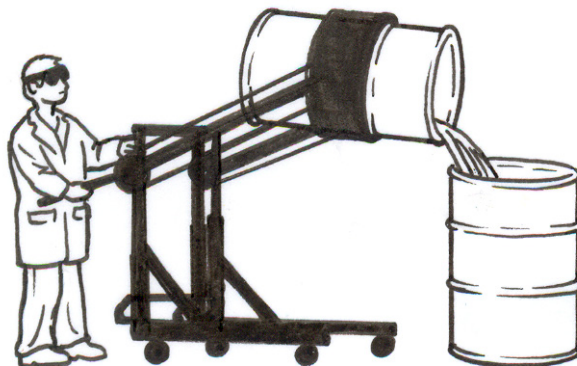


Figure 14.13 Rotating pallet holder



Figure 14.14 Magnetic handles for carrying sheet metal



Figure 14.15 Magnetic lifting head on overhead crane

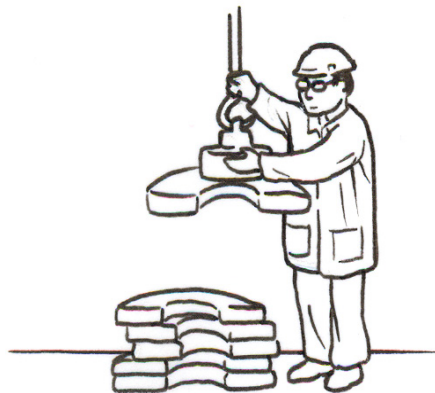


Figure 14.16 Spring-loaded hand truck platform that eliminates stooping

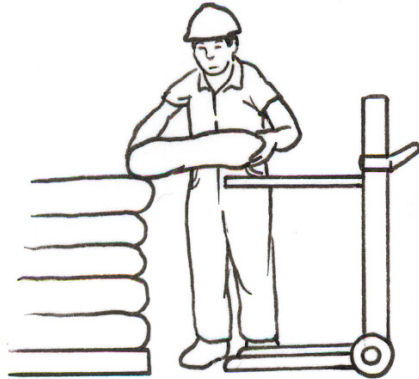


Figure 14.17 Sliding cargo floor

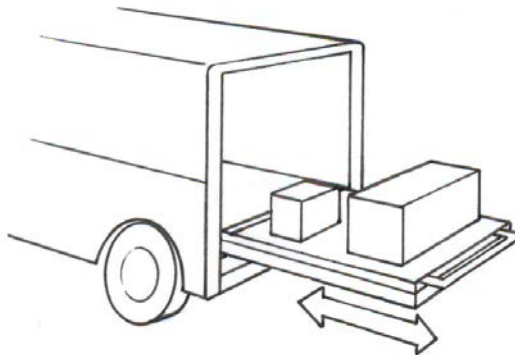


Figure 14.18 Hand operated hoist

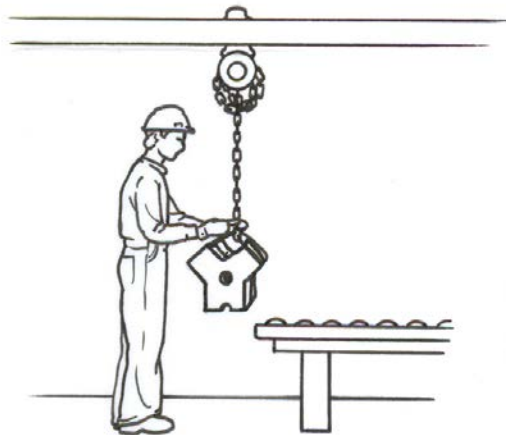


Figure 14.19 Heavy loads suspended from and moved on overhead trolleys

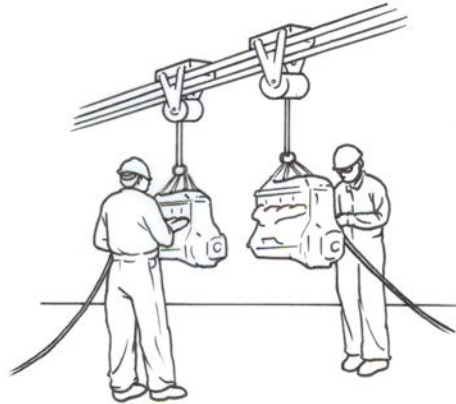


Figure 14.20 Roller conveyor



Figure 14.21 Variable height scissor lift

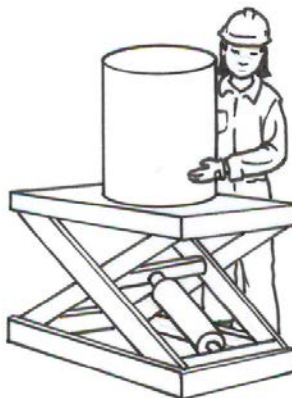


Figure 14.22 Variable height mobile scissor lift truck



Figure 14.23 Four-wheel drum truck



Figure 14.24 Drum lifter



Figure 14.25 Forklift truck with specialized drum attachment



Figure 14.26 Lifter for manhole covers



Figure 14.27 Wheeled dolly for moving small, heavy items

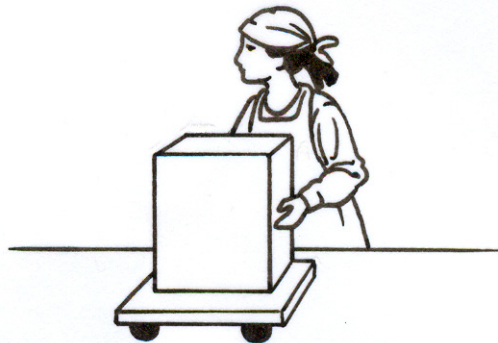


Figure 14.28 Hydraulic jig mechanically positions and holds work piece

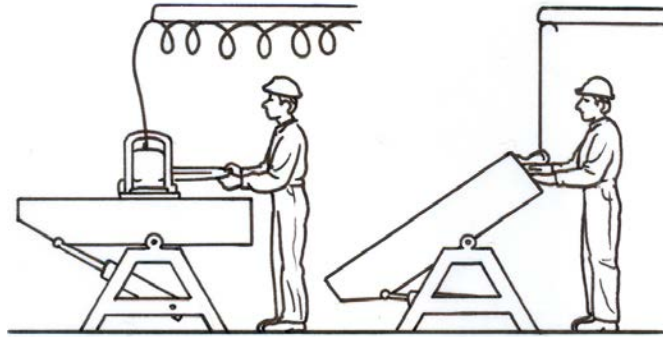


Figure 14.29 Overhead crane

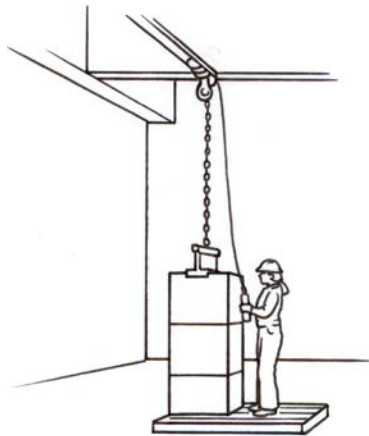


Figure 14.30 Mobile floor crane

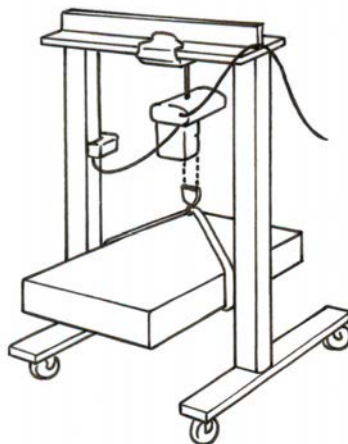


Figure 14.31 Vacuum lifter

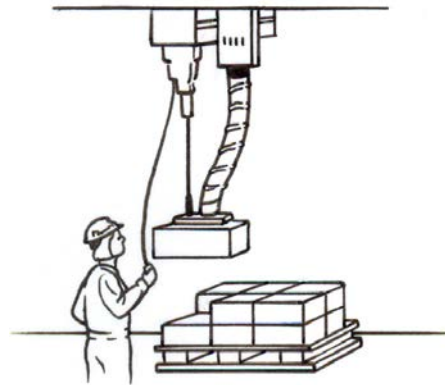


Figure 14.32 Electric powered hoist on moveable davit arm

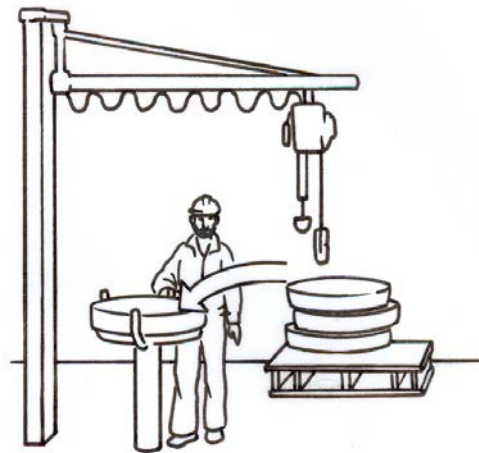


Figure 14.33 Specialized attachment for lifting stack of boxes

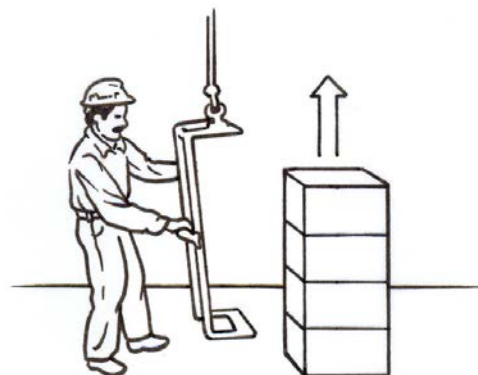


Figure 14.34 Spring-mounted weigh scale platform reduces unnecessary handling

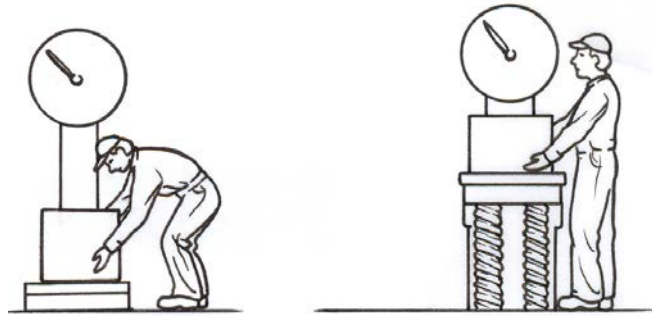


Figure 14.35 Hose to container on trolley reduces lifting of liquid-filled container

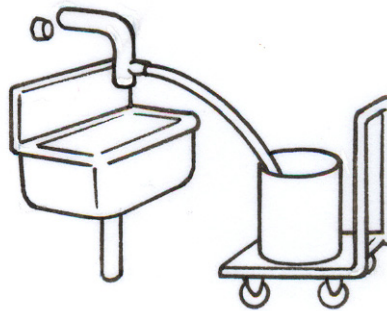


Figure 14.36 Pouring device eliminates handling of container filled with hot liquid



Figure 14.37 Self height-adjusting storage container that turns

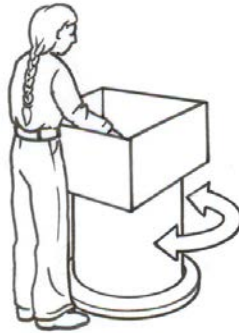
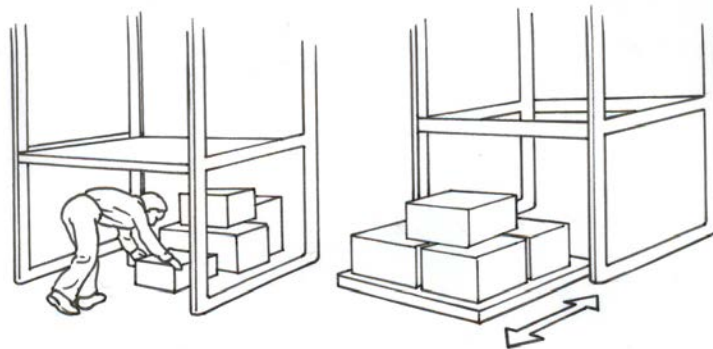


Figure 14.38 Sliding pallet



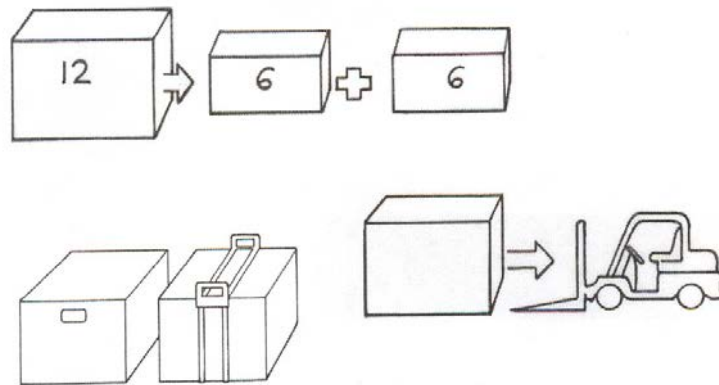
Section 209 Adapting heavy or awkward loads

In some situations, and with a particular heavy or awkward load, it may not be reasonably practical for the employer to provide equipment as required by section 208. In such circumstances the employer is required to

- (1) adapt the load to make it easier for workers to lift, lower, push, pull, carry, handle or transport the load without injury. Examples of how to do this include:
 - (a) reducing the weight of the load by dividing it into two or more manageable loads (see Figure 14.39);
 - (b) increasing the weight of the load so that no worker can handle it and therefore mechanical assistance is required (see Figure 14.39);
 - (c) reducing the capacity of the container;
 - (d) reducing the distance the load must be held away from the body by reducing the size of the packaging; and
 - (e) providing handholds (see Figure 14.39); or

- (2) otherwise minimize the manual handling required to move the load. Examples of how to do this include:
- (a) team lift the object with two or more workers;
 - (b) improve the layout of the work process to minimize the need to move materials;
 - (c) reorganize the work method(s) to eliminate or reduce repeated handling of the same object;
 - (d) rotate workers to jobs with light or no manual handling; and
 - (e) use mobile storage racks to avoid unnecessary loading and unloading.

Figure 14.39 Examples of dividing a load, increasing the weight of a load, and providing a load with lifting handles



Some comments about lifting technique

For many years, workers were taught to keep their backs straight and “lift with your legs.” Despite years of train-the-trainer programs preaching this approach, back injuries have not decreased so researchers have questioned this method of lifting. In practice, most people use a semi-squat posture, with both the back and knees slightly bent.

People make up their own minds as to the most efficient way of lifting loads in terms of energy and time. This so-called freestyle technique is fine as long as the following basic principles are followed:

- (1) *keep the natural curve in the lower back*—when standing straight, the lower back naturally curves to create a slight hollow. Always try to maintain this curve when lifting, lowering or moving objects. The spine and back are their most stable in this position;
- (2) *contract the abdominal muscles*—contract the abdominal muscles during lifting, lowering or moving activities. This improves spine stability. Sometimes described as “bracing,” contracting the abdominal muscles even slightly (as little as four to five percent) improves spine stability and reduces the likelihood of injury;

- (3) *avoid twisting*—twisting the back can make it less stable, increasing the likelihood of injury. Bracing helps reduce any tendency to twist; and
- (4) *hold it close*—keep the load as close to the belly button and body as possible. Doing so reduces the strain on muscles of the back and trunk. If necessary, protective clothing such as leather aprons should be used so that sharp, dirty, hot, or cold objects can be held as close to the body as possible.

Some comments about pushing and pulling

Whenever possible, loads should be pushed rather than pulled (see Figure 14.40). The reasons for this include:

- (a) the feet can be run over and the ankles struck painfully when pulling carts or trolleys;
- (b) pulling a load while facing the direction of travel means that the arm is stretched behind the body, placing the shoulder and back in an awkward posture. This increases the likelihood of injury to the shoulder and arm;
- (c) pulling while walking backwards means that the person is unable to see where he or she is going; and
- (d) most people can develop higher push forces than pull forces as they lean their body weight into the load.

Trolleys and carts should be sized and designed to allow almost any worker to move a load without excessive effort (see Figure 14.41).

Figure 14.40 Pushing is preferred to pulling with an arm extended backwards

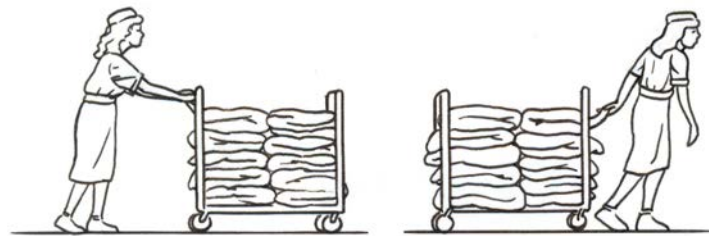
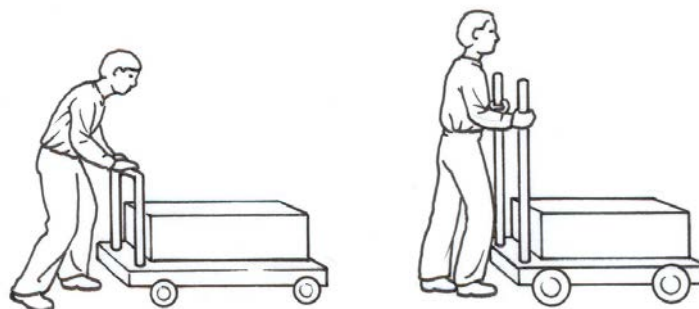


Figure 14.41 Cart push bar must be at a height suitable for all workers



For more information



Lifting and Your Back—Some Fresh Ideas, Government of Alberta, February 2017



Let's Back Up a Bit—Some Truths About Back Belts, Government of Alberta, OHS Bulletin, August 2010



Seven Myths about Back Pain, Government of Alberta, February 2017



Sitting and Preventing Back Pain, Government of Alberta OHS Bulletin, August 2010



Guide to Workplace Ergonomics, Darcor Limited, 2014

Sections 209.1 and 209.2 General Comments

Healthcare organizations have identified several challenges in trying to reduce injuries related to patient handling tasks. These include:

- (a) lack of appropriate numbers and types of patient lifting devices;
- (b) facility design issues that compromise the ability to provide proper ergonomic solutions to lifting and transferring tasks;
- (c) reluctance of staff to employ mechanical lifting aids in patient handling tasks,
- (d) inadequate training of caregivers in biomechanics;
- (e) lack of communication about the status of patients, i.e., requirements for specific lifting/transferring strategies; and
- (f) increased weight of many patients, impacting the ability to use standard lifting devices.

Section 209.1 Work site design—health care facilities

An effective method of reducing patient handling injuries is the provision of mechanical devices to assist in patient lifts, transfers and repositioning tasks. Successful musculoskeletal injury prevention programs are those that reduce manual lifting and increase the use of equipment that limits physical stress on workers.

This section requires that appropriate patient lifting equipment be incorporated into the design and construction of new health care facilities and when existing facilities undergo renovation.

This equipment is meant to include mobile patient lifts (see Figure 14.42) and ceiling lifts.

Figure 14.42 Example of patient lift





Choosing appropriate equipment can be quite challenging, as the need for flexibility in the healthcare environment is significant. The following criteria can be considered in area design configuration:

- (a) ceiling lifts should track all the way into the bathroom;
- (b) adequate space should be provided for lifting, transferring, toileting and performing other care duties;
- (c) sufficient clearance beside, at the foot of, and on the transfer side of the bed to allow for two caregivers and equipment as necessary, i.e., equipment may include a stretcher, wheelchair, lifting device, etc.;
- (d) under-bed clearance should accommodate patient lifting devices;
- (e) sufficient appropriately placed electrical outlets to allow the lift device(s) to be used;
- (f) in bathrooms, doorway entrances and the space within should accommodate wheelchairs, lifts and up to two caregivers in addition to the patient;
- (g) consider bariatric equipment and its required clearances. Manufacturers may have guidebooks for architects and planners that provide specific clearances for room design;
- (h) in bathrooms, toilet height should take into account lift equipment requirements;
- (i) corridors of sufficient width to allow patient lifting equipment to be moved and stored;
- (j) doorways that are wide enough to accommodate patient lifting equipment;
- (k) hard, smooth flooring (no carpet) that allows for easy movement of wheeled patient lifting equipment; and
- (l) sufficient storage space for patient lifting equipment and supplies to ensure that they are readily available.

This requirement is not retroactive. This section does not apply to new facility construction, alterations, renovations or repairs started before July 1, 2009.

For more information

 *New Zealand patient handling guidelines: the Liten up approach, 2003.*

 *Provincial Safe Resident Handling Standards for Musculoskeletal Injury Prevention in British Columbia.*

Section 209.2 Patient/client/resident handling

This section requires that an employer develop and implement a safe patient/client/resident handling program if workers are required to lift, transfer or reposition patients/clients/residents. The program must include an annual evaluation of its effectiveness at preventing worker injuries. Once implemented, employers are responsible for ensuring that workers follow the program. In turn, workers are required to follow the safe handling program.

To maximize the success and benefits of such a program, it should

- (a) identify key stakeholders to facilitate buy-in and participation;
- (b) develop a budget to address initial and on-going funding requirements. This reduces the likelihood of surprises and supports sustainability of the program;
- (c) identify implementation issues and address each one of them;
- (d) define accountabilities so that program performance can be evaluated; and
- (e) include a program evaluation plan that provides the building blocks for continuous improvement efforts and provides the necessary feedback to assess progress. To assess success, a mechanism must be in place to identify outcome measures, collect and analyze data, and report results.

For more information

 *No Unsafe Lift Workbook, Worksafe Alberta.*

The No Unsafe Lift Workbook provides a complete and comprehensive framework for developing, implementing and evaluating a patient handling program.

Section 210 Assessing manual handling hazards

Before a worker manually lifts, lowers, pushes, pulls carries, handles or transports a load that could injure the worker, an employer must perform a hazard assessment that considers

- (a) the weight of the load;
- (b) the size of the load;
- (c) the shape of the load;
- (d) the number of times the load will be moved; and
- (e) the manner in which the load will be moved.

The purpose of performing a hazard assessment is to identify workplace hazards specific to the lifting and handling of loads that can cause or aggravate an injury. The hazard assessment must meet the general requirements for hazard assessments as required by Part 2 of the *OHS Code*. Readers are referred to the explanation to Part 2 for information about hazard assessment, elimination and control.

A hazard assessment tool appropriate to the criteria listed above is presented in the Safety Bulletin *Lifting and Handling Loads—Part 2 Assessing Ergonomic Hazards*, listed below.

Many checklists and assessment tools are available from a variety of sources. The recommended assessment tool is part of one that was introduced in May 2000 by the State of Washington, Department of Labor and Industries, and is now also being used in British Columbia. The use of similar hazard assessment tools that are equally effective is acceptable.

Once the assessment has been completed and hazards identified, they must be eliminated or controlled. Suggestions for eliminating and controlling lifting and handling hazards can be found in the Safety Bulletin *Lifting and Handling Loads—Part 3 Reducing Ergonomic Hazards*, listed below.

For more information



Lifting and Handling Loads—Part 1 Reviewing the Issues, Government of Alberta, August 2010.



Lifting and Handling Loads—Part 2 Assessing Ergonomics Hazards, Government of Alberta, August 2010.



Lifting and Handling Loads—Part 3: Reducing Ergonomic Hazards, August 2010.

Section 211 Musculoskeletal injuries

Musculoskeletal injuries, or MSIs, go by many different names, including repetitive strain injuries, repetitive motion injuries and cumulative trauma disorders. Whatever the term used, the effect is the same: bones, joints, ligaments, tendons, muscles and other soft tissues are being injured.

MSIs also have some more familiar names. Tennis elbow is an MSI that can result from the repetitive swinging of a tennis racquet or from other repetitive arm movements similar to those used by tennis players. Other MSIs have similar names that indicate the type of work being done, for example, carpet layer's knee, letter carrier's shoulder and pizza cutter's wrist. MSIs also have medical names such as carpal tunnel syndrome, thoracic outlet syndrome and tendonitis.

Section 1 of the *OHS Code* defines a musculoskeletal injury (MSI) as an injury to a worker of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissues that is caused or aggravated by work and includes overexertion injuries and overuse injuries.

Overexertion and overuse injuries can be described as follows:

- (a) overexertion injuries, e.g., sprains, strains and tears resulting from excessive physical effort as might happen during lifting, lowering, pushing, pulling, etc; and
- (b) overuse or repetitive motion injuries, e.g., resulting from repeated overuse of a part of the body. While it is commonly believed that computer users experience high levels of repetitive motion injury, the problem is rarely recognized among those workers who use their hands extensively in food processing, materials handling and the professional trades.

The reason MSIs are the subject of the *OHS Code* is that they are the leading cause of lost-time injury claims in Alberta. In each of the years from 1997 to 2008, according to data provided by the Workers' Compensation Board — Alberta, the percentage of all lost-time claims due to MSIs ranged from approximately 26 percent to 30 percent. The next closest category, "struck by object," represented approximately 13 percent of all claims. MSIs are a serious source of injury and a largely unrecognized source of productivity and financial loss for employers.

Subsection 211(a)

If a worker reports to the employer what the worker believes to be work related symptoms of an MSI, the employer must review the activities of the worker to identify work-related causes of the symptoms, if any.

An injury is probably work related if

- (a) an event at the work site either caused or contributed to the resulting injury; or
- (b) an event at the work site *significantly* aggravated a pre-existing injury.

Work-relatedness is presumed for injuries resulting from events occurring at the work site. An injury is not work related if it involves signs or symptoms that surface at work but result solely from a non-work-related event that occurs outside the workplace.

Sometimes it is not obvious whether the injury event occurred at the work site or occurred away from work. In such cases the employer should evaluate the worker's duties and working environment to decide whether or not one or more events at the work place either caused or contributed to the resulting injury, or significantly aggravated a pre-existing condition or injury. In some cases, the help of an ergonomist, physician, occupational health nurse, occupational therapist or similarly qualified person may be necessary.

As a guideline, a preexisting injury can be considered to have been “significantly aggravated” when an event at the work site

- (a) results in the worker having to be away from work for one or more days;
- (b) results in the worker having their work activities restricted to prevent further aggravation; or
- (c) results in the worker having to transfer jobs and the transfer would not have occurred but for the occupational event.

An injury is usually considered to be a preexisting condition if it resulted solely from a non-work-related event that occurred outside the workplace.

Signs and symptoms

Employers and workers need to know that redness, swelling and the loss of normal joint movement are the first signs of an MSI, i.e., the things that can be seen. Symptoms are what the worker feels but cannot be seen, i.e., numbness, tingling, or pain (see Table 14.1).

Table 14.1 Common symptoms of an MSI

Symptom	Description or observation
Pain (sharp, shooting or dull)	Often the most common feeling, pain may be present at rest or may occur when the person tries to use the injured body part
Tenderness	The area may be painful or sensitive to touch
Heat or burning	The injured area may feel warmer than normal. The injured person may feel a burning sensation
Tingling, pins and needles, or numbness	The injured person may feel a tingling sensation along the injured area. The injured person may also lose feeling at or around the injured area
Heaviness	The injured body part may feel as if it weighs more than normal
Clumsiness or weakness	The injured worker may drop items frequently or find it difficult to grasp or hold onto objects. The injured person may find it difficult to hold onto things that would normally be easy to hold.
Cramping or spasm	Muscles may stay in a contracted state or contract and relax on their own

Source: *An Ergonomics Guide for Kitchens in Healthcare*, Occupational Health and Safety Agency for Healthcare (OHSAH) in BC, 2003

Stages of injury

Most workers affected by MSIs do not realize that if nothing is done to correct their problems they may be headed for increasing, and potentially devastating, discomfort and disability. There are three stages of injury.

Stage 1

- Discomfort may persist for weeks or months but is reversible.
- Most workers experience pain and weakness during work activities but improve on days away from work.
- Interference with work tasks is minimal.

Stage 2

- Discomfort may persist for months.
- Symptoms begin more quickly and last longer.
- Physical signs may be present, and sleep may be disturbed.
- Work tasks may be difficult to perform.

Stage 3

- Discomfort may persist for months or years.
- Symptoms are always present, even at rest.
- Activities of daily living are disrupted, and sleep is disturbed.
- The person is unable to perform light duties at work.
- The likelihood of recovery is poor.

Worker reports symptoms to employer

The worker reporting symptoms to the employer is what triggers the employer's obligation to

- (a) review the worker's activities;
- (b) review the activities of other workers doing similar tasks; and
- (c) identify work-related causes of the symptoms, if any.

The worker can report his or her symptoms to the employer verbally or in written form. The employer may have an injury-reporting process already in place, in which case it should be followed. The worker may provide the employer with documentation from a physician but this is not necessary to trigger the employer's obligations.

Once the worker has reported his or her symptoms, the employer must review the worker's activities and those of other workers doing similar tasks. This action serves at least two purposes:

- (1) comparing work activities among workers may provide an insight into why the worker is experiencing a problem while other workers may not. Perhaps there are issues related to work station design, equipment use, technique, etc., that might explain why the worker is experiencing symptoms; and
- (2) other workers doing similar tasks may also be experiencing symptoms, or may be prone to similar injury, but have not yet gotten to the point that they have reportable symptoms. By reviewing the activities of these other workers, the employer may be able to intervene before they experience symptoms and injuries.

While comparing and reviewing the activities of the injured worker and other workers doing similar tasks, the employer must identify any work-related causes of the symptoms. This is really a hazard assessment that should use an assessment tool or checklist specific to MSIs. An assessment tool appropriate to MSIs is presented in the Safety Bulletin *Musculoskeletal Injuries—Part 5 Assessing Ergonomic Hazards*, list at the end of this explanation. Using the assessment tool will help to determine if the causes of the symptoms are work-related. The help of an ergonomist, physician, occupational health nurse, occupational therapist or other professional knowledgeable about MSIs may be needed to help the employer with this review, identification and assessment of work-relatedness.

Many checklists and assessment tools are available from a variety of sources. The recommended assessment tool is one that was introduced in May 2000 by the State of Washington, Department of Labor and Industries, and is now also being used in British Columbia. The use of similar hazard assessment tools that are equally effective is acceptable.

Risk factors

Three major factors that involve how a worker's body functions during work contribute to MSIs. They are awkward body positions, excessive force (forceful exertions) and repetition.

Awkward body positions

Awkward body positions are often the result of the location and orientation of the object being worked on, poor workstation design, product design, tool design or poor work habits (see Figures 14.43 through 14.49). Less-than-optimal postures such as leaning forward from the waist for extended periods of time, or bending the neck downwards at an exaggerated angle, can load muscles with "static work." Static work involves muscles being tensed in fixed positions and over time, becoming tired, uncomfortable, and even painful.

Figure 14.43 Raising and tilting the bin can eliminate an awkward posture

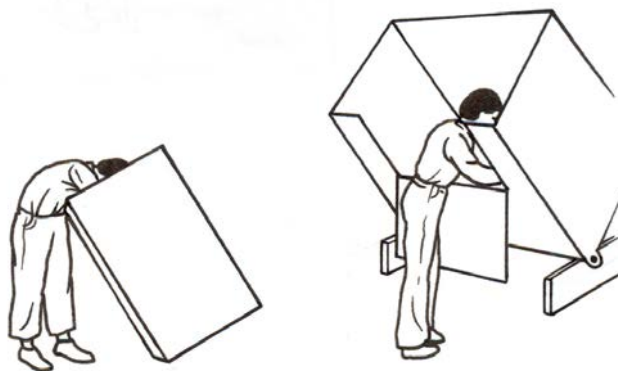


Figure 14.44 Placing the conveyor closer to the worker reduces excessive reaching and an extended body position

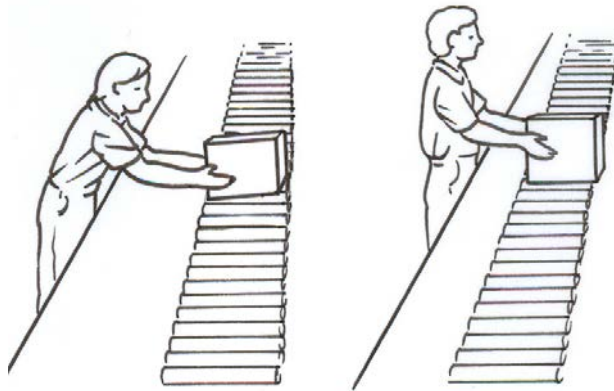


Figure 14.45 Example of heavy, static work



Figure 14.46 A raised work platform can eliminate an awkward posture

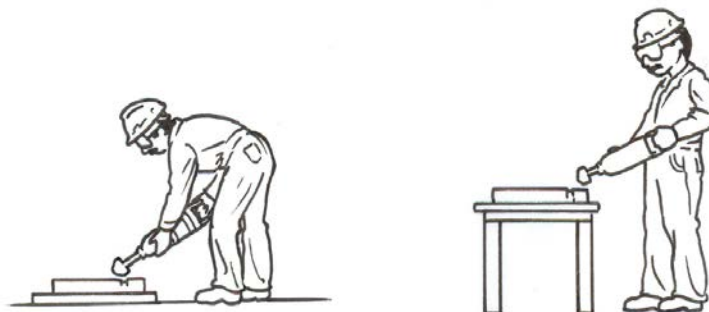


Figure 14.47 A wheeled footstool can make awkward work comfortable

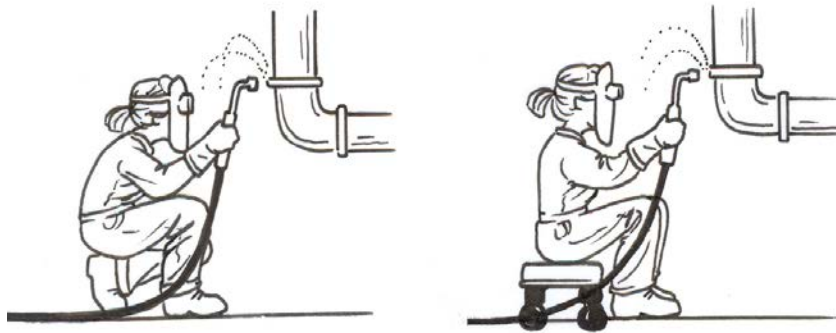


Figure 14.48 A tall, tilting table eliminates an awkward work position

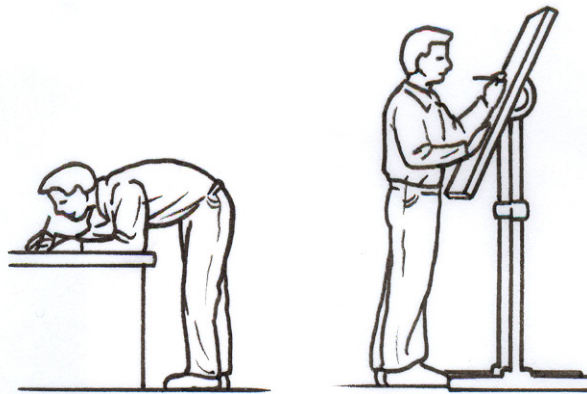


Figure 14.49 An elevated work platform reduces awkward overhead reaches



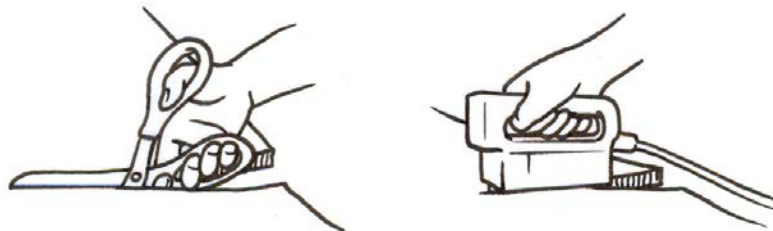
Forceful exertions

Forceful exertions (excessive force) may overload muscles, tendons and ligaments. Forceful exertions are commonly used when lifting, pushing, pulling and reaching. A packer on an assembly line for example may often use a highly forceful grip to assemble a lightweight item or lift a box or carton, especially if it is slippery or difficult to grasp. Awkward wrist and arm positions may also contribute to the problem (see Figures 14.50 and 14.51).

Figure 14.50 A bent tool eliminates an awkward wrist position and provides good grip



Figure 14.51 Electric scissors can eliminate the high hand forces required to cut thick material



Repetition

Repetitive movements eventually wear the body down. Without sufficient time to recover between repetitions, muscles become tired and may cramp. Other muscles try to help but may also become tired, cramp and become injured.

How quickly this happens depends on *how often* a repetitive motion is performed, *how quickly* it is performed, and for *how long* the repetitive motion continues. Repetitive work is more of a problem when it is combined with awkward body positions and forceful exertions. A worker who packages a small product day after day or who uses a stapler or power nailer to assemble wooden frames are examples of workers performing repetitive work.

Subsection 211(b)

Once the assessment has been completed and if the causes of the symptoms are work related, then the employer must eliminate or control the causes to try to avoid further injuries. Suggestions for eliminating and controlling MSI hazards can be found in the Safety Bulletin *Musculoskeletal Injuries—Part 6 Reducing Ergonomic Hazards*, listed below.


For more information


-  *Wrist Splints and MSIs*, Government of Alberta OHS Bulletin, September 2010.
-  *How to Use Wrist Rests*, Government of Alberta OHS Bulletin, September 2010.
-  *Proper Height of Work Surfaces*, Government of Alberta OHS Bulletin, September 2010.
-  *Anti-Fatigue Matting*, Government of Alberta OHS Bulletin, August 2010.
-  *All Shook Up—Understanding Vibration*, Government of Alberta OHS Bulletin, May 2004.
-  *Hand Tool Ergonomics—Tool Design*, Government of Canada.
-  *Determining The Size Of An Access Opening*, Government of Alberta OHS Bulletin, August 2010.
-  *Exercise Balls Instead of Chairs? Maybe Not*, Government of Alberta OHS Bulletin, August 2010.
-  *Fatigue, Extended Work Hours and Workplace Safety*, Government of Alberta, February 2017.
-  *Focus on Human Performance Part One: Sleep Inertia*, Government of Alberta OHS Bulletin, September 2010.
-  *Focus on Human Performance Part 2: Working in the Cold*, Government of Alberta OHS Bulletin, September 2010.
-  *Good Product Design—Avoiding the Average*, Government of Alberta OHS Bulletin, September 2010.
-  *New Thinking About Carpal Tunnel Syndrome*, Government of Alberta OHS Bulletin, September 2010.
-  *Push It or Pull It*, Government of Alberta OHS Bulletin, September 2010.


 *Putting the “I” in Ergonomics*, Government of Alberta OHS Bulletin, October 2007.


 *That Hurts! Contact Stress at Work*, Government of Alberta OHS Bulletin, September 2010.

General information about MSIs


 *How to Make Your Computer Workstation Fit for You*, WorsksafeBC, 2009 Edition.

 *Preventing Musculoskeletal Injury (MSI)*, WorsksafeBC, 2009 Edition.


 *Understanding the Risks of Musculoskeletal Injury (MSI): An educational guide for workers on sprains, strains, and other MSIs*, WorsksafeBC, 2008 Edition.


 *Ergonomics tips for the Hospitality Industry*, WorsksafeBC.

 *Typing Injuries FAQ*, tifaq Website.


 *Back to Basics: A guide to good back health*, Workers’ Compensation Board Alberta, 2015.


 *Occupational Overuse Syndrome: Checklists for the Evaluation of Work*, Department of Labour New Zealand, August 1991.

 *Fitting the Task to the Person: Ergonomics for Very Small Business*, California Department of Industrial Relations, December 2000.

 *The Learning Zone—Welcome to the Ergonomics 4 Schools*, The Institute of Ergonomics & Human Factors, United Kingdom.

Office Ergonomics


 CSA Guideline Z412-17—*Office ergonomics—An application standard for workplace ergonomics*.


 *Office Ergonomics Training*, Office-Ergo Website, 2018.


 *Typing Injuries*, tifaq Website.

 *Office Ergonomics*, Workers’ Compensation Board Alberta, 2007.

Health care industry

 *An Ergonomics Guide for Kitchens in Healthcare, Occupational Health and Safety Agency for Healthcare in BC, 2003 Edition.*

 *An Ergonomics Guide for Hospital Laundries, Occupational Health and Safety Agency for Healthcare in BC, 2003 Edition.*

 *Preventing Musculoskeletal Injury (MSI): A guide for employers and joint committees, WorsksafeBC, 2009 Edition.*

Section 211.1 Training to prevent musculoskeletal injury

Workers who may be exposed to the possibility of musculoskeletal injury (MSI) must be trained in specific measures to eliminate or reduce that possibility. This section establishes a basic training outline that employers are to follow.

Training must include:

- (a) how to identify factors that could lead to an MSI;
- (b) early signs and symptoms of MSIs and their potential health effects; and
- (c) preventive measures including
 - (i) the use of altered work procedures;
 - (ii) mechanical aids; and
 - (iii) personal protective equipment.

Part 15 Managing the Control of Hazardous Energy

Highlights

- This Part reflects the most current views on “locking out,” widely referred to as the “control of hazardous energy.”
- This Part explicitly recognizes that the control of hazardous energy applies to machinery, equipment and powered mobile equipment, as well as piping, pipelines and process systems containing a harmful substance under pressure.
- This Part recognizes that energy-isolating devices can be secured
 - (a) by individual workers,
 - (b) by a group (often referred to as a “group lock-out”), or
 - (c) a complex group process (a procedure-based “group lock-out” process that is implemented when circumstances, such as a plant turnaround, make “group lock-out” impractical).
- Sections 215.4 and 215.5 present requirements specific to pigging and the isolation of piping.

Introduction

In this Part, hazardous energy is defined as

“electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or any other form of energy that could cause injury due to the unintended motion energizing, start-up, or release of such stored or residual energy in machinery, equipment, piping, pipelines, or process systems”

Workers servicing, repairing, testing, adjusting or inspecting machinery, equipment, powered mobile equipment, piping, pipelines, or process systems may be injured if there is unintentional movement, the equipment is unexpectedly energized, unexpectedly started up, or releases stored energy. A detailed, comprehensive hazard assessment can identify the type and location of hazardous energy sources. Part 2 of the *OHS Code* requires that a hazard assessment be conducted before the work activities listed above are performed on machines, equipment, piping, pipelines, or process systems.

If there is a hazard to workers, control of hazardous energy involves the following steps:

- (1) Isolating the location at which work is to be carried out from sources of energy. This is accomplished by shutting off the machine, equipment, or process systems, or

regulating flow in piping or pipelines and by operating or installing a mechanical device (energy-isolating device) that relieves, blocks, bleeds, restrains or otherwise physically prevents or controls the transmission or release of energy for each energy source that may affect the work area.

- (2) Verifying that the work area is isolated from all energy sources and the machinery, equipment, piping or process system is inoperable. This requires testing to verify that energy from each source cannot reach the work area. In the case of interlocked systems, the interlock sequence should be fully completed or overridden.
- (3) “Locking” the isolation by ensuring that the energy-isolating device and all relevant components are physically secured to prevent the release of energy that could cause inadvertent movement or activation. Access to the securing device must be properly managed.
- (4) Once the work activity has been completed, returning the system to operation by removing any securing devices, verifying that no worker is in danger, and releasing the energy-isolating device.

Section 212 Isolation

Subsection 212(1)(a)

The employer is responsible for ensuring that the work activity is performed safely. Specifically, work cannot be performed until the machinery, equipment, or powered mobile equipment has come to a complete stop (except as permitted by subsection 212(2)), all sources of hazardous energy have been isolated by an energy-isolating device and the device has been secured. An employer can choose from three approaches to securing an energy-isolating device:

- (1) by individual workers (see section 214),
- (2) by a group (see section 215), or
- (3) by a complex group process (see section 215.1).

Subsection 212(1)(b)

“Rendering inoperative” may involve removing vital parts, putting blocking in place, pinning, or other equally effective methods. Whatever method is used, it must provide a level of worker protection *equal to or greater* than that provided by isolating and securing. If such alternate practices are used, it is important to advise workers that the method is for energy control and must not be altered.

While this approach typically creates a “zero-energy” states it can also result in residual energy being contained in element(s) of the machine, equipment, or powered mobile equipment. In this case, a hazard analysis can indicate if further hazardous energy control may be needed.

Subsection 212(2)

In some instances, it may be necessary to work on equipment while it is operating, e.g., troubleshooting, minor adjustments, testing, etc. This approach is only justifiable if it is required by the manufacturer or it is not reasonably practicable, in the case where there are no manufacturer specifications, to render the equipment inoperative. The approach cannot be used simply because it is more convenient than isolating and securing. In this case, the employer must develop and implement written procedures for control of identified points of hazardous energy to ensure that the work is performed safely. It is suggested that workers be involved in the preparation of these procedures and controls. Section 8 of the *OHS Regulation* requires that the procedures be in writing and available to workers.

Subsection 212(3)

When the work activity involves piping, a pipeline, or a process system that contains a “harmful substance” as defined in the *OHS Code*, the employer must stop or reduce to a safe rate the flow of product in the piping, pipeline or process system. The location at which the work is to take place must then be isolated from the flow and the isolation secured in accordance with section 215.4

Energy-isolating devices

Before carrying out the work, all energy-isolating devices that control an energy source and will be involved in the isolation must be located. This may include isolation points in different areas, e.g., material conveyor that runs through two operating units.

Examples of an energy-isolating device include:

- (a) a manually operated electrical circuit breaker;
- (b) a disconnect switch;
- (c) a line valve; and
- (d) a block or similar device that blocks or isolates energy.

Push buttons, selector switches and other control circuit type devices are not energy-isolating devices.

Cord-connected and permanently connected electrical equipment

When work is done on cord-connected electrical equipment, e.g., repairing a radial arm saw, changing the blade on a circular saw, cleaning a delicatessen’s meat slicer, etc., a worker can isolate the equipment by securing an isolating device to the electrical plug or, more practically, rendering the equipment inoperative. An acceptable approach to rendering the equipment inoperative is for the worker doing the work to

- (a) disconnect the plug from its electrical supply;
- (b) keep the plug in sight and within reach so that no one else can accidentally plug in the equipment; and

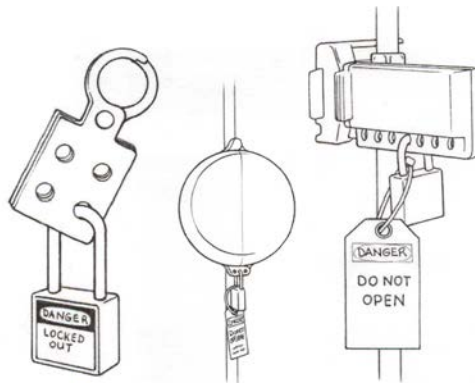
- (c) keep the plug under his or her exclusive and immediate control at all times while working on the equipment.

If the worker leaves the equipment unattended and the work is incomplete, then the worker must verify that the plug is disconnected from its electrical supply before the worker resumes work on the equipment. The worker must then follow steps (b) and (c) as described above. In the case of permanently connected electrical equipment, the worker must secure the equipment's energy-isolating device(s), e.g., circuit breaker, disconnect switch, etc., before proceeding with the work.

Securing devices

To ensure that there is no inadvertent release of energy or energization, the energy-isolating device(s) must be physically secured in the isolating position. A securing device is anything such as a personal lock that holds an energy-isolating device in its off or safe position (see Figure 15.1). The device must be "positive," meaning that once secured into position, it cannot fall off or allow the energy-isolating device to move from its off or safe position. A dowel rod placed in a valve handle, duct tape across a circuit breaker or a sign placed above a box containing fuses that have been removed form an electrical panel would not be "positive" securing devices. The securing device or mechanism must be strong enough to withstand inadvertent opening without the use of excessive force, unusual measures, or destructive techniques, e.g., metal-cutting tools.

Figure 15.1 Examples of securing



In some situations, several energy-isolating devices may be locked near one another and must be secured at the same time. One approach is to use a personal lock to secure each energy-isolating device in its off or safe position. Also acceptable is the practice of running a cable, bar or chain through the lock points of the energy-isolating devices (once they are in the off or safe position), then securing the cable, bar or chain against removal with a personal lock. If this approach is used, the following conditions apply:

- (1) the strength, diameter and routing of the cable, bar or chain must be sufficient to keep the energy-isolating device in the "off" or "safe" position; and
- (2) the construction and strength of the securing devices must be sufficient to prevent their removal without tools.

There is no limit on the length of cable, bar or chain that is acceptable, or the maximum number of energy-isolating devices that may be secured at one time. The system must provide a level of worker protection that is at least as good as if there was an individual securing device on each energy-isolating device.

Use of warning tags

While there is no requirement in the *OHS Code* to use a warning tag, if one is used it should indicate that the machinery, equipment, or powered mobile equipment to which it is attached is not to be operated until the tag is removed.

If used, such a tag should be securely fastened to the energy-isolating device. If the warning tag cannot be attached directly to the energy-isolating device, it should be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

Warning tags should be standardized so that their meaning is immediately clear to all workers. This may include standardizing colour, size, shape, and the format and type of information printed on the tag.

Hazardous energy control in electric utility industry

The electric utility industry must follow two different safety regulations when dealing with the control of hazardous energy — *Alberta Electrical Utility Code* and the *OHS Code*. The requirements of the EUC apply to electric utility systems operating at voltages greater than 750 V, i.e., generation, transmission and distribution systems, and to the auxiliary, metering and control circuits operating at lower voltages that affect or influence these high voltage systems. Strict adherence to the requirements of the EUC ensures the safety of workers working on such systems and circuits. This is achieved through the use of elaborate procedures involving an operator-in-charge, voice commands, non-personal locks and/or warning tags.

For voltages and systems other than those described above, the electric utility industry must meet the requirements of this Part of the *OHS Code*.

Section 213 Verifying isolation

Before working on the machinery, equipment, or powered mobile equipment that has been de-energized (and energy points isolated and secured) or rendered inoperative, a worker must verify that it is, in fact, inoperative. This is often referred to as a “bump” test. The worker must try to activate the machinery, equipment, or powered mobile equipment to make sure that it doesn’t operate — this usually involves activating the control switches and then listening to and watching the equipment.

In group lockout situations, a foreman, supervisor, or operator may perform the “bump” test on everyone’s behalf. Workers must be satisfied that the machinery, equipment, or powered mobile equipment will not operate. A worker should refuse to work on the equipment until the test is done and the worker is sure that it is safe to proceed with the work. In rare cases, energy-isolating devices have been found to be defective, allowing start-up of the supposedly de-energized unit. Where such a problem is identified, and unless another energy-isolating device can be secured to truly isolate the equipment, the original, defective energy-isolating device(s) must be repaired or replaced before any work on the equipment is performed.

Securing Isolation

Section 214 Securing by individual workers

Subsection 214(1)

If an employer chooses this option for securing an energy-isolating device, each worker involved must attach his or her own personal lockable securing device, typically a keyed padlock, to the energy-isolating device.

Subsection 214(2)

A worker who has placed a lock is also responsible for verifying that the energy source has been effectively isolated.

Subsection 214(3)

In the case where more than one worker is working at the same isolation point, each worker must attach his or her own personal lockable securing device, typically a keyed padlock, to the energy-isolating device. The first worker to do so must then verify, on behalf of all workers, that the energy source has been effectively isolated.

Subsection 214(4)

When using personal locks and in the case where the worker is reassigned before the work is completed, or the work is extended from one shift to another, continuity of hazardous energy control must be maintained. This can be accomplished by

- (a) another worker, authorized by the employer (typically a supervisor or crew leader), placing his or her lock prior to the first worker removing his or her lock; or
- (b) ensuring that there is an effective transfer of control of the initial worker’s lock to another worker who is typically designated by the employer for this purpose.

Subsection 214(5)

A personal lock must be traceable back to the worker who owns it and installs it. This is important when locks need to be removed and can serve as a check on the whereabouts of workers, particularly when many workers are involved and there are many pieces of equipment.

Locks can be made traceable in at least two ways:

- (1) they can bear a marking unique to each worker, e.g., engraved name, identification code, colour code, symbol code, etc.; or
- (2) incorporate an identification tag that identifies the worker to whom the lock is assigned. If this method is used, the tag must be secured to the lock in such a way that the tag cannot fall off.

Subsection 214(6)

It is not uncommon for personal locks to have engraved into them an identification code consisting of a combination of letters and numbers rather than the name of the worker to whom the lock is assigned. To provide traceability back to the lock owner, the employer must ensure that the worker's name is readily available throughout the period of time that the lock is used. If a lock or locks must be removed, the employer must be able to readily determine to whom the lock has been assigned.

Subsection 214(7)

Removing a lock usually means that work is completed and the machinery, equipment, or powered mobile equipment is ready to be returned to operation. A lock should not be removed until this is the case. In some situations, removing the lock may create a dangerous situation for workers.

When an energy-isolating device is secured with more than one personal lock, the final lock being removed is the most critical. The removal of this lock means that energy may no longer be isolated and that the unit is ready to be returned to service. Although each worker removing his or her lock can "ensure that no worker will be in danger if [the lock] is removed," it is only the worker removing the final lock that really needs to do this. A situation worth noting in which keeping the final lock in place may be particularly important is during a shift or personnel change.

Maintaining continuity of energy control may mean that the final lock is not removed until the shift or personnel change is completed. If removal of the final lock may endanger workers during a shift or personnel change, then the final lock must not be removed until it is safe to do so.

Section 215 Securing by a group

Subsection 215(1)

When multiple workers are involved or multiple energy-isolating devices must be secured, a group process can be used. For example, securing by a group can be used when ten workers are working on a project that requires four energy-isolating devices to be secured in order for the work to be done safely. If the employer chooses to use a group procedure, the procedure must meet the requirements of subsections 215(2) through 215(6).

Subsection 215(2)

Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 215(3)

In this case, one worker designated by the employer (typically a supervisor or crew leader), is assigned the responsibility of placing and/or activating the energy-isolating devices. Another designated worker (or the same worker) must then

- (a) place a securing device (typically a keyed padlock) on each energy-isolating device;
- (b) put the key to each securing device in a lockable key-securing device (lock box, key ring, etc.) and apply his or her personal lock;
- (c) complete, sign, and post a list identifying the machinery or equipment included in the procedure; and
- (d) confirm and document that all hazardous energy sources in the group lockout situation are effectively isolated.

The purpose of subsection 215(3)(d) is to verify that all energy sources that could cause injury due to unintended motion, energizing, start-up or release of residual energy (see *OHS Code* definition of “hazardous energy”) are effectively isolated. Verification may be achieved by testing circuitry, attempting to cycle machinery, visual inspection, monitoring movement or discharge, observing bleeds, gauges or indicators, or other equally effective approaches. The approach used should offer the best degree of assurance that isolation has been achieved.

Documenting this step provides a record of the activity having been completed. This is not confirming that the locks were placed in the correct locations. This is making sure that placement of the locks has resulted in the energy sources being effectively isolated. Having a worker confirm that locks are physically placed in the correct location is not the same as verifying that all energy sources are effectively isolated.

Subsection 215(4)

Once effective isolation has been verified and before starting the work activity, each worker involved in the work then applies his or her own lock to the key-securing device. This ensures that the master key(s) cannot be removed from the key-securing device until each worker removes his or her personal lock. This prevents the equipment from being returned to operation until each personal lock is removed.

Subsection 215(5)

In the case where a worker is reassigned before the work is completed, or the work is extended from one shift to another, continuity of hazardous energy control must be maintained. This must be accomplished by an effective transfer of control of the initial worker's lock to another worker who is typically designated by the employer for this purpose.

Subsection 215(6)

Upon completing the work, each worker removes his or her lock from the key-securing device. When the last lock is removed, the worker authorized by the employer to do so then removes his or her lock from the energy-isolating device and verifies that no worker will be in danger due to removal of the lock in accordance with section 215.3.

Section 215.3(2) applies in an emergency or if the worker who attached the lock is not available when required to remove it. In this case a worker designated by the employer (typically a supervisor or crew leader) may remove the lock in accordance with a procedure that includes verifying no workers will be in danger due to removal of the lock.

Section 215.1 Securing by complex group control

In some cases, it may not be reasonably practicable to use an individual or group lock out process. To maintain worker safety, normal group lock out practices may need to be adapted or modified. A complex group control process is a mechanism to do this.

The complex group control process relies on written procedures and a work permit or master tag procedure to ensure the safety of workers. These two elements replace the traditional approach of each worker placing a personal lock on each energy-isolating device or on a group lock box.

The reasons for choosing to use a complex group control process most likely involve a combination of several of the following factors:

- (1) *the physical size and extent of the machinery, equipment, piping, pipeline or process system*—the machinery, equipment, etc., may occupy such a large area, or occupy multiple areas, that it becomes impractical for all affected workers to apply their

personal locks to all the energy-isolating devices. This usually results in the employer using a group lock out process but may, based on the other factors listed, lead to the use of a complex group process;

- (2) *the relative inaccessibility of the energy-isolating devices*—some energy-isolating devices may be difficult to access and the act of getting to and from them could potentially expose workers to hazardous situations or conditions, e.g., fall hazards, confined space entry hazards, exposure to elevated noise levels, etc. Eliminating this unnecessary exposure may be a good reason for choosing to use a complex group control process;
- (3) *the number of workers involved in the work requiring hazardous energy control*—at some point so many workers may be involved in the work that using group lock boxes and their accessories becomes impractical. This may occur in situations such as plant shut downs when significant numbers of workers new to the work site begin working there;
- (4) *the number of energy-isolating devices involved*—so many energy-isolating devices may be involved that it is impractical for all affected workers to apply their personal locks to all of them. This usually results in the employer using a group lock out process but may, based on the other factors listed, lead to the use of a complex group process;
- (5) *an extended length of time of the isolation*—an extended or lengthy lock out period may prevent personal locks from being put to use elsewhere, requiring an employer to issue additional personal locks to workers; or
- (6) *the interdependence and interrelationship of the components in the system or between different systems*—the system or systems being locked out may be so complex that from the safety and efficiency perspectives, using a complex group control process makes the most sense.

Section 215.1 of the *OHS Code* does not require the approval by a Director of Inspection for a complex group process. However, it does not mean that employers are relieved of their responsibility to protect the health and safety of the workers. Employers must follow and comply with the requirements in Sections 215.1 (2) to 215.1(5). Since securing by the complex group control is an administrative process, it is recommended that if this is chosen to secure the isolation, the process should be certified by a professional engineer.

A worker designated by the employer (typically a supervisor or crew leader), carries out the isolation by activating and securing all energy-isolating devices. Another worker, designated by the employer, is responsible for verifying that the isolation is effective.

To ensure the safety of all workers involved in the lock out process, the work permit or master tag system being used requires that

- (a) each involved worker personally signs on and off the job; or
- (b) a crew leader signs on and off the job on behalf of a crew or team of workers.

When complex group control is used, each worker must be allowed the option of placing a personal lock on the lockable securing device and then verifying isolation.

Upon completing the work, each involved worker must be accounted for before locks are removed. The worker authorized by the employer to do so must verify that no workers are in danger due to the locks/isolating devices being removed and the machinery, equipment, piping, pipeline or process system being returned to operation.

Verifying isolation

Subsection 215.1(3)(d) requires that a second worker, designated by the employer, confirms that all energy sources in a complex group control situation are effectively isolated.

The purpose of the second worker's action is to verify that all hazardous energy sources that could cause injury due to unintended motion, energizing, start-up or release of residual energy (see *OHS Code* definition of "hazardous energy"), are effectively isolated. Verification may be achieved by testing circuitry, attempting to cycle machinery, visual inspection, monitoring movement or discharge, observing bleeds, gauges or indicators, or other equally effective approaches. The approach used should offer the best degree of assurance that isolation has been achieved.

The second worker is not confirming that the first worker physically placed the locks in the correct location. The second worker is making sure that the placement of the locks has resulted in the energy sources being effectively isolated. Having a second worker confirm that locks are physically placed in the correct locations is not the same as verifying that all energy sources are effectively isolated.

Section 215.2 Securing remotely controlled systems

Where machinery, equipment, piping, pipeline, or a process system is such that energy-isolating devices are in remote or non-contiguous locations, e.g., process control equipment is located 200 kilometres away from the computer that controls it, the securing process must still provide a level of protection that is equivalent to securing by individual workers (section 214), securing by a group (section 215), or securing by a complex group process (section 215.1). To achieve this level of protection, a control system isolating device must be used in combination with written authorizations and safe work procedures. The goal is to ensure that workers performing the work verify effective isolation through direct communication with the isolating authority designated by the employer.

A control system isolating device must physically prevent activation of remotely controlled equipment. In the case of a computer-controlled system, a password or series of passwords does not *physically* prevent activation of the control system. Before defaulting to using control system isolating devices, the employer should consider more traditional alternatives, including rendering the equipment inoperative. If the alternatives are not possible or practicable, examples of how to physically prevent activation of the control system include:

- (a) locking out the ports on the computer(s) to prevent control devices such as a keyboard or mouse from being used; and
- (b) locking out the room in which the controlling computer(s) is located.

Section 215.3 Returning equipment to operation

Subsection 215.3(1)

Except as described in subsection 215.3(2), only the worker who installed the lock, or is the designated worker under section 215(3) or section 215.1(3), is allowed to remove it. This is intended to prevent other persons from removing the lock and unknowingly creating a safety hazard.

Subsection 215.3(2)

Situations may arise in which the worker who installed the lock is unavailable, e.g., off shift, on holidays, in transit, etc., or an emergency involving the equipment arises. In such situations, the lock may be removed by a competent worker designated by the employer to remove the lock. This ensures that the employer is aware of what is going to be done and that an appropriate worker performs the removal. Such removal must be done in accordance with a written procedure (as required by section 14 of the *OHS Act*) that includes verifying that no worker will be in danger due to removal of the lock.

Subsection 215.3(3)

Before all securing devices are removed,

- (a) each worker involved in the work activity must be accounted for;
- (b) any personal locks placed by workers must be removed in accordance with subsection 215.3(1); and
- (c) the person about to return equipment to operation must first make sure that they, and other workers, are not in any danger. Audible and/or visual signals and warnings are often used to warn of equipment start-up. Personally contacting workers in the area who might be at risk of injury may be necessary in some circumstances to let them know that the equipment is being returned to operation.

Subsection 215.3(4)

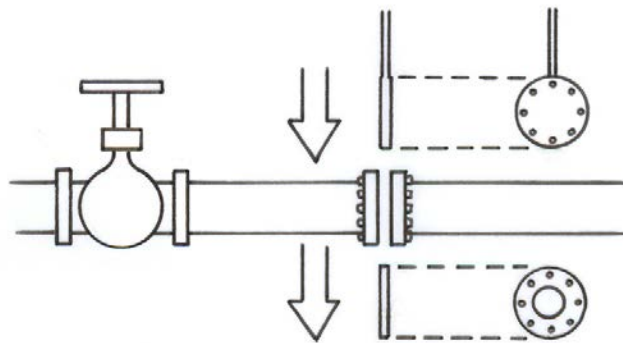
No explanation required.

Piping and Pigging

Section 215.4 Isolating piping

Employers must ensure that blanking, blinding or double block-and-bleed systems are in place and can be used to isolate pipes containing harmful substances under pressure. Blanking involves inserting a physical barrier through the cross-section of a pipe so that materials are prevented from flowing past that point (see Figure 15.2). Blinding involves disconnecting a pipe and attaching a physical barrier to its end so that materials are prevented from flowing out of the pipe.

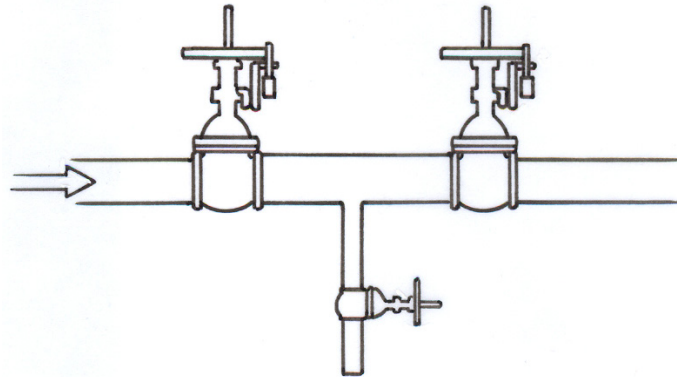
Figure 15.2 Example of blanking



Double blocking and bleeding involves use of a three-valve system where a pipe has two closed valves and an open drain valve positioned between them so that material is prevented from flowing and is re-directed in case of a valve leak (see Figure 15.3) When used, a double block-and-bleed must be situated directly upstream of the work area. This means that if flow in the pipe can come from more than one direction, a double block-and-bleed setup is required on each upstream side. The valves of a double block-and-bleed system must be secured to ensure an acceptable level of safety. Securing must be by a “positive” mechanical means that is either

- (1) lockable (operated by a key or similar device) and attached to or integral with the securing device; or
- (2) not lockable but is strong enough to withstand inadvertent/unauthorized opening without the use of excessive force, unusual measures, or destructive techniques, e.g., metal-cutting tools.

Figure 15.3 Examples of a double block and bleed



Piping that has been blanked or blinded must be clearly marked to indicate the presence of the blank or blind. Piping systems that contain harmful substances must be blanked, blinded or double block-and-bleed before and during the repair, modification or replacement of the piping.

In some circumstances it may not be reasonably practicable to provide blanking, blinding or double block and bleed isolation. In these cases, the employer must ensure that an alternate means of isolation is implemented. The alternative must

- (1) adequately protect workers; and
- (2) be certified as appropriate and safe by a professional engineer.

Section 215.5 Piggings and testing of pipelines

Where piggings and testing is being done, only workers directly involved with that operation are allowed to be in the immediate area of piping exposed while the work is in progress. Workers must not be in the immediate vicinity of a pressurized pigcatcher or pipe-end during piggings and testing. Pigs may only be removed after the pigcatcher has been depressurized.

Part 16 Noise

Highlights

- The noise exposure limits in this Part are based on a 3 decibel (dB) exchange rate. This means that when the sound energy level is doubled (an increase of 3 dB), the corresponding exposure time is halved.
- Section 217 requires employers to ensure that new or renovated work sites, new work processes, or new equipment brought into a workplace achieve a noise level of 85 dBA or as low as reasonably practicable.
- Section 219 requires employers to do a noise exposure assessment if workers are, or may be, exposed to noise at a work site in excess of 85 dBA L_{ex} . An L_{ex} measurement averages a worker's total exposure to noise over the entire workday and adjusts it to an equivalent 8-hour exposure. Noise must be measured in accordance with the Canadian Standards Association's (CSA) noise measurement standard.
- Section 221 requires employers to develop a formal noise management program if workers are exposed to excess noise at a work site. The section lists the mandatory components of the program. (Section 8 of the *OHS Regulation* requires that the program be in writing and available to workers.)
- Section 223 presents the requirements for audiometric testing.
- Service providers who develop or implement noise management programs or perform audiometric testing on behalf of an employer must ensure that the services they provide meet the requirements in Part 16.

Section 216 Duty to reduce

The employer is required to reduce worker exposure to noise in areas where workers may be present. Noise is a recognized workplace hazard. It must be assessed as required by section 7 of the *OHS Code*, and then eliminated and controlled as required by section 9.

As required by section 9, noise must be controlled through the use of engineering controls first, then administrative controls if engineering controls are not effective. Only if engineering or administrative controls do not or are impracticable to eliminate or reduce a hazard sufficiently is an employer permitted to use appropriate personal protective equipment.

Engineering controls

Four main types of engineering controls can be used to reduce or eliminate noise:

- (1) *substitution*—replace noisy equipment, machinery or processes with quieter ones;
- (2) *modification*—modify the way equipment operates so that it generates less noise. This may include installing a muffler, reducing equipment vibration by dampening or bracing, improved lubrication, balancing rotating parts or operating equipment at a lower speed. Alternatively, the area itself can be modified. Reverberation, for example, can be reduced by covering walls with sound absorbing materials;
- (3) *isolation*—this may involve isolating workers from a noisy area by having them work in an enclosed room. Examples of this approach include:
 - (a) segregating noisy areas with sound barriers and partitions;
 - (b) isolating noisy equipment by placing it in an enclosure; and
 - (c) using sound absorbent material and covers over noisy equipment.
- (4) *maintenance*—malfunctioning or poorly maintained equipment generates more noise than properly maintained equipment. Noise control equipment must also be properly maintained to be effective.

Developing engineering controls may involve engineers, safety and industrial hygiene personnel and the workers who operate, service and maintain the equipment. The effectiveness of the controls will depend on a thorough assessment of the noise source and individual worker exposure. The contribution of each noise source to the overall noise level must be considered.

The control options available should be evaluated based on their effectiveness, cost, technical feasibility and implications for equipment use, service and maintenance. Enclosing a piece of equipment, for example, may cause it to overheat or create maintenance difficulties. Other potential complications such as effects on lighting, heat production, ventilation and ergonomics, should also be considered. The function and purpose of planned or existing controls must be fully discussed with workers so they understand the purpose of the controls and do not inadvertently interfere with them.

Administrative controls

Administrative controls involve changes in work schedules or operations that reduce worker noise exposure. Typical controls include rotating work schedules or changing production schedules to limit the amount of time workers are exposed to noise.

Protective equipment

When engineering and administrative controls cannot reduce noise exposure sufficiently, or where they are not reasonably practicable, the employer must provide workers with hearing protection (see section 222). Hearing protection is considered to be any device designed to reduce the level of sound reaching the eardrum. Earmuffs and earplugs are the main types of hearing protection typically used. A wide range of

hearing protection can be found within each of these categories. The amount of protection or sound attenuation provided by a hearing protector depends on its characteristics and how it is worn. The selected hearing protector must be capable of keeping noise exposure at the ear below the occupational exposure limit for noise.

Section 217 Noise control design

The most effective method of dealing with noise at a workplace is to prevent or eliminate the noise from being produced in the first place. The purpose of this section is to ensure that employers consider noise reduction up front when constructing or modifying a work site or work area, when introducing a new work process or introducing equipment that is new to the work site or work area.

Considering noise control in the design, construction or alteration of a workplace can create a more effective control system that takes into account factors such as work area orientation and the types of equipment to be used. Retrofitting a work site or work area with soundproofing or using other noise control strategies often results in less effective noise reduction. This is because the strategies must fit the existing work area—they may not be the optimal design for reducing noise to the desired level.

The material used in the construction of buildings, machines, piping and tanks has a direct effect on noise control. Some materials and structures dampen sound extremely well. Others do not and should be avoided if noisy equipment or processes will be present in the work area.

The construction or design of a new work site or significant physical alterations, renovations or repairs to an existing work site or work area must achieve a noise level of no more than 85 dBA, or as low as reasonably practicable. In determining whether noise has been reduced to the lowest level reasonably practicable, the employer needs to take into account

- (a) the orientation and size of the work area;
- (b) the number and location of workers in the work area;
- (c) physical parameters such as temperature, pressure and humidity;
- (d) the types of building materials and construction techniques available to reduce noise levels;
- (e) the type of equipment that will be used in the work area; and
- (f) cost constraints.

The employer should document the assessment process, particularly if conditions at the work site are likely to change in the future.

Equipment or processes that involve high speeds, high pressure and high flow velocities, combined with light building structures and minimum floor space, can lead to noise problems if noise limits are not specified. Employers should target noisy equipment or operations for noise reduction through replacement, set noise level criteria

for new equipment in purchase documents and request noise level specifications from manufacturers. Workers should be members of the purchasing team since they will be directly affected by the new equipment.

It is not just the noise that the equipment or process itself generates, but how much noise it will make once installed or introduced at the work site. Factors to consider include the total energy of the sound sources, how sound travels at the workplace, the ability of the room or area to absorb sound, and the degree to which the noise is concentrated in a certain direction as opposed to sound that radiates evenly in all directions.

The employer is required to ensure that new equipment is designed, constructed and installed to achieve the lowest noise level practicable. In some cases, it may be practicable to modify the equipment or substitute less noisy equipment. In other cases, the ability to control noise will be limited by

- (a) technological constraints—some equipment is inherently noisy and advances in technology are unable to reduce its noise below a certain level;
- (b) the availability of equipment or materials—there may be no alternative;
- (c) space constraints—quieter equipment may be too large to fit into the available space;
- (d) workplace conditions such as temperature, pressure, humidity; and
- (e) cost constraints.

In these cases, other methods of noise control will be required to reduce worker exposure.

Subsection 217(2)

Section 217(1) does not apply to alterations, renovations or repairs, work processes or equipment on farming and ranching sites, introduced prior to December 1, 2018.

Section 218 Worker exposure to noise

Table 1 of Schedule 3 of the *OHS Code* specifies occupational exposure limits for noise and is shown below as Table 16.1. Table 16.2 is an expanded version of Table 1 of Schedule 3, showing exposure durations at each incremental exposure level. Additional entries can be calculated using either of the following formulas:

$$dB(A) = 10 \log_{10} \left(\frac{2.53 \times 10^9}{T} \right)$$

where:

T is the exposure duration in hours

or

$$T = \frac{480}{2^{(L-85)/3}}$$

where:

T is the time of exposure, in minutes

L is the exposure level, in dBA

Table 16.1 presents the occupational exposure limits for noise based on exposure duration. As noise intensity increases, the amount of time an unprotected worker can be safely exposed to that noise decreases. The limits represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech. The values should not be regarded as fine lines between safe and dangerous noise levels.

A 3 dB exchange rate is used to determine when time of exposure needs to be reduced. Exchange rate is the relationship between noise level and exposure duration. The 3 dB exchange rate is also known as the equal-energy rule or hypothesis (equal amounts of sound energy produce equal amounts of hearing damage, regardless of how the sound energy is distributed in time). On an energy basis, the 3 dB exchange rate permits the calculation of a true time-weighted average exposure to noise. Based on the mathematical relationship for sound power level,

$$L(dB) = 10 \log_{10} \left(\frac{W}{W_0} \right)$$

where:

L is the sound power level

W is sound power

W_0 is a reference sound power,

every doubling of energy results in an increase in L of 3 dB. Therefore, for every 3 dB increase in noise level, the exposure time must be halved.

A ceiling limit of 115 dBA is included in the exposure limits—no unprotected worker exposure is permitted above this ceiling. Above this level it is assumed that the unprotected ear is damaged instantly by the noise (animal research suggests that the critical level is between 115 and 120 dBA).

When daily noise exposure consists of different periods of different noise levels, the daily dose should not exceed 100, as calculated by the following equation:

$$D = \left(\frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_n}{T_n} \right) \times 100\%$$

where:

D is the daily dose, expressed as a percentage

C_n is the total time of exposure at a specified noise level

T_n is the exposure duration permitted at the specified noise level (eg 8 hours for 85 dBA).

Table 16.1 Occupational exposure limits for noise (appears as Table 1 of Schedule 3 of the *OHS Code*)

Exposure Level (dBA)	Duration
82	16 hours
83	12 hours and 41 minutes
84	10 hours and 41 minutes
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes
100	15 minutes
103	8 minutes
106	4 minutes
109	2 minutes
112	56 seconds
115 and greater	0

Note: Values have been rounded to the nearest digit.

Table 16.2 Expanded version of Table 16.1

Exposure Level (dBA)	Duration
82	16.0 hours
83	12.7 hours
84	10.1 hours
85	8.0 hours
86	6.3 hours
87	5.0 hours
88	4.0 hours
89	3.2 hours
90	2.5 hours
91	2.0 hours
92	1.6 hours
93	1.3 hours
94	1.0 hour
95	48 minutes
96	38 minutes
97	30 minutes
98	24 minutes
99	19 minutes
100	15 minutes
101	12 minutes
102	9 minutes
103	8 minutes
104	6 minutes
105	5 minutes
106	4 minutes
107	3 minutes
108	2 minutes
109	2 minutes
110	1 minute
111	1 minute
112	56 seconds
113	45 seconds
114	35 seconds
115 and greater	0

Section 219 Noise exposure assessment

The first step in a noise management program or in efforts to control noise is to assess existing workplace noise levels. This section requires employers to conduct an assessment where workers are or may be exposed to noise levels in excess of the occupational exposure limits shown in Table 1 of Schedule 3 and exceed a noise level of 85 dBA L_{ex} .

A number of factors should be considered when analyzing the extent of the hazard to which workers may be exposed:

- (a) sound from a source can travel by more than one path to the location where it becomes a hazard;
- (b) many industrial sound sources are directional, i.e., sound sources such as intake and exhaust vents radiate more sound in one direction than another;
- (c) sound from equipment may be transmitted by vibration;
- (d) the frequency of the noise has a large impact on how far it travels from the source as well as the measures needed to control it. In addition, a person's perception of noise is related to the frequency of the noise, with human hearing being best at frequencies between 500 and 5000 Hz. Noise at frequencies below 500 Hz and above 5000 Hz can still cause hearing damage, even though these sounds are not perceived to be as loud. Noise measurements made with an instrument equipped with an A-weighted network will discount the contribution of low frequency components to the overall noise measurement;
- (e) if noise exposure changes due to seasonal or product variations, noise measurements need to be repeated; and
- (f) where workers rotate irregularly between different jobs and activities, it may be more useful to determine noise exposure based on the job and worker noise exposure based on the time a worker spends at each job or activity.

An initial noise assessment should be performed in any work area where workers must raise their voices to be heard over background noise. The assessment should include work areas that are indoors, outdoors and in mobile equipment. If the results of the initial assessment indicate that no workers are exposed to noise levels exceeding the exposure limits, then periodic assessments should be performed thereafter to make sure that conditions have not changed over time. Periodic assessments should be done on an annual basis and when

- (a) new equipment or work processes that generate noise are introduced to the work site;
- (b) noise levels change due to equipment deterioration;
- (c) work practices or work procedures change; or
- (d) workers complain of ringing in the ears, temporary changes in hearing or increased levels of noise in their work area.

The noise assessment should be done by an industrial hygienist, audiologist or professional with appropriate training and the noise must be measured in accordance with the CSA Standard Z107.56-06, *Procedures for the Measurement of Occupational Noise*. Workers, the joint work site health and safety committee or health and safety representative, as applicable, should be permitted and encouraged to observe and participate in monitoring activities, as long as doing so does not interfere with the monitoring. Worker participation helps ensure valid results as workers can identify noise sources, indicate periods when noise exposure may differ, and recognize whether noise levels are typical or atypical. Workers can explain how different operating modes affect equipment sound levels and can describe their tasks and working positions.

Performing noise measurements

There are many ways of measuring occupational noise and a variety of instruments for doing so. The choice of a particular method or instrument depends on many factors, including the purpose of the measurement and the environment in which the measurement is made. Monitoring procedures need to be thoroughly defined to ensure consistency from one measurement to the next. Instrumentation, calibration, measurement parameters and methods for data analysis must be clearly described.

This section requires that noise measurements be performed in accordance with CSA Standard Z107.56-06 *Procedures for the Measurement of Occupational Noise Exposure*. Using this Standard ensures that a consistent procedure is followed when making noise measurements. The procedure determines a worker's long term noise exposure using measurements of equivalent sound level in the workplace. Procedures for measuring all types of noise—continuous, pure tones, impulse—are provided in the standard. All types of noise are measured in terms of equal energy. The standard can be used to measure the noise exposure of individuals or groups and measurements are taken using a 3 dB exchange rate. The standard provides procedures for measuring noise and reporting the results.

While the CSA standard does not address the frequency of the noise being measured, this is an important factor when determining noise exposure. In environments where the noise is mostly low frequency, measurements taken with an instrument equipped with an A-weighted filter will underestimate noise exposure. It is useful therefore to conduct a frequency analysis of the noise using a sound level meter with an octave band filter or, if this type of equipment is not available, to measure the noise with both C-weighted and A-weighted filters and compare the results.

If the results vary widely, the noise may have a large low frequency component to it. This will need to be taken into account when measuring noise exposure (correction may be applied to the A-weighted values) and when determining noise levels for the purpose of implementing control measures. Table 16.3 shows the variations among readings taken with A-, B- and C-weighted filters.

Table 16.3 Selected relative response for A-, B- and C-weighted filters

Frequency (Hz)	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)
20	-50.5	-24.2	-6.2
50	-30.2	-11.6	-1.3
100	-19.1	-5.6	-0.3
500	-3.2	-0.3	0
1000	0	0	0
2000	+1.2	-0.1	-0.2
5000	+0.5	-1.2	-1.3
10000	-2.5	-4.3	-4.4
20000	-9.3	-11.1	-11.2

Source: Earshen, John J. (1986) Sound Measurement: Instrumentation and Noise Descriptors, *Noise and Hearing Conservation Manual* 4th Edition, American Industrial Hygiene Association, pp 51

Notes:

- (1) Although the B-weighted filter is rarely used in noise exposure measurements, its responses are presented for comparison purposes.
- (2) How to use the table: A sound with a frequency of 1000 Hz has an intensity of 90dB. At this frequency, the readings in dBA, dBB and dBC are all the same (90). At 500 Hz, the reading corresponds to 86.8 dBA, 89.7 dBB and 90 dBC. At 50 Hz, the reading corresponds to 59.8 dBA, 78.4 dBB and 88.7 dBC.

Competent person

A competent person, otherwise known as a competent worker, performs the noise measurements. This person must be able to correctly use the instrumentation and be able to understand and interpret the measurement results.

Updating measurements

Noise measurements must be updated when equipment or processes change that could affect the noise levels or the duration of worker exposure.

Instrumentation

Three different types of instrumentation can be used to measure noise exposure:

- (1) a sound level meter;
- (2) a noise dosimeter; or
- (3) an integrating sound level meter.

Sound level meter

This is the basic measuring instrument for noise. It consists of a microphone that converts sound pressure variations into electrical signals, a frequency selective amplifier,

a level range control, frequency weighting to shape the frequency response of the instrument, and an indicator. For each particular application, the measurement technique must be carefully chosen and controlled to obtain valid and consistent results.

ANSI Standard S1.4-1983 (R2006), *Specification for Sound Level Meters*, provides three frequency weighting scales (A, B and C, although only A-weighted measurements are used in the *OHS Code*) and two exponential time averaging characteristics, slow and fast. In most industrial settings, the meter fluctuates less if measurements are made with the slow response setting. The fast response setting is normally used to measure how noise fluctuates over time rather than noise exposure.

The standard specifies three grades of instruments:

- (1) Type 0—intended for use in a laboratory as a reference standard;
- (2) Type 1—intended for precision measurements of sound in the field and laboratory;
and
- (3) Type 2—designated for general field use to measure typical environmental sounds where high frequencies do not dominate.

The accuracy of a sound level meter is dependant on the type of meter, the frequency being measured, the orientation of the sound relative to the microphone and the time variation of the sound pressure. Selection of a particular sound level meter should be made following a review of the need for accuracy, the frequency and other characteristics of the sound being measured.

Correct use of the microphone is very important to obtaining accurate measurements. Microphones are designed for use in a particular environment across a specific range of sound pressure levels and frequencies. They also differ in directionality as some must be pointed directly at the sound source and others at an angle to the sound source. Equipment users need to follow the manufacturer's instructions regarding the type and size of microphone and how it is to be used.

Noise dosimeter

A noise dosimeter is a sound level meter worn by the worker. It measures and stores sound levels during an exposure period and computes the exposure as a percentage of a criterion level such as an occupational exposure limit. The noise must be measured using an A-weighted filter with a 3 dBA exchange rate in order to compare the measured results to the exposure limits specified in the *OHS Code*. ANSI Standard S1.25-1991 (R1997), *Specification for Personal Noise Dosimeters*, provides acceptable characteristics for noise dosimeters.

In noise dosimetry, the microphone is attached to the worker whose noise exposure is being measured. Placement of the microphone is important in estimating exposure. The microphone is usually mounted on a shoulder, at the chest, or in the ear.

When noise levels are continuous and the worker remains essentially in one work area during the work shift, measuring noise exposure with a sound level meter is relatively straightforward. However, a noise dosimeter is preferred for measuring worker exposure when noise levels vary or are intermittent, when they contain components of impulse noise or when the worker frequently moves around during the work shift.

Integrating sound level meter

This instrument is a sound level meter with properties similar to those of a dosimeter. Like a noise dosimeter, it can be used to measure varying or intermittent noise and impulse noise and the worker can move around while wearing the instrument.

Typical applications for integrating sound level meters are identical to those for standard sound level meters. Integrating sound level meters can however be used to measure the average sound pressure level around noisy equipment or other sound sources where the integrating capacity can be used to determine the average sound level in space as well as time. The two main differences between sound level meters and integrating sound level meters are

- (1) averaging durations for an integrating meter are usually much longer than those for a standard sound level meter, extending to minutes or hours; and
- (2) the integrating meter gives equal emphasis to all sounds that occur during the selected averaging period, while the standard sound level meter gives more emphasis to recently occurring sounds.

Instrument operation

To ensure that measurements are accurate, sound measuring equipment must be calibrated, maintained and operated according to the manufacturer's specifications. Calibrations are often required annually.

Section 220 Results recorded

Written measurement results must include the date of the measurement, the workers or occupations evaluated, the type of measuring equipment used, the sound level readings measured and the work location evaluated. For quality control purposes, the measuring equipment should be uniquely identified by number or other appropriate designation. A worker affected by noise at the workplace must be able to access a copy of the measurements on request. The employer must also make measurement results available to an officer on request. As long as the employer continues to operate within Alberta, a copy of the measurements must be kept on file at the employer's premises.

Section 221 Noise management program

If a noise exposure assessment confirms that workers are exposed to noise in excess of the occupational exposure limits listed in Table 1 of Schedule 3, the employer must

develop and implement a noise management program (sometimes referred to as a hearing conservation program). Section 14 of the *OHS Act* requires that the program's procedures be in writing and available to workers. Workers are required to cooperate with the employer in implementing the program. Section 200 of the *OHS Code* also requires the employer, contractor or prime contractor (if there is one) to consult and cooperate with the joint work site health and safety committee or health and safety representative, as applicable, to develop procedures.

The program must include the following seven components:

- (1) worker education;
- (2) measuring or monitoring worker exposure to noise;
- (3) posting warning signs in any work area where the noise level exceeds 85 dBA;
- (4) use of noise control methods;
- (5) selection, use and maintenance of hearing protection devices;
- (6) audiometric testing; and
- (7) annual program review.

Worker education

The success of a noise management program largely depends on effective worker education. Workers need to understand the reasons for, and requirements of, the program. Workers must also understand their role in the program. Worker education should be ongoing and meet the specific exposure and prevention needs of each worker or group of workers.

At a minimum, the worker education component of the program should include the following elements:

- (a) regulatory requirements and responsibilities;
- (b) occupational exposure limits—what they are and why they are needed;
- (c) the effects of noise on hearing;
- (d) the employer's policy on eliminating noise as a hazard, including the noise controls already in place or planned for the future;
- (e) identification of hazardous noise sources at the workplace;
- (f) training in the use of protective equipment, i.e., purpose of hearing protectors, types of protectors available, advantages and disadvantages of the various types of hearing protectors available, selection, fitting, use and care, troubleshooting. This training should include supervised, hands-on practice in the proper fitting of hearing protectors;
- (g) audiometric testing, i.e., its role in preventing hearing loss, a description of the test procedure, interpretation and implications of test results; and
- (h) individual responsibilities for preventing hearing loss, i.e., compliance with the program, noise exposure and hearing loss in non-occupational settings.

Measuring or monitoring worker exposure to noise

What needs to be done to protect workers depends on the level and type of noise they are exposed to at the workplace. Measuring sound levels identifies noise sources and those workers most likely to be exposed to noise exceeding the occupational exposure limits.

Posting warning signs

Warning signs must be posted at the periphery of any work area where the noise level exceeds 85 dBA. The signs should include a statement that hearing protectors must be worn while in the area. A supply of several types of hearing protectors should be readily accessible to those entering the area. Signs should present their warning graphically and in words. The words should be written in English and if workers are unable to read English, the words should also appear in the predominant language of the workplace.

Audiometric testing

Workers exposed to noise levels exceeding the occupational exposure limits listed in Table 1 of Schedule 3 must undergo audiometric testing. The purpose of testing is to establish a baseline measurement of the worker's hearing and to then monitor the worker's hearing at regular intervals to detect changes in hearing ability. Audiometry is discussed in more detail in section 223.

Use of noise control methods

When reducing worker exposure to noise, engineering controls are preferred, then administrative controls, and finally appropriate personal hearing protection. Engineering controls try to minimize or eliminate exposure by altering or removing the source; administrative controls try to control exposure by modifying the circumstances of the worker's exposure; personal hearing protection reduces exposure when the other approaches have not reduced the hazard to an acceptable level. Noise control methods are discussed in more detail in section 217.

Selection, use and maintenance of hearing protectors

Hearing protectors are generally defined as anything worn to reduce the level or volume of sound entering the ear. Examples of hearing protectors are shown in Figure 16.1. Hearing protectors are subject to many problems and should be considered the last resort against hazardous noise situations. Hearing protectors can fail to provide adequate protection in many situations due to discomfort, incorrect use with other safety equipment, dislodgment, deterioration and abuse. Hearing protectors provide their greatest protection against high frequency noise and significantly less protection against low frequency noise. Nevertheless, hearing protectors can protect against noise-induced hearing loss if their use is carefully planned, evaluated and supervised.

Workers should be provided with a choice of two or three types of protectors from the class of hearing protection considered to be most appropriate for each worker's work area noise level and hearing deficit (if any). The type of protection most appropriate for a particular worker depends on the other equipment that must be worn such as safety headwear, protective eyewear, respirator, the shape and size of the worker's head and ear canals, and relative comfort. Comfort is subjective and is not related to the Class of protector, i.e., a Class C protector is not necessarily any more or less comfortable than a Class B protector.

Workers do not always know when their protectors are defective or worn out. Some premoulded earplugs shrink and/or harden when exposed continuously to ear wax and perspiration. Flanges may break off and plugs may crack. Earmuff cushions may harden or crack, and headbands may lose their tension. Workers need to know how to recognize when a hearing protector requires repair or replacement. Defective and poorly or improperly fitting protectors need to be identified and repaired, replaced or refitted.

Annual program review

The noise management program must be reviewed on a regular basis to make sure it is effective. The extent of the review should be based on the sophistication and complexity of the program, but must at least include review of the training program, an assessment of the need for further noise measurement and the adequacy of control measures.

The key measure of a program's success is whether it prevents work-related noise-induced hearing loss. The employer should consider information from the physician or audiologist when evaluating the effectiveness of the education and training programs related to noise, and the effectiveness of noise control measures. Overall results can be compared from year to year to identify trends within occupations, for various processes, between different departments, or between different work sites. It is easier to identify specific problems when results are grouped in this way.

All components of the program should be reviewed for compliance with the employer's policies and procedures, for completeness and accuracy, and for compliance with regulatory requirements.

Section 222 Hearing protection

The following factors must be considered when selecting hearing protectors:

- (a) who will be wearing the equipment;
- (b) compatibility with other safety equipment;
- (c) workplace conditions such as temperature, humidity and pressure;
- (d) comfort—protectors that are not comfortable will not be worn;
- (e) ease of use and handling; and
- (f) impact on the wearer's ability to communicate.

The hearing protectors selected must meet the requirements of CSA Standard Z94.2-02, *Hearing Protection Devices—Performance, Selection, Care and Use*. This Standard provides performance requirements for personal hearing protection devices. The standard classifies muffs and earplugs as Class A, B or C depending on the level of protection they provide. Class C provides the least degree of protection while Class A provides the greatest. Table 2 of Schedule 3, indicates the class of hearing protection to be used at various noise levels.

The classification of hearing protectors is based on how much they attenuate or reduce sound levels at nine different frequencies: 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3150 Hz, 4000 Hz, 6300 Hz and 8000 Hz. The manufacturer must provide this information to the equipment user.

The CSA Standard has introduced a 0 to 4 grading system for hearing protection devices. A device with a “0” grading provides the least protection, a device with a “4” grading provides the most. Grades are assigned to hearing protection devices based on laboratory attenuation measurements. The purpose of using a grade system is to be able to make a “go” or “no-go” determination, i.e., either the hearing protection is right for the noisy situation or it is not. Such absolute decisions require the actual hazard to be known, i.e., both sound pressure levels and duration of exposure must be assessed.

Equipment manufactured in the United States may bear a Noise Reduction Rating (NRR)—a class will not be specified. The NRR is not comparable to the attenuation data required by CSA. However, the manufacturer must still provide the attenuation data required by the standard and a comparison of this data with the information provided in Table 3 of the Standard, shown as Table 16.4 will allow the user to determine the class of the hearing protector. The equipment must, in addition, comply with other requirements specified in the CSA standard.

Table 16.4 Sound Attenuation Requirements for Hearing Protectors

Frequency, Hz	Minimum attenuation, dB		
	Class A	Class B	Class C
125	10	5	None
250	18	12	None
500	26	16	None
1000	31	21	11
2000	33	23	13
3150	33	23	13
4000	31	21	11
6300	33	23	13
8000	33	23	13

Source: CSA Standard Z94.2-02

The noise reduction rating (NRR) of a hearing protector cannot be used reliably to determine its classification. Because NRR values are calculated differently than the class definitions given in Table 16.4, there is considerable overlap of NRR values between Classes A and B. Generally, however, a hearing protector with an NRR value of at least 24 and with mean attenuation values of at least 26, 31, and 33 dB at 500, 1000 and 2000 Hz, respectively, meets the Class A requirements.

A protector that does not meet the Class A mean attenuation requirements at 500, 1000 and 2000 Hz, but has an NRR value of at least 17, generally falls into Class B. Likewise, a protector with an NRR value of less than 17 generally falls into Class C.

Note that the attenuation values shown in Table 16.4 are determined in a laboratory by the manufacturer. When hearing protectors are worn, they generally provide much less protection. An often used rule of thumb is to reduce the manufacturer's attention value by half to estimate the actual noise reduction achieved in the field.

Use of dual hearing protection

If hearing protection has been chosen according to Table 2 of Schedule 3 to control worker exposure to noise, once a worker is exposed to noise greater than 105 dBA L_{ex} the worker must wear both a plug and a muff (dual hearing protection). At noise levels greater than 110 dBA L_{ex} , dual hearing protection must be worn *and* time of exposure reduced.

When dual hearing protection is worn, the noise reduction (attenuation) at each frequency is not the sum of the individual hearing protector's attenuations, it is usually much less. This is due to the fit of the hearing protectors and the volume of air trapped between them as well as limitations created by bone conduction. Bone conduction allows sound energy to be transmitted through the bones and tissues of the skull to the inner ear, bypassing the hearing protector. It poses a limitation on the protection that any hearing protector can provide, regardless of how well it seals to the ear canal and prevents sound from entering the ear.

Hearing protectors do not work well at noise levels greater than 110 dBA L_{ex} . For this reason, a worker's exposure time must also be reduced, even while dual hearing protection is worn. The time reduction should be based on a 3 dBA exchange rate, as shown in Table 16.5.

Table 16.5 Exposure time reduction with dual hearing protection

Exposure Level (dBA L_{ex}^1)	Exposure Time ² (hours)
110	8
113	4
116	2
119	1
122	0.5
125	0.25

- 1 Worker exposure must be measured in accordance with CSA Standard Z107.56-06, *Procedures for the Measurement of Occupational Noise Exposure*.
- 2 This is the total noise exposure that the worker may have over the work shift. For the remainder of the work shift the worker cannot be exposed to noise greater than 85 dBA.

Proper use of hearing protection

To be of value, hearing protection must be used properly and whenever the worker is in a noisy area. For this reason, workers must be trained in the selection, maintenance and proper use of the equipment. To ensure that noise-exposed workers are motivated to use and care for the equipment properly, they must understand the hazards associated with noise exposure.

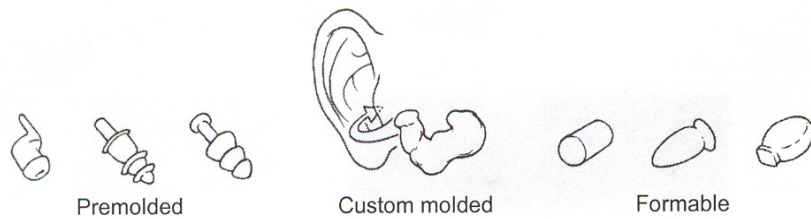
It is critical that workers know how the equipment is to be worn. For maximum protection, a hearing protector must make a tight seal within the ear canal or against the side of the head. Earplugs or muffs that do not fit properly can lose 5 to 15 dB of their noise protection capacity. Modifying hearing protectors to reduce wearer discomfort by drilling holes in earcups or reducing earmuff headband tension can seriously compromise their effectiveness and is not permitted. More comfortable but equally effective protectors should be found.

While it is important to have manufacturer instructions describing the use and maintenance of the equipment, workers cannot be relied upon to receive effective instruction on fit, care and use by reading the instructions alone. Proper fitting techniques should be demonstrated and practiced by the worker under supervision.

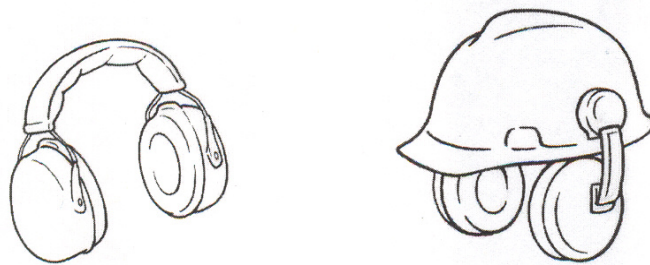
Once hearing protectors are issued to workers, the employer must ensure they are worn. In turn, workers must use the equipment according to the training provided by the employer.

Figure 16.1 Examples of hearing protectors

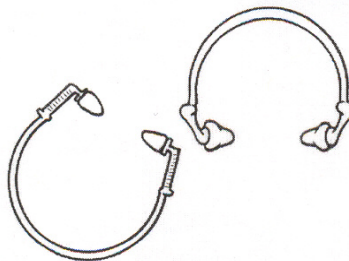
Ear Plugs



Ear Muffs



Semi-insert



Section 223 Audiometric testing

The employer is responsible for

- (a) identifying noise-exposed workers;
- (b) ensuring that noise-exposed workers have hearing tests conducted by an audiometric technician;
- (c) paying the costs associated with a hearing test;
- (d) keeping a log book containing audiometer calibration data; and
- (e) keeping a record of whether the hearing test was done (but not a copy of the actual hearing test).

Any worker who is or may be exposed to noise in excess of 85 dBA L_{ex} and the noise exposure limits in Table 1 of Schedule 3, must undergo audiometric testing. By definition, this worker is considered to be a “noise-exposed worker.” For example, any worker who is exposed or may be exposed to noise greater than an average of 85 dBA over 8 hours, or an average of 82 dBA over 16 hours, must undergo audiometric testing at the employer’s expense.

Audiometric testing of workers’ hearing is important to the success of a noise management program since it is the only way to actually determine if occupational hearing loss is being prevented. Because occupational hearing loss happens gradually over time, workers often fail to notice changes in their hearing ability until a relatively large change occurs. By comparing audiometric tests from year to year, hearing damage can be caught earlier and appropriate protective measures implemented to prevent further damage.

When a worker is or may be exposed to noise in excess of the exposure limits shown in Table 1 of Schedule 3, the worker must receive a baseline audiogram as soon as practicable, but no later than six months after the start of employment. The baseline audiogram should be performed as soon after the start date as possible. The requirement for a baseline audiogram also applies if a worker is exposed to such noise due to a change in activities (the introduction of new equipment or processes for example) or duties (reassigned to a new job or a new, noisier area within the workplace).

Audiometric testing should be done after a minimum 12-hour period during which the worker is not exposed to any noise. For workers who have audiometric testing conducted during their work shift, hearing protection may be used to meet the no noise requirement. Audiometric testing conducted after a worker has been exposed to noise during his/her work shift may detect a temporary threshold shift, causing the worker’s hearing to appear worse than it really is.

Additional tests are then required 12 months after the baseline test and every two years thereafter. The results can then be compared with the baseline audiogram to check for changes in hearing sensitivity and identify a temporary hearing loss before it becomes permanent. The employer must bear the costs of testing, including time from work, if that is required.

The audiometric test consists of pure-tone-air-conduction threshold testing of each ear at 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz. At each frequency, the threshold recorded for the ear is the audiometer’s lowest signal output level at which the individual responds in a specified percentage of trials. Noise exposure increases hearing thresholds, resulting in threshold shifts toward higher values (poorer hearing). Exposure to noise usually causes gradual development of hearing loss over time. During each overexposure to noise, the ear develops a temporary reduction in sensitivity, called a temporary threshold shift. This shift reverses over a period of hours or days if the ear is

allowed to recover in a quieter environment. If the exposure is to a sufficiently high enough level of noise, of sufficient duration or repeated, the temporary threshold shift may not reverse completely and a permanent threshold shift begins to develop.

Who does the audiometric testing?

The employer is responsible for ensuring that audiometric tests are conducted by a qualified audiometric technician who works in consultation with a physician, audiologist or occupational health nurse. The audiometric technician must keep a log book that contains the audiometer's calibration records. The log book, and therefore the calibration records, must be kept with the audiometer throughout its useful lifetime. The audiometer must be calibrated at intervals specified by the manufacturer.

Service providers who conduct audiometric testing on behalf of an employer must ensure that their services adhere to the requirements of subsection 223. Where the service provider provides the services of an audiometric technician, physician or audiologist, the service provider must ensure that these services are provided by competent workers, as outlined in Section 7 of the *OHS Act*.

Testing area

To determine if the testing environment has acceptable background noise levels must be measured. Background noise levels must be less than those listed in Table 3 of Schedule 3 and must also be recorded and kept with the calibration records. This means that if test equipment is moved to a different location, noise levels must be measured at that new location.

The purpose of conducting background noise level measurements is to ensure that background noise does not interfere with the audiometric testing and give false results.

Record keeping

The audiometric technician must record the results of the hearing test as well as maintain the calibration log books.

Audiograms are confidential medical records and cannot be given to the employer. The employer must ensure that the audiogram and the worker's medical history are under the sole control of a health professional designated under subsection 223(2)(a). Audiograms can only be released with the worker's written consent.

Test results

The audiometric technician must give the worker a copy of the results of the audiogram. The worker is encouraged to keep a record of audiometric test results in case the worker develops a hearing loss. Because employers are only required to keep audiometric test

results for 10 years, the worker should keep copies of his or her audiometric testing records over the course of his or her working life.

If the results of the audiogram are abnormal, the audiometric technician must advise the worker of the test result and request the worker to provide a health history related to hearing. The audiometric technician must send the results of an abnormal audiogram or an audiogram showing an abnormal shift, the baseline audiogram, and the health history to the physician or audiologist designated by the employer to review audiograms.

Responsibility of designated physician and audiologist

The physician or audiologist designated by the employer reviews relevant medical information and the audiogram to ensure that the test results are valid. If the audiogram is valid, the physician or audiologist confirms the classification of the test results as being either an abnormal audiogram or demonstrating an abnormal shift. The physician or audiologist can recommend follow-up, which may include repeat testing or referral to another health care professional.

If the physician or audiologist confirms that the audiogram is an abnormal or an abnormal shift audiogram, the worker must be advised of this within 30 days of the physician or audiologist receiving the test results. With the worker's written consent, the physician or audiologist must provide a copy of the audiometric test results to the worker's physician.

The physician or audiologist must advise the employer as to the effectiveness of the noise management program in place at the work site as it relates to worker hearing. When advising the employer as to the effectiveness of the noise management program, the worker's actual audiograms should not be given to the employer, as these are considered confidential worker information. Audiograms should be categorized and an explanation of the group results given to the employer.

Analyzing group audiometric test results can provide a good indication of the program's effectiveness. In order for the employer to evaluate the effectiveness of its program, the employer should also designate a knowledgeable person at the work site to consult with the physician or audiologist to provide specific details of the noise management program, such as hearing protection worn, work site noise levels, and personal dosimetry results. In workplaces where noise is a hazard, the employer should work with the joint work site health and safety committee or health and safety representative to monitor the effectiveness of the noise management program.

The audiometric technician or health professional must keep the audiogram and health history for at least 10 years.

Who pays for audiometric testing?

The employer is responsible for paying for audiometric testing and the interpretation of the results. Every effort should be made to have the audiometric testing conducted during normal working hours. If the testing takes place during the worker's hours of work, the worker's wages, salary or benefits must be paid for the period of time the worker is being tested. If it is impractical for the worker to have the audiogram during his or her normal working hours, the employer must pay the worker for the time that is spent having the test conducted. If travel to or from the audiometric testing happens during working hours, the worker is entitled to his/her wages, salary or benefits for the travel time.

Part 17 Overhead Power Lines

Highlights

- The safe limit of approach distances have been made consistent with the 2002 edition of Alberta's *Electrical and Communication Utility Code (ECUC)*.
- Section 226 clarifies that the safe limit of approach distances do not apply to loads, equipment, or buildings less than 4.15 metres in height while they are being transported beneath energized overhead power lines.
- Section 227 recognizes that special approach distances apply to electric utility workers, electric utility trimmers and qualified electrical utility workers.

Requirements

Section 225 Safe limit of approach distances

Subsection 225(1)

Safe limit of approach distances for overhead power lines are intended to prevent power line contacts, injuries and fatalities (see the "Overview" to this Part for a discussion of power line contacts).

If work is done or equipment is operated within 7 metres of an energized overhead power line, the employer must contact the power line operator to determine the voltage of the power line. As shown in Table 17.1, the power line voltage determines the safe approach distance. Until the power line operator verifies the voltage, the employer must maintain a safe clearance distance of 7 metres. The distances listed in Schedule 4 have been taken from Alberta's *Electrical and Communication Utility Code (ECUC)*, 2nd Edition, 2002.

Table 17.1 Safe limit of approach distances from overhead power lines for persons and equipment (appears as Schedule 4 in the OHS Code)

Operating voltage between conductors of overhead power line	Safe limit of approach distance for persons and equipment
0-750 volts Insulated or polyethylene covered conductors (1)	300 millimetres
0-750 volts Bare, uninsulated	1.0 metre
Above 750 volts Insulated conductors (1) (2)	1.0 metre
750 volts-40 kilovolts	3.0 metres
69 kilovolts, 72 kilovolts	3.5 metres
138 kilovolts, 144 kilovolts	4.0 metres
230 kilovolts, 260 kilovolts	5.0 metres
500 kilovolts	7.0 metres

Notes:

- (1) Conductors must be insulated or covered throughout their entire length to comply with this group.
- (2) Conductors must be manufactured to rated and tested insulation levels.

Subsection 225(1.1)

An employer must ensure that the appropriate distance as listed in Schedule 4 is maintained as a limit at all times and that no worker or equipment comes any closer than that distance. This can only be varied with the permission and assistance of the power line operator in accordance with subsection 225(2).

Subsection 225(2)

Situations may arise in which work must be done or equipment operated near an energized power line at distances less than the safe limit of approach distance for that particular voltage. In such cases, the employer must notify the operator of the power line before beginning the work and obtain the operator's assistance in protecting workers involved in the work. The operator may protect workers by de-energizing the power line, relocating it, isolating it, or performing some other equally effective action.

Subsection 225(3)

This subsection is intended to prevent safe limit of approach distances being reduced by piles of earth or other materials placed beneath or adjacent to an overhead power line.

Subsection 225(4)

As required by section 8 of the *OHS Code*, the employer is responsible for making workers aware of the hazards associated with work near energized overhead power lines. The employer should make workers aware of the safe limit of approach distances included in the *OHS Code*. Workers must follow the employer's directions to maintain the appropriate safe clearance distances.

Section 226 Transported loads, equipment and buildings

This section clarifies that the distances listed in Schedule 4 do not apply to loads, equipment, or buildings less than 4.15 metres in height while they are being transported beneath energized overhead power lines. Examples of such situations include a tractor trailer passing beneath a power line or a building being transported on a flatbed trailer along a highway and passing beneath power lines.

The 4.15-metre height limitation comes from section 4 of the *Commercial Vehicle Dimension and Weight Regulation* (AR 315/2002) under the *Traffic Safety Act*. Vehicles and their loads must not exceed this height when operating on a highway unless Alberta Transportation has granted a special permit to do so.

Additional information on this topic can be found at Alberta Queen's Printer website.



Commercial Vehicle Dimension and Weight Regulation, Government of Alberta.

The safe limit of approach distances do not apply because the clearance distance does not vary during transportation and "work" is not being performed. The distances always apply when loads and equipment are moved about on a work site when "work" is being done. Examples include a dump truck loading or unloading gravel, a mobile crane moving from one location to another at a work site, a rolling scaffold being repositioned.

Overhead power lines are installed at heights that allow equipment, buildings, or objects to be safely moved beneath them. The safe installation height varies depending on the location of the power line as shown in Table 17.2. These values are set by Rule 2-016(1) of the *Electrical Communication and Utility Code* (ECUC), 2nd Edition, 2002.

Table 17.2 Minimum height above ground of overhead power lines

Location of overhead power line	Height above ground
Areas normally accessible to pedestrians only	3.6 m
Driveways to residences or residential garages	4.1 m
Areas where agricultural equipment is normally used	4.2 m
Lanes, alleys or entrances to commercial or industrial premises	4.8 m
Roads and highways	5.3 m
Right-of-way of underground pipelines	5.4 m

According to Rule 2-016(2) of the ECUC, equipment, a building, or an object exceeding the heights listed in Table 17.2 must not be moved under an overhead power line until the operator of the overhead power line is contacted and takes whatever steps are necessary to protect workers and the power line. The power line operator must be contacted before the move begins and the operator is required to provide assistance as soon as possible.

Some employers routinely (and perhaps on very short notice) move equipment, buildings, or objects exceeding the heights listed in Table 17.2. These employers may find it difficult to comply with Rule 2-016(2). It is suggested that the employer and the power line operator(s) work together to develop processes that anticipate such difficulties and ensure that the move is done safely.

Section 227 Utility worker and tree trimmer exemption

This section recognizes that section 225 does not apply to electric utility workers, qualified electric utility workers or electric utility tree trimmers to whom other distances apply. The *Electrical and Communication Utility Code* (ECUC) defines these workers as follows:

“electric utility worker” means

- (a) a worker trained to recognize hazards associated with energized electrical equipment or lines and trained and experienced to work safely near energized electrical equipment or lines in accordance with the requirements of [the *ECUC*] while performing duties assigned by an employer; and
- (b) a worker trained and experienced to work safely on energized electrical equipment or lines operating at voltages below 750 V between conductors in accordance with the requirements of [the *ECUC*] while performing duties assigned by an employer.

“electric utility tree trimmer” means a worker certified by the Industrial Vegetation Management Association of Alberta, or other acceptable agency, to remove trees or portions of trees near power lines or other electrical equipment including aerial trimming in accordance with the requirements of [the *ECUC*].

“qualified electric utility worker” means a power line or station electric utility worker trained and experienced to work safely on energized electrical equipment or lines in accordance with the requirements of [the *ECUC*] while performing duties assigned by the employer.

These workers are specially trained and qualified to perform work near energized overhead power lines. These workers must comply with different safe limit of approach distances specified in the *Electrical and Communication Utility Code*.

Overview

Contacts with energized overhead power lines are a common occurrence in Alberta. In the 12-month period ending March 31, 2003, 369 contacts with overhead power lines were reported to Alberta Municipal Affairs. An additional 68 contacts with underground power lines were reported in the same time period. The 437 contacts are believed to represent just a small fraction of the total number of annual power line contacts—most go unreported.

Regulations under the *Safety Codes Act* require all electrical accidents and power line contacts to be reported to Alberta Municipal Affairs, Safety Services. The telephone number of the Safety Services office to which reports should be made is (780) 427-8256. The e-mail address for Safety Services is safety.services@gov.ab.ca.

If a power line contact occurs at a mine or mine site, the Director of Inspection having responsibility for mines must also be notified. This is required by section 544 of the *OHS Code*.

Table 17.3 presents historical power line contact data for the 15-year period ending December 31, 2007. Table 17.4 lists the type of contact or damage associated with the

contacts that occurred in the 12-month period ending December 31, 2007. Table 17.5 summarizes power line fatality information for the 15-year period ending December 31, 2007. Complete summary reports for other time periods and years can be found at Alberta Municipal Affairs website.

Precautions to take when working near overhead lines

The following is a list of suggested practices that should be followed when working near overhead power lines.

- (1) Equipment operators and users must respect the safe limit of approach distances specified in section 225 of the *OHS Code*.
- (2) A competent signaller as described in section 191 of the *OHS Code* should be used. The signaller's only responsibility is to make sure that the equipment operator does not get closer than the safe limit of approach distance.
- (3) No one should be allowed to touch the load or any part of the equipment until the signaller indicates it is safe to do so.
- (4) Other workers not directly involved in the work being performed should be kept away from equipment when it is being used near overhead power lines.
- (5) Equipment operators must always be aware of the position of their equipment in relation to overhead power lines. They should not depend on safety devices such as hook insulators, insulating blankets, etc.
- (6) Equipment operators should be aware that a long span of power line can rise and fall as the ambient temperature changes, affecting safe limit of approach distances. Wind-induced swing can also affect these distances.
- (7) Grounding equipment in the area of the power line is not a safe practice.
- (8) The route that a crane or similar equipment will follow should be marked out before it is moved. Uneven terrain can cause the boom or other structure to weave or bob, increasing the likelihood of power line contact.
- (9) When using tag lines to control an elevated load, the tag lines should be made of a non-conducting material such as dry rope.

Table 17.3 Historical summary of reported power line contacts in Alberta

	92/93	93/94	94/95	95/96	96/97	97/98	98/99	2000	2001	2002	2003	2004
Overhead contacts	414	457	430	265	371	477	349	230	386	346	390	471
Underground contacts	102	95	65	45	133	122	86	52	66	54	78	79
Total	516	552	495	310	504	599	435	282	452	400	468	550

	2005	2006	2007
Overhead contacts	368	353	264
Underground contacts	70	63	80
Total	418	416	344

Source: Alberta Municipal Affairs, Safety Services

Table 17.4 Type of contact or damage associated with overhead power line contacts that occurred in the 12-month period ending December 31, 2007.

Type of contact or damage	Number of line contacts
Vehicle-mounted equipment (booms, hoists, cranes, etc)	29
Trucks with raised boxes and vehicles transporting high loads	65
Excavating or earth moving vehicles	53
Farm implements	38
Relocating structures (grain bins)	2
Vehicles out of control	50
Aircraft, parachutes, kites, etc.	4
Falling, brushing or trimming trees	3
(a) Utility tree trimmers/workers	16
(b) Others	
Drilling and seismic equipment	0
Other inadvertent contacts	4
TOTAL	264

Source: Alberta Municipal Affairs, Safety Services

Table 17.5 Historical summary of fatalities associated with power line contacts in Alberta

	92/93	93/94	94/95	95/96	96/97	97/98	98/99	2000	2001	2002	2003
Due to contact with overhead power line	4	3	0	0	1	7	1	1	1	1	1
Due to contact with under-ground power line	0	0	0	0	0	0	0	0	0	0	0
Total	4	3	0	0	1	7	1	1	1	1	1

	2004	2005	2006	2007
Due to contact with overhead power line	1	1	1	1
Due to contact with under-ground power line	0	0	0	0
Total	1	1	1	1

Source: Alberta Municipal Affairs, Safety Services

Part 18 Personal Protective Equipment

Highlights

- Section 229 recognizes that the face piece of a full face piece respirator can provide eye protection.
- Section 232 requires workers to wear flame resistant outerwear if they could be exposed to a flash fire or electrical equipment flashover.
- Section 233 provides several options in protective footwear. Footwear requirements are based on the hazards feet may be exposed to. External safety toecaps are permitted as an alternative to protective footwear when a medical condition prevents a worker from wearing normal protective footwear. Footwear approved to ASTM Standard F2413 is now acceptable for use in Alberta.
- Section 233(1.1) prohibits employers from requiring workers to use footwear that may pose a health or safety risk to them. Workers have the right to use footwear that is safe, comfortable and appropriate for their workplace.
- Section 234 recognizes both Canadian Standards Association (CSA) and American National Standards Institute (ANSI) standards for protective headwear.
- Section 235 requires employers to ensure that a worker riding a bicycle or using in-line skates or a similar means of transport wears an approved cycling helmet.
- Section 246 requires employers to ensure that respiratory protective equipment must be approved by the National Institute for Occupational Safety and Health (NIOSH) or by another organization that sets standards and tests equipment, and is approved by a Director of Occupational Hygiene. Directors of Occupational Hygiene are staff members of Alberta Labour appointed by the Minister under Section 42 of the *OHS Act*.
- Section 247 requires that employers select respiratory protective equipment in accordance with CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*.
- Section 250 requires that employers test respiratory protective equipment for fit, according to CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*.

Requirements

Section 228 Duty to use personal protective equipment

Subsection 228(1)

If the hazard assessment required by section 7 of the *OHS Code* indicates that personal protective equipment (PPE) is required, the employer and supervisor must ensure that workers wear **and** use the required PPE properly.

The *OHS Code* requires employers to provide PPE in a limited number of situations where, for example, there is a breathing hazard or where noise exposure limits are exceeded. This Part does not require employers to provide PPE such as hard hats, safety boots, flame resistant clothing or eye protection. Where such equipment is necessary, employers must make sure that workers use it.

Regardless of who supplies the PPE, paragraph 228(1)(c) makes the employer responsible for ensuring that the PPE is in a condition to perform the function for which it was designed. Cracked eye protection, worn out safety boots and excessively dirty flame resistant overalls are examples of conditions that employers need to be aware of and either correct or have corrected.

For PPE to be effective, workers must be trained in its correct use, care, limitations and assigned maintenance. The employer is responsible for providing this training. Workers must be aware that wearing and using PPE does not eliminate the hazard. If the PPE fails, the worker will be exposed to the hazard. Workers need to understand that PPE must not be altered or removed even though they may find it uncomfortable—sometimes equipment may be uncomfortable simply because it does not fit properly.

Employers exceeding the requirements of Part 18

This Part uses language such as “If a worker’s eyes may be injured or irritated...,” “If a worker may be exposed to a flash fire...,” “If the hazard assessment identifies that protective footwear needs to...,” and “If there is a foreseeable danger of injury....” In all cases, it is the employer’s responsibility to assess the presence and significance of the relevant hazard, determining if workers should use a particular type of personal protective equipment.

There are situations in which no foreseeable danger exists—either at a portion of the work site or at the entire work site—yet an employer still requires that workers use a particular type of personal protective equipment. In such situations the employer has usually set a blanket policy that all workers must use the personal protective equipment regardless of where workers are to on the work site and regardless of the presence or absence of the hazard.

Employers have the freedom to set and enforce such a policy as the policy does not violate the requirements of the *OHS Code*. Such a policy exceeds the minimum requirements of the *OHS Code*. Of course, such policies must be considered in the context of other Alberta legislation, such as human rights legislation.

Subsection 228(2)

Workers have several obligations. Workers must use PPE according to the training and instruction they receive. Workers must inspect PPE prior to use and not use PPE found to be in a condition that makes the PPE unsuitable for use. For example, if a worker required to use a self-contained breathing apparatus (SCBA) cannot get a good facial seal because the face piece is too small, the worker must not use the apparatus. Section 5 of the *OHS Act* imposes a responsibility on workers to report this situation to the employer so that it can be corrected.

Subsection 228(3)

The use of PPE must not itself endanger the worker. Examples of such situations are:

- (a) safety toecaps in place of protective footwear—a worker wearing toecaps should not be required to do much walking around the work site. The toecaps may create a tripping hazard;
- (b) a poorly fitting suit worn to prevent exposure to chemicals may not seal well at the wrists and ankles;
- (c) a worker issued latex gloves may have an allergy to latex; and
- (d) a face shield covered with dirt and debris may affect a worker's ability to see clearly.

Eye Protection

Section 229 Compliance with standards

Subsection 229(1)

If a worker's eyes may be injured or irritated at a work site, the employer is required to ensure that the worker wears eye protection equipment that is approved to CSA Standard Z94.3-07, *Eye and Face Protectors*, CSA Standard Z94.3-02, *Industrial Eye and Face Protectors*, or CAN/CSA-Z94.3-99, *Industrial Eye and Face Protectors*. For compliance purposes, at least one component of an assembled product or system must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI. For example, if the mark or label appears on the frame, then the entire product is approved; if the mark or label appears on an earpiece, then the entire product is approved.

The CSA standard sets minimum performance requirements for the testing of industrial eye and face protection. This includes testing for impact resistance, ignition/flammability, visibility, field of view and other characteristics. With the exception of subsections 229(2.3) and 229(3), eye and face protectors meeting the

requirements of the 1989 or 2003 editions of ANSI Standard Z87.1, *Occupational and Educational Eye and Face Protection*, are not recognized by the OHS Code.

The employer is not required to pay for and provide eye protection equipment. However, the employer and supervisor is required to ensure that a worker wears such equipment if a worker's eyes may be injured or irritated at a work site. The employer is also required to ensure that the eye protection equipment selected is appropriate to the work being done and the hazard(s) involved.

Situations can arise in which the eyes are exposed to multiple hazards all at the same time. When this happens, protection must be provided against the highest level of each hazard. For example, if the work involves both flying particles and the possibility of an acid splash, using spectacles is not good enough. At a minimum, Class 2B goggles must be used. The following paragraphs describe the CSA Classes of protective equipment available and Table 18.1 recommends the type of protective equipment that should be used based on the hazard.

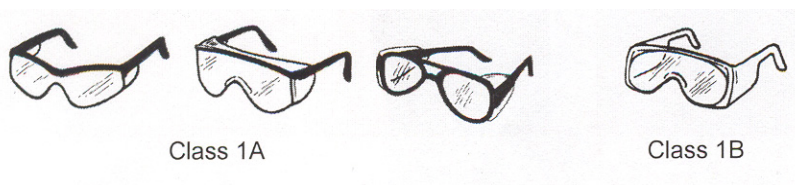
CSA classification of eye and face protectors (CSA Standard Z94.3-07, Eye and Face Protectors)

The CSA Standards classify eye and face protection into seven classes as follow:

Class 1—Spectacles (see Figure 18.1)

- Class 1A spectacles for impact protection with side protection;
- Class 1B spectacles for impact and radiation protection with side protection.

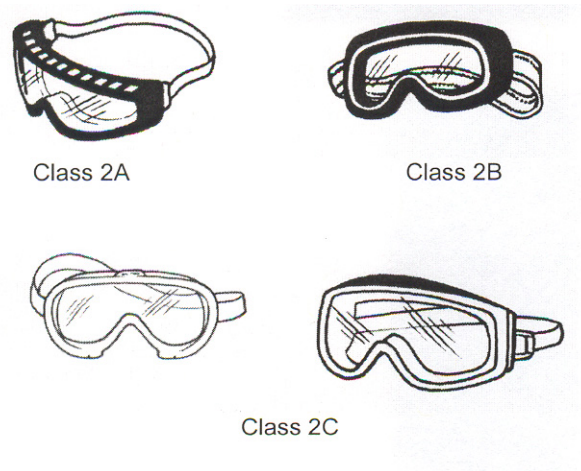
Figure 18.1 Spectacles



Class 2—Goggles (see Figure 18.2)

- Class 2A goggles for impact protection with direct ventilation;
- Class 2B goggles for impact, dust and splash protection; non-ventilated and indirectly ventilated; and
- Class 2C goggles are Class 2A or 2B goggles with radiation protection.

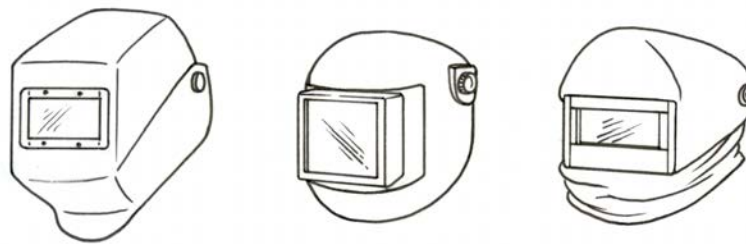
Figure 18.2 Goggles



Class 3—Welding helmets (see Figure 18.3)

- This Class includes a variety of configurations.

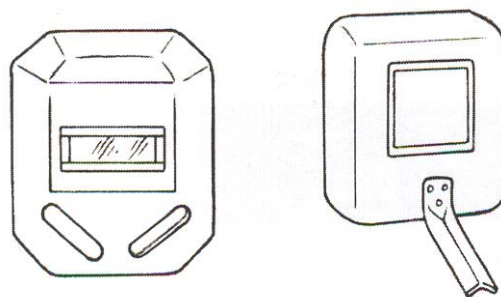
Figure 18.3 Welding helmets



Class 4—Welding hand shields (see Figure 18.4)

- This Class includes a variety of configurations.

Figure 18.4 Welding hand shields



Class 5—Non-rigid helmets (hoods) (see Figure 18.5)

- Class 5A non-rigid helmets have an impact-resistant window;
- Class 5B non-rigid helmets are intended for dust, splash and abrasive materials protection;
- Class 5C non-rigid helmets have radiation protection; and
- Class 5D non-rigid helmets are intended for high-heat applications.

Figure 18.5 Non-rigid helmet (hood)



Class 6—Faceshields (see Figure 18.6)

- Class 6A faceshields offer impact and splash protection;
- Class 6B faceshields offer radiation protection; and
- Class 6C faceshields are intended for high-heat applications.

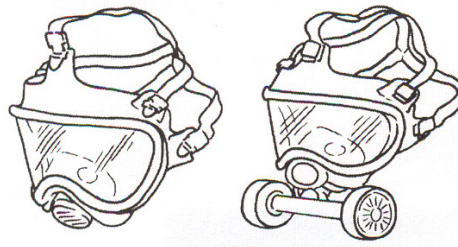
Figure 18.6 Faceshields



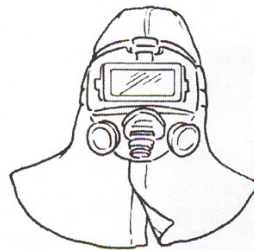
Class 7—Respirator facepieces (see Figure 18.7)

- Class 7A respirator facepieces offer impact and splash protection;
- Class 7B respirator facepieces are Class 7A respirator facepieces with radiation protection;
- Class 7C respirator facepieces have loose-fitting hoods or helmets; and
- Class 7D respirator facepieces are Class 7C respirator facepieces with radiation protection.

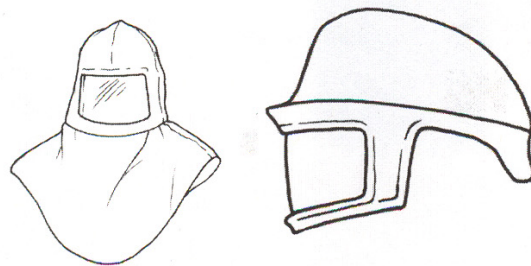
Figure 18.7 Respirator facepieces



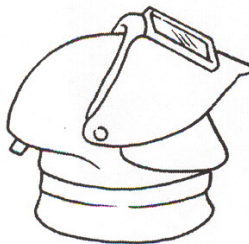
Class 7A



Class 7B



Class 7C



Class 7D

Table 18.1 Hazards and recommended eye and face protectors

Nature of hazard	Typical hazardous activities	Spectacles Class 1		Goggles Class 2			Welding helmet Class 3	Welding hand shields Class 4	Non-rigid hoods Class 5				Faceshields Class 6		
		A	B	A	B	C			A	B	C	D	A	B	C
Flying objects	Chipping, scaling, stonework, drilling, grinding, buffing, polishing, etc; hammer mills, crushing, heavy sawing, planing; wire and strip handling; hammering, unpacking, nailing; punch press, lathe work, etc.	✓		✓	✓				✓	✓			✓		
Flying particles, dust, wind, etc.	Woodworking, sanding; light metalworking and machining; exposure to dust and wind; resistance welding (no radiation exposure); sand cement, aggregate handling; painting; concrete work, plastering; material batching and mixing	✓		✓	✓				✓	✓			✓		
Heat, sparks, and splash from molten materials	Babbling, casting, pouring molten metal; brazing, soldering, spot welding, stud welding; hot dipping operations		✓			✓					✓	✓		✓	✓
Acid splash; chemical burns	Acid and alkali handling; degreasing, pickling and plating operations; glass breakage; chemical spray; liquid bitumen handling				✓					✓			✓		
Abrasive blasting materials	Sand blasting; shot blasting; shotcreting				✓				✓				✓		
Glare, stray light	Reflection, bright sun, and lights; reflected welding flash; photographic copying	✓		✓	✓				✓	✓			✓		

Nature of hazard	Typical hazardous activities	Spectacles Class 1		Goggles Class 2			Welding helmet Class 3	Welding hand shields Class 4	Non-rigid hoods Class 5				Faceshields Class 6		
		A	B	A	B	C			A	B	C	D	A	B	C
Optical radiation that can injure the eyes (where moderate reduction of optical radiation is required)	Torch cutting, welding, brazing, furnace work; metal pouring, spot welding, photographic copying		✓			✓					✓			✓	
Optical radiation that can injure the eyes (where large reduction of optical radiation is required)	Electric arc welding; heavy gas cutting; plasma spraying and cutting; inert gas shielded arc welding; atomic hydrogen welding						✓	✓							

Source: Based on Table A.1 of CSA Standard Z94.3-02 *Eye and Face Protectors*

Subsection 229(2)

Even if prescription eyewear is made with “impact resistant” plastic lenses, the eyewear still does not protect the eyes like safety eyewear. Some of the differences between safety and prescription eyewear are:

- (a) safety eyewear must meet the impact strength requirements of the CSA Standards listed—able to withstand the impact of a 6.4 millimeter diameter steel ball travelling at 46.5 metres/second. Prescription eyewear is not subjected to such a test;
- (b) safety eyewear frames must be manufactured so that when struck by an object, the lenses cannot be pushed through the back of the frame into the wearer’s face. Prescription eyewear may not have this feature; and
- (c) safety eyewear must have side protection, meet safety standard dimension requirements, and be tested as a complete protector. Prescription eyewear may not meet these requirements.

For those who need it, prescription safety eyewear is available from optometrists. Such eyewear meets the requirements of the referenced CSA standards by using certified lenses and frames. Acceptable prescription safety eyewear has the following characteristics:

- (a) lenses are etched or marked with the manufacturer’s identification; and
- (b) frames are marked with the manufacturer’s trademark and the mark or label of the nationally accredited testing organization that evaluated and approved the eyewear to one of the listed CSA standards.

Subsections 229(2.1) and 229(2.2)

These subsections recognize that in some cases, prescription safety eyewear must be used that has treated safety glass lenses rather than plastic lenses. For example, a work environment may contain an atmosphere that could be corrosive to a plastic lens. Where this is the case, the lenses made of glass must meet the requirements of at least one of the listed ANSI standards. The ANSI standards are referenced because the use of glass lenses is not recognized by CSA’s protective eyewear standards.

Prescription safety eyewear having bifocal, trifocal or progressive, i.e., a range of focal lengths from near to far distances, glass lenses has limited impact resistance. As a result, glass lenses must not be used where there is a danger of impact, i.e., there is a probability that the lens can be struck by some object, unless they are worn behind eye protection equipment approved to at least one of the CSA standards listed in subsection 229(1).

Subsection 229(2.3)

Practically speaking, prescription safety eyewear sometimes uses ANSI-compliant frames with CSA-compliant lenses. This subsection acknowledges this situation and allows it.

Subsection 229(3)

Situations may arise in which a full face piece respirator is required and the work also requires the eyes and face to be protected from debris, flying particles and dust. In the past, the performance of such work required the use of *both* a respirator and approved protective eyewear. This approach often reduced the ability of workers to see properly and was cumbersome.

The referenced editions of CSA Standard Z94.3 include impact testing of respirator face pieces, eliminating the need for additional protective eyewear. However, at the time of release of the *OHS Code*, CSA did not have a certification program in place to test respirator face pieces to the new requirements. Until a certification program is in place, respirator face pieces meeting the faceshield impact requirements of section 9 of the referenced editions of ANSI Standard Z87.1, *Practice for Occupational Health and Educational Eye and Face Protection*, are considered acceptable. It is understood that CSA will have a certification program in place in the near future.

Section 230 Contact lenses

Opinions about the safety of contact lenses at the workplace vary widely. The critical point is that contact lenses are not intended to be used as protective devices. They are not a substitute for PPE. If eye and face protection is required for certain work operations, then all workers, including contact lens wearers, must wear the proper protective devices. The arguments against wearing contact lenses are that

- (a) dusts or chemicals can be trapped behind the lens and cause irritation or damage to the cornea;
- (b) gases and vapours can irritate the eyes and cause excessive watering; and
- (c) chemical splashes may do more harm when contact lenses are worn. If lens removal is delayed, first aid treatment may not be as effective and, as a result, the eye's exposure time to the chemical may be increased.

However, the opposite may be true as well. Contact lenses may prevent some substances from reaching the eye, minimizing or even preventing an injury. Both situations have been documented.

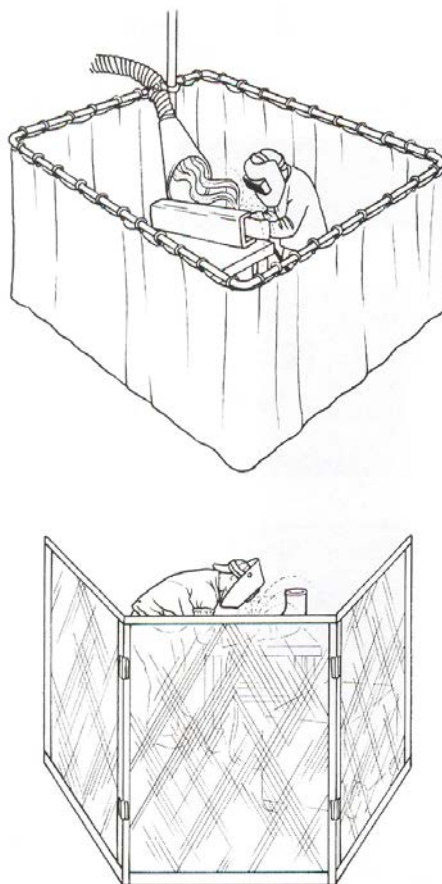
If wearing contact lenses poses a hazard to the worker's eyes during work activities, this section requires the employer to advise the worker of the hazards and the alternatives available to contact lenses.

Section 231 Electric arc welding

A worker performing electric arc welding is responsible for ensuring that all workers in the area are protected from exposure to the radiation created by the arc. Workers in the

area can be protected if they wear appropriate eye protection or the arc welding is done behind a screen as shown in Figure 18.8.

Figure 18.8 Examples of protective screens used in arc welding



Section 232 Flame resistant clothing

Flash fires and explosions are common hazards at a variety of Alberta workplaces. These hazards are present in work areas where flammable materials are present, handled, processed, or stored. In the petrochemical industry, for example, flash fires can occur at well head sites, collection points, compressor stations, refineries, and petrochemical and plastics plants. In such areas, the potential exists for developing an explosive atmosphere capable of injuring or killing workers and causing extensive property damage.

Industrial flash fires and explosions result from the accidental release and ignition of flammable fuels or chemicals. The size and duration of the flame that results from this ignition is determined by the amount of fuel available, the efficiency of combustion, and the environmental and physical characteristics of the site of the flash fire or explosion. The temperatures attained by flash fires have been estimated to range from 550 to

1050°C, although higher temperatures are believed to occur. Even the lowest estimated temperature exceeds the temperature at which most regular clothing fabrics burst into flames.

If a worker may be exposed to a flash fire or electrical equipment flashover, i.e., arc flash, the employer must ensure that the worker wears flame resistant outerwear and uses other protective equipment appropriate to the hazard. The employer is not required to pay for and provide flame resistant outerwear. However, the employer is required to ensure that a worker wears this equipment if there is a danger of a flash fire or flashover.

Commentary about clothing and PPE for arc flash protection

Readers will note that while this section requires workers to wear and use appropriate flame resistant (FR) outerwear and other PPE for protection against arc flash events, the section does not specify compliance with a particular standard or standards. In particular, CSA Standard Z462-08, *Workplace electrical safety*, is not referenced.

CSA Standard Z462, which is based on a similar U.S. Standard NFPA 70E, *Standard for Electrical Safety in the Workplace*, was published at the end of December, 2008. As such, it was published *after* most of the requirements of the 2009 edition of the *OHS Code* were finalized. Despite the fact that CSA Standard Z462 is not referenced in the *OHS Code*, this section does require that an employer ensure that workers who may be exposed to an arc flash wear FR outerwear and use other PPE appropriate to the hazard. In determining the rating of the outerwear and which PPE is appropriate, some employers are using Z462 as a source of guidance information. Readers need to recall that FR clothing and other arc flash PPE are only required if the equipment being worked on is energized. If the equipment is isolated and de-energized, this safety equipment is unnecessary.

An employer can choose to use Z462 for guidance, or any other standard or information source that the employer considers appropriate; a listing of other standards relevant to arc flash protection are shown below. The *OHS Code* does not specify which standard or information source the employer must use.

For more information

📖 ASTM Standard F1506-08, *Standard Performance Specification for Textile Material for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards*

📖 ASTM Standard F1891-06, *Standard Specification for Arc and Flame Resistant Rainwear*

📖 CSA Standard Z462-08, *Workplace Electrical Safety*

- 📖 ULC Standard CAN/ULC-61482-1-06, *Live working—Flame resistant materials for clothing for thermal protection of workers—Thermal hazards of an electrical arc—Part 1: Test methods*
- 📖 IEC Standard 61482-1-1: 2009, *Protective clothing against the thermal hazards of an electrical arc—Part 1—1: Test methods—Method 1: Determination of the arc rating (APV or EBT50) of flame resistant materials for clothing*
- 📖 IEC Standard 61482-2: 2009, *Live working—Protective clothing against the thermal hazards of an electric arc—Part 2: Requirements*

Subsection 232(2)

Workers who have survived flash fires and explosions and were not wearing flame resistant outerwear have suffered terribly painful and disfiguring burns. However, in general, they do not suffer the most serious burns on their uncovered head and hands. Instead, the areas that *are* covered by their regular clothing and *not* protected by flame resistant outerwear are the most severely burned. The burning clothing, in contact with the skin and burning long after the flame has retreated, causes the most severe burns. Clothing that melts without burning can also cause significant damage as it must often be peeled away from the damaged skin and tissues that remain beneath the melted clothing.

To reduce the possibility of clothing melting to the skin or burning, the clothing workers wear beneath their flame resistant outerwear must be made of flame resistant fabrics or natural fibres. Examples of appropriate natural fibres include wool, cotton, and silk. The worker is responsible for ensuring this is done. Readers should refer to the manufacturer's specifications that accompany the flame resistant outerwear for more information.

For more information

- 📖 CGSB Standard CAN/CGSB-155.20-2000 *Workwear for Protection Against Hydrocarbon Flash Fire*, Canadian General Standards Board (CGSB)
- 📖 CGSB Standard CAN/CGSB-155.21-2000 *Recommended Practices for the Provision and Use of Workwear for Protection Against Hydrocarbon Flash Fire*, Canadian General Standards Board (CGSB)

Foot Protection

Section 233 Footwear

Subsection 233(1)

The employer is not required to pay for and provide safety footwear. However, the employer is required to assess the hazards (see section 7 of the *OHS Code*) that the worker's feet will be exposed to and determine if there is a danger of injury to the worker's feet. The employer is also required to ensure that the protective footwear selected is appropriate to the work being done and the hazard(s) involved.

The employer must determine the appropriate protection required for the feet based on the work assigned to each worker. In doing so, the following factors should be considered: the potential for slipping, uneven terrain, abrasion, ankle protection and foot support, the potential for crushing injuries, temperature extremes, exposure to chemical substances, puncture hazards, electrical shock and any other recognizable hazard.

The assessment must consider the work procedures and conditions present at the workplace. An employer may change the work procedures and workplace conditions to reduce or remove the hazard. For example, an employer may limit the number of workers doing tasks that could cause foot injury. Or the employer may change the way the tasks are done. Protective footwear need only be worn while a worker is exposed to the hazard that requires it. When determining the requirements for appropriate protective footwear, worker training and supervision are not an acceptable substitute for protective footwear.

The hazard assessment to determine appropriate footwear will result in persons or activities being placed into one of three categories:

Category 1

The hazards present require footwear approved to

- (a) CSA Standard Z195-02, *Protective Footwear*, or
- (b) ASTM Standard F2413-05, *Specifications for Performance Requirements for Protective Footwear*.

Because safety footwear is only approved to the specific hazards listed in the standards, the employer must be aware of hazards to which workers are exposed and against which the footwear provides protection.

If a hazard requires metatarsal protection, i.e., protection to the top surface of the foot, metatarsal protectors must be an integral part of the footwear. This form of protection is typically required in foundries and heavy manufacturing where steel

plate, beams or rails are handled, but it is not normally required in construction. Metatarsal protectors that only attach to the laces or are only strapped in place do not meet the requirements of the referenced CSA standard. Such protectors must not be used because there is no assurance that they will be properly supported by the toecap.

Category 2

Some hazards are present that require foot protection but not necessarily to the level of category 1. For example, it is unlikely that a lifeguard at a beach needs footwear with safety toe protection. It is much more likely that the lifeguard needs footwear offering protection against cuts from objects on the beach.

Hazards for which protection may be required include slipping, uneven terrain, abrasion, ankle protection and foot support, temperature extremes and corrosive substances. CSA Guideline Z195.1-02, *Guideline on Selection, Care, and Use of Protective Footwear*, helps employers assess hazards and select the most appropriate protective footwear for the situation.

Category 3

There are no hazards of foot injury for which specific protective footwear is necessary. This situation applies to most workers in an office setting.

Footwear suggestions for certain types of workers

The following situations serve as examples of the types of footwear workers should wear. Because circumstances at workplaces can vary significantly, these recommendations are general and may need to be altered. For example, an employer may arrange the work in a manner that eliminates all hazards of foot injury and therefore the need for protective footwear.

- Example 1: A worker in the construction industry, or any other similar working environment where there is risk of toe injury, should wear approved safety footwear with Grade 1 toe protection (see Table 18.2 for information about the grades of toe protection available.)
- Example 2: A worker in the construction industry, or any other industry with a possibility of sole puncture, should wear footwear with protective sole plates.
- Example 3: A worker in any industry with a potential for electric shock, for example an electrician or powerline technician, should wear footwear with dielectric protective soles, in addition to any other protective features required by the circumstances of the work.
- Example 4: A worker using high pressure washing or cutting equipment should wear footwear or footwear cover devices that protect the whole top area of the

foot from accidental contact with the washing or cutting stream. Conventional safety toe and metatarsal protectors do not cover a sufficient portion of the worker's foot to protect the foot during this type of work.

Because conventional protective footwear does not offer sufficient protection against this hazard, alternative footwear appropriate to the hazard must be used. Subsection 233(3) allows the use of protective footwear that is not approved to the listed standards.

Example 5: A worker in a warehouse should wear safety footwear with Grade 1 toe protection.

Example 6: A worker in a retail store environment using pallet jacks, forklifts or other rolling equipment should wear footwear with Grade 1 toe protection.

There are activities and work environments where a heavy work shoe or boot, or a specific protective feature, might normally be required but wearing such footwear could endanger the worker or damage the work environment. These exceptions apply while the worker is performing the particular job function. When the worker is performing other job functions or walking through surrounding hazards, the worker must wear footwear appropriate to those job functions or hazards. Some examples include the following:

Example 7: A roofer applying asphalt shingles or similar materials that can be damaged by heavy work boots will generally wear light, soft-soled footwear such as running shoes.

Example 8: A carpet layer or similar finishing trade that requires a worker to constantly kneel down will generally not wear safety-toed footwear.




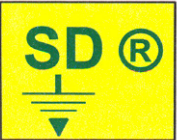
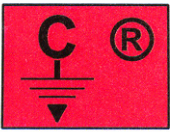

Example 9: A worker climbing or walking on skeletal steel structures will generally not wear safety-toed footwear because such footwear offers limited grip on steel surfaces. However, the worker should wear substantial footwear having leather uppers reaching past the ankles to provide ankle support and abrasion resistance.

Example 10: A worker in the logging industry walking on logs or on steep sidehills or uneven ground will generally not wear safety-toed footwear. Subsection 233(3) should be applied since the principle hazard is slipping, a hazard not addressed by the standards listed in subsection 233(2). Substantial footwear having leather uppers and a heavily lugged sole is usually a better choice.

Subsection 233(1.1)

This section prohibits employers from mandating workers to use footwear that may pose a health and safety risk to the workers. For example, workers may voluntarily wear high heels or other footwear if safe to do so, but cannot be mandated to by employers.

Table 18.2 Protective footwear markings

Outside Labels	Location	Criteria	Intended Application
	The label will appear on the outer side or on the tongue of the right shoe.	Green triangle indicates sole puncture protection with a Grade 1 protective toe to withstand impacts up to 125 joules. Comparable to a 10 kg weight dropped 1.3 metres.	For any industry, especially construction, where sharp objects (such as nails) are present, heavy work environments.
	The label will appear on the outer side or on the tongue of the right shoe.	Yellow triangle indicates sole puncture protection with a Grade 2 protective toe to withstand impacts up to 90 joules. Comparable to a 10 kg weight dropped 0.9 metres.	For light industrial work environments requiring puncture protection, as well as toe protection.
	The label will appear on the outer side or on the tongue of the right shoe.	White rectangle with orange Greek letter Omega indicates soles that provide resistance to electrical shock.	For any industry where accidental contact with live electrical conductors can occur. <i>Warning: Electrical Shock Resistance deteriorates with wear and in a wet environment.</i>
	The label will appear on the outer side or on the tongue of the right shoe.	Yellow rectangle with green "SD" and grounding symbol indicates soles are static dissipative.	For any industry where a static discharge can create a hazard for worker or equipment.
	The label will appear on the outer side or on the tongue of the right shoe.	Red rectangle with black "C" and grounding symbol indicates soles are electrically conductive.	For any industry where static discharge may create a hazard of explosion.
	The label will appear on the outer side or on the tongue of the right shoe.	White label with green fir tree symbol indicates chain saw protective footwear.	For forestry workers and others exposed to hand-held chain saws or other cutting tools.

Source: CSA Special Publication Z195.1-02 Guideline on Selection, Care, and Use of Protective Footwear

Note: The ® appearing on the labels represents the mark or label of the nationally accredited testing organization that evaluated and approved the footwear.

Subsection 233(2)

Footwear approved to the listed standards offers protection against a limited number of hazards. If workers are exposed to one or more of these hazards, and the hazard assessment shows these to be the principle or only hazards needing to be protected against, then footwear approved to the listed standards must be used. For compliance purposes, the footwear must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI.

However, as described in Examples 4 and 10 above, if the principle hazard or hazards differ from those addressed by the standards, alternative, unapproved footwear appropriate to the hazards must be used. The employer should be able to explain the reason(s) for selecting unapproved footwear based on the hazards that workers are exposed to.

Footwear approved to the standards offers, alone or in combination

- (1) toe protection,
- (2) a puncture resistant sole,
- (3) metatarsal protection (protection to the top part of the foot),
- (4) electrical protection, and
- (5) chainsaw protection.

Subsection 233(3)

Conventional protective footwear offers protection against a limited number of hazards (see explanation above). If such footwear does not offer adequate protection because the worker is likely to be exposed to a hazard other than one of those referred to in subsection 233(2), then the use of alternative footwear that may not be approved to one of the referenced standards is permitted. The employer must ensure that this unapproved footwear is appropriate to the hazard. The employer should be able to explain the reason(s) for selecting unapproved footwear based on the hazards that workers are exposed to.

Subsection 233(4)

The use of safety toecaps as an alternative to approved protective footwear is limited by several conditions:

- (a) the affected worker must be able to provide the employer with a medical certificate, signed by a physician, indicating that the worker is unable, for medical reasons, to wear approved footwear;
- (b) the safety toecaps must, at a minimum, meet the impact force test requirements for footwear of CSA Standard Z195-02, *Protective Footwear* or ASTM Standard F2413-05, *Specification for Performance Requirements for Protective Footwear*. The impact force required is based on the type of foot hazard the worker is exposed to. For example, if the worker needs Grade 1 protection, then the toecap must be able to withstand the

impact force required by Grade 1 foot protection. The purpose of the toecaps is to provide impact protection. Toecaps are not an acceptable replacement for, for example, protective footwear offering chain saw protection;

- (c) safety toecaps are not suitable replacements for integral metatarsal protectors. If the worker is exposed to metatarsals hazards, then safety toecaps cannot be used;
- (d) safety toecaps do not have soles capable of providing protection against sharp objects penetrating the soles of shoes with which the toecaps are being used. If the worker is exposed to sole penetration hazards, then safety toecaps cannot be used; and
- (e) safety toecaps may present a tripping hazard, an electrical safety hazard if made of conductive materials. The employer must take these factors into consideration when determining if safety toecaps can be used as a safe and effective alternative to approved protective footwear.

Subsection 233(5)

No explanation required.

Head Protection

Section 234 Industrial headwear

Subsection 234(1)

The *OHS Code* does not require all workers under all circumstances to wear industrial protective headwear, i.e., hard hats. Only if there is a foreseeable danger of injury to a worker's head at a work site is industrial protective headwear required. The decision to require workers to use industrial protective headwear should be based on the results of the hazard assessment required by section 7 of the *OHS Code*.

For compliance purposes, industrial protective headwear intended for use where there is a significant possibility of lateral impact to the head must meet the requirements of CSA Standard CAN/CSA-Z94.1-05, *Industrial Protective Headwear*, or ANSI Standard Z89.1-2003, *American National Standard for Industrial Head Protection*, for Type II head protection. The headwear must be of the appropriate Class for the type of work being performed. The employer is not required to provide the equipment, but the employer and supervisor must ensure it is used if it is required.

Industrial safety headwear has traditionally been designed and tested to provide protection from an impact directed more or less downward onto the top of the head. The 1992 edition of CSA Standard Z94.1 introduced a new requirement for protection of the head from an impact landing on the side of the head. This was in response to injury studies that indicated a significant incidence of injury due to people being struck on the side of the head by objects, even when wearing safety headwear. According to the

standard, a lateral impact occurs when an object strikes the headwear from any direction other than directly above. All protective headwear that meets the requirements of this standard provides lateral impact protection.

The 1997 edition of the referenced ANSI standard added requirements specific to lateral impact, creating a new Type II category for head protection.

CSA Standard

CSA Standard Z94.1-05, *Industrial Protective Headwear*, applies to headwear intended to protect the heads of industrial workers. The standard defines the areas of the head that are to be protected and includes basic performance requirements for impact protection, object penetration, stability and dielectric properties (the ability of a material to resist the passage of electric current).

The standard divides protective headwear into three Classes according to its intended use:

- (a) *Class G (General Use)*—this Class is intended to provide workers with protection against impact and penetration. This headwear is non-conducting and must pass the 2200 V dielectric-strength test specified for Class G headwear. Although this class of protective headwear is manufactured from non-conducting materials, it must never be considered to be part of a protective system against electric shock. This protective headwear provides limited protection against electric shock following accidental contact between the headwear and exposed energized electrical sources.
- (b) *Class E (Electrical Trades)*—this Class is intended to provide workers with protection against impact and penetration. This headwear is non-conducting and must pass the 20,000 V dielectric-strength test specified for Class E headwear. Although this class of protective headwear is manufactured from high grade non-conducting material, it must never be used as a primary barrier in a protective system designed to prevent contact with live electrical apparatus. This headwear provides improved protection against electric shock following accidental contact between the headwear and exposed energized electrical sources.
- (c) *Class C (Conducting Headwear)*—this Class is intended to provide the user with protection against impact and penetration only.

Protective headwear meeting the CSA requirements may have a brim around the entire circumference of the shell or have a partial brim with a peak.

ANSI Standard Z89.1-2003

Type II helmets that meet the 1997 or 2003 editions of ANSI Standard Z89.1, *American National Standard for Industrial Head Protection*, may also be used at the workplace. The ANSI Standard applies to protective helmets intended to provide limited protection for the head against impact, flying particles, electric shock or any combination of these hazards.

The standard divides protective helmets into two types and three classes according to their intended use. Type I helmets are intended to reduce the force of impact resulting from a blow only to the top of the head. Type II helmets are intended to reduce the force of impact resulting from a blow that may be received off-centre or to the top of the head. The three classes are as follows:

- (a) *Class G (General)*—this Class is intended to reduce the danger of contact exposure to low voltage conductors and must pass the 2200 V dielectric-strength test specified for Class G helmets. These helmets are used in mining, construction, shipbuilding, tunnelling, lumbering and manufacturing.
- (b) *Class E (Electrical)*—this Class is intended to reduce the danger of contact exposure to high voltage conductors and must pass the 20,000 V dielectric-strength test specified for Class E helmets. This Class of headwear is used extensively by electrical workers.
- (c) *Class C (Conductive—no electrical protection)*—this Class is designed specifically for lightweight comfort and impact protection. This Class is usually manufactured from aluminum and offers no dielectric protection. Class C helmets are used in certain construction and manufacturing occupations, oil fields, refineries and chemical plants where there is no danger from electrical hazards or corrosion. They are also used on occasions where there is a possibility of bumping the head against a fixed object.

ANSI types and classes are combined to provide products classified as Type I, Class G or Type II, Class E, etc. Helmets meeting the ANSI requirements may have a brim around the entire circumference of the helmet shell or have a partial brim with a peak.

Class of headwear to be worn

An electrician working only on “residential type” circuits of 240 volts or less may wear headwear classified by CSA as Class G or E, or classified by ANSI as Class A or B. Headwear having one of these classifications has a dielectric-strength test rating of 2200 volts. While this upper voltage limit around residential type circuits may seem conservative, it takes into account the effects of accumulated dirt on the headwear and wear and tear of the headwear material.

Electrical utility workers, electricians and other workers who work on circuits having voltages exceeding 240 volts must use headwear classified by CSA and ANSI as Class E. Headwear having this classification has a dielectric test rating of 20,000 V.

Workers who are not exposed to energized electrical equipment in the normal course of their work may use headwear of any Class, including headwear classified by CSA and ANSI as Class C (Conductive). If workers receive special training and are given work assignments requiring work near exposed energized electrical sources, they must have and wear headwear with the appropriate dielectric rating. For example, workers assigned to clean and paint utility poles may be exposed to electrical hazards and should therefore wear electrically protective headwear.

Protective headwear use

Industrial headwear is designed to absorb some of the energy of a blow through partial destruction of its component parts. Headwear that has experienced a severe impact should be replaced even though it may not appear to be damaged. Unless permitted by the manufacturer, headwear must not be painted or cleaned with solvents, and the adhesive used on decals applied to the headwear must not interact with the headwear material to reduce its strength.

For maximum head protection, the headwear's shell and suspension should be checked according to the manufacturer's instructions before each use. If the shell or linings are found to have a crack, dent, or hole, or if the suspension is torn or broken, the headwear should either be discarded or the particular part replaced with an identical part from the original manufacturer.

Unless permitted by the manufacturer, headwear users should not carry or wear anything inside their protective headwear. A cap or object may contain metal parts that reduce the dielectric protection provided by the headwear. A clearance distance must be maintained between the wearer's head and the headwear's shell for the protection system to work properly. A cap or other object may limit this clearance. Products such as fabric winter liners or cotton sunshades are designed to work in conjunction with the headwear and their use is acceptable.

Unless permitted in the manufacturer's written instructions for use, protective headwear must not be worn backwards. All headwear is tested while in its intended forward-facing direction. Very few models of headwear have undergone testing in both the forwards- and backwards-facing directions. Those products that have been tested and passed testing in both directions have usually required their suspension system to be reversed. In this case, only the shell of the headwear is backwards—the brow pad of the headband sits against the forehead and the extended nape strap is at the base of the skull.

Subsection 234(1.1)

A small utility vehicle is a small vehicle designated for off-road use, equipped with a bench-type seat and a steering wheel, and designed to transport more than one person. There are a variety of manufacturers and they are known by a variety of trade name including Polaris Ranger, Pug Back Forty, Bobcat Toolcat, John Deere Gator, Kawasaki Mule, Toro Twister and CubCadet Volunteer.

If a small utility vehicle is equipped with seat belts and rollover protection, riders are not required to wear a safety helmet. In such cases, the employer's procedures must require that riders use the seat belts.

Employers need to make sure that what looks like rollover protection is not simply part of a roof canopy. Confirm with the product manufacturer that the structure provides true rollover protection to occupants of the machine. Rollover protection devices bear a tag or decal, permanently affixed to the device, usually located on the device where it attaches to the frame of the machine.

Subsection 234(2)

If the possibility of lateral impact to the head is unlikely, the headwear can meet the requirements of

- (a) CSA Standard CAN/CSA-Z94.1-05, *Industrial Protective Headwear*, or
- (b) ANSI Standard Z89.1-2003, *American National Standard for Industrial Head Protection*.

In assessing the “possibility of lateral impact to the head,” employers should consider the likelihood of a lateral impact occurring. Headwear providing lateral impact protection must be used if a lateral impact is foreseeable and likely based on the type of work normally performed. Examples of typical workplace situations requiring such protection include a workshop in which multiple overhead cranes are used to transport loads around the shop, workers involved in the felling of trees, workers involved in tree care operations (see Part 39) and workers involved in processes in which substantial flying objects or debris are generated.

Section 235 Bicycles and skates

Subsection 235(1)

The employer must ensure that a worker riding a bicycle, using in-line skates, or similar means of transport such as a three-wheeled cycle, skateboard, or roller skates, wears a helmet approved to one of the listed standards. For compliance purposes, a helmet must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI.

This section applies to workers while working, and includes bicycle couriers, workers using in-line skates at grocery stores and workers at restaurants who may use roller skates or similar means of transport.

Subsection 235(2)

Workers are often required to wear a hard hat whenever they are present at an industrial work site. At large industrial complexes, workers may use bicycles or similar conveyances in place of vehicles as a means of getting from one work area to another. To avoid the need to carry additional headwear (a bicycle helmet) and constantly switch between the hard hat and bicycle helmet, this section permits workers to wear their hard hat in place of a helmet. To do so, speeds must not exceed 20 kilometres/hour and the hard hat must be equipped with a chin strap. The worker must use the chin strap.

Some hard hats have earmuff-style hearing protectors. When placed over the ears, these protectors can actually help to keep the hard hat on the head. However, if a worker's head is jolted (as might happen during a fall from a bicycle or similar conveyance), the hard hat and earmuffs quickly fall off. A hard hat with earmuff-style hearing protection is therefore unacceptable as an alternative to a hard hat with fastened chin strap.

Section 236 All-terrain vehicles, snow vehicles, motorcycles

Subsection 236(1)

Operators of all-terrain vehicles, snow vehicles, motorized trail bikes, motorcycles or a small utility vehicle must wear protective headwear meeting the requirements of one of the listed standards.

For compliance purposes, the helmet must bear a "DOT" mark or the mark or label of a nationally accredited testing organization such as CSA, UL, SEI. The presence of a "DOT" mark or an organization's mark or label proves that the helmet meets the requirements of the appropriate listed standard.

Subsection 236(2)

Headwear complying with an earlier edition of one of the listed standards may remain in service if the helmet is still in good condition. Existing helmets need not be replaced simply because they comply with an earlier edition of one of the listed standards.

Subsection 236(3)

The requirement to wear protective headwear while operating an all-terrain vehicle, snow vehicle, motorized trail bike or motorcycle does not apply if the machine is equipped with rollover protective structures meeting the requirements of section 270 and seat belts or restraining devices meeting the requirements of section 271.

Subsection 236(4)

Workers sometimes access work sites by all-terrain vehicle, snowmobile or motorcycle. An example of such a situation involves reading meters located in substations along the length of a pipeline. Workers dismount their vehicle(s), enter the substation, perform measurements, return to their vehicle(s) and move on to the next substation. At issue is the need to remove the helmet and replace it with a "hard hat" during the period that workers are in the substation.

Protective headwear meeting the requirements of subsection (1) offers impact and penetration protection equal to or better than that provided by a "hard hat." However, this headwear cannot pass the dielectric strength test to which hard hats are subjected since the metal fasteners and hardware attached to the helmet shell are capable of providing a conductive path through the helmet to the wearer.

A worker wearing headwear meeting the requirements of subsection (1) may, upon reaching the work site and beginning work tasks, continue to wear that headwear instead of industrial protective headwear, i.e., a hard hat, provided that

- (1) work tasks do not expose the worker to any potential contact with exposed energized electrical sources. Where the work being performed exposes the worker to any potential contact with exposed energized electrical sources, appropriately selected protective headwear meeting the requirements of section 234 must be used; and
- (2) the tasks performed at the work site are of limited duration. This condition is intended to limit the period of time during which the headwear is used in place of a hard hat. The time limitation reflects the fact that headwear intended for use with all-terrain vehicles, snow vehicles, etc., is less comfortable to wear, restricts the ability to hear and may restrict peripheral vision. Typical work tasks of limited duration include taking or recording measurements, reading meters, making process control adjustments. Where the duration of the tasks being performed exceeds that of the tasks listed as typical examples, appropriate protective headwear meeting the requirements of section 234 must be worn.

Section 237 Fire fighters

Helmets used by structural and wildland firefighters have characteristics or features specific to the type of work being performed. Protective headwear meeting the requirements of the referenced NFPA standards has the required characteristics or features.

For compliance purposes, protective headwear meeting the NFPA standards must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI. Without this mark or label, the headwear is not in compliance even if the manufacturer's label and product literature states that the headwear complies with one of the referenced standards. The marking also indicates the standard that the headwear complies with.

NFPA Standard 1971 (2007 edition), *Protective Ensemble for Structural Fire Fighting*, includes headwear requirements for protection against top and lateral impact, resistance to penetration, electrical exposure, flame resistance, heat distortion and several other characteristics. The headwear must be equipped with a faceshield or goggles, or both, ear covers, and fluorescent and reflective trim.

NFPA Standard 1977 (2005 edition), *Protective Clothing and Equipment for Wildland Fire Fighting*, includes headwear requirements for protection against top impact, resistance to penetration, electrical exposure, flame resistance, heat distortion and several other characteristics. The headwear must have retroreflective markings, i.e., markings that reflect light directly back to its source, and its weight is limited to 570 grams (20 ounces).

Section 238 Bump hat

Unlike industrial protective headwear, bump hats are not equipped with a shock-absorbing liner and suspension system that can absorb the energy of an object striking the headwear. Bump hats are intended for use in situations where the danger of injury is limited to striking the head against stationary objects. Examples of these situations include automotive repair operations, meat processing facilities, underwater dives in restricted spaces, servicing hard-to-reach equipment in a complex mechanical room.

Section 239 Exemption from wearing headwear

To perform certain functions, workers may need to remove their protective headwear or the use of protective headwear may not be practical. When this is the case, the employer must ensure that an adequate alternative means of protecting the worker's head during the work process is in place. This might be a simple matter of having persons working above the worker stop work and ensure that nothing falls down during the time that the worker beneath them is without head protection.

Providing overhead protection with a solid barrier or properly designed safety net are other approaches that may protect the worker from the hazard. If the falling object hazard is still present after the work process is completed, the worker must immediately return to wearing his or her protective headwear.

In some cases, employers may need to address accommodation of workers who wear headwear for religious purposes. These circumstances are addressed by human rights legislation.

Life Jackets and Personal Flotation Devices

Section 240 Compliance with standards

Subsection 240(1)

A life jacket meeting Canadian General Standards Board (CGSB) Standard CAN/CGSB-65.7-M88 AMEND, *Lifejackets, Inherently Buoyant Type*, provides a minimum buoyant force of 93 newtons (21 pounds-force) and is often of the "keyhole" style. The colour may be bright yellow, orange or red. The life jacket is designed to provide support for the head so the face of an unconscious person is held above the water with the body inclined backwards from the vertical position. The jacket must have a permanent label identifying the

- (a) standard it meets,
- (b) size of the jacket,
- (c) mass (weight) of the person for which the jacket is designed,
- (d) name of the manufacturer,

- (e) lot number,
- (f) date of manufacture, and
- (g) Transport Canada approval number.

Subsection 240(2)

Personal flotation devices meeting CGSB Standard CAN/CGSB-65.11-M88 AMEND, *Personal Flotation Devices*, are the most common and generally the most comfortable personal flotation device, offering up to 69 newtons (15.5 pounds-force) of buoyancy. A device meeting this Standard is *not* required to turn an unconscious person from a facedown position in the water to a position where the wearer's face is out of the water. The shell colour is bright yellow, orange or red. These devices can be either the vest or "key hole" style. The device must have a permanent label or marking identifying the

- (a) standard it meets,
- (b) date of manufacture,
- (c) acceptable chest size,
- (d) name of manufacturer, and
- (e) Transport Canada approval number.

Section 241 Use of jackets and flotation devices

When workers are transported by boat, the employer must ensure that each worker wears a lifejacket. However, as permitted by subsection (3), a personal flotation device—which is generally more comfortable to wear than a lifejacket—may be worn by workers if the work is performed from a boat for an extended period of time. This use of a personal flotation device is conditional on the employer ensuring that a life jacket is readily accessible to each worker on the boat.

Limb and Body Protection

Section 242 Limb and body protection

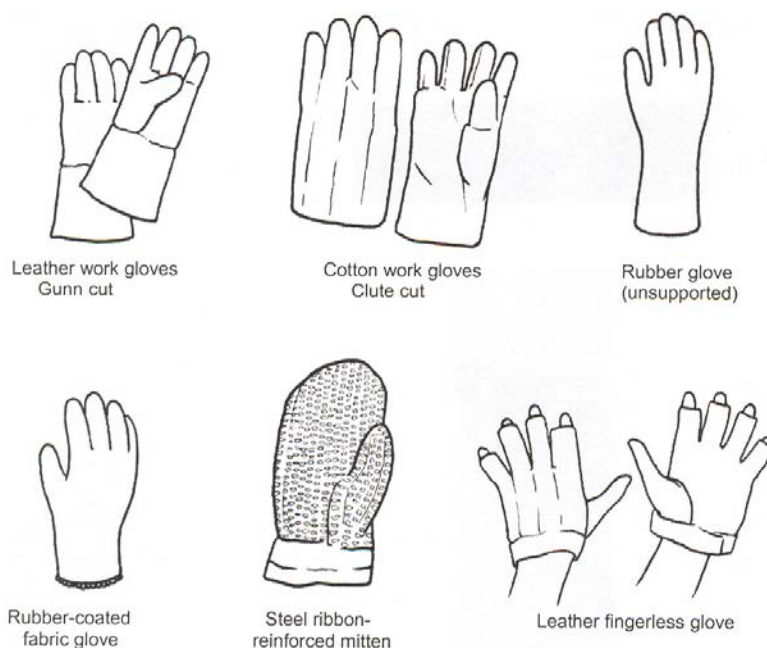
Hand and arm protection

Examples of injuries to arms and hands include burns, cuts, electrical shock, amputation and absorption of chemicals. There is a wide assortment of gloves, sleeves, and wristlets for protection against various hazards.

Employers need to determine the type and style of hand protection their workers need. Work activities should be studied to determine how much finger dexterity is needed to safely do the work, the duration, frequency, and degree of exposure to hazards, and the physical stresses that will be applied. The protection selected must be appropriate to the type of hazard.

Workers must be trained to understand the limitations of the protective equipment they are using. Figure 18.9 shows examples of protective gloves and other hand wear.

Figure 18.9 Examples of protective gloves and other hand wear



Torso protection

Exposure to heat, splashes from hot metal and liquids, impacts, cuts, acids, and radiation can injure the torso. A variety of protective clothing is available such as vests, jackets, aprons, coveralls and full body suits.

Heat-resistant materials such as leather are often used in protective clothing to guard against dry heat and flame. Rubber and rubberized fabrics, neoprene and plastic offer protection against some acids and chemicals. The manufacturer's specifications and selection guides should be consulted for information about the effectiveness of specific materials against specific chemicals.

Disposable suits of plastic-like or other similar synthetic materials are particularly important for protection from dusty materials or materials that can splash. If the substance is extremely toxic, a completely enclosed chemical suit may be necessary. The clothing should be inspected to ensure proper fit and function for continued protection. Figure 18.10 includes examples of torso protection.

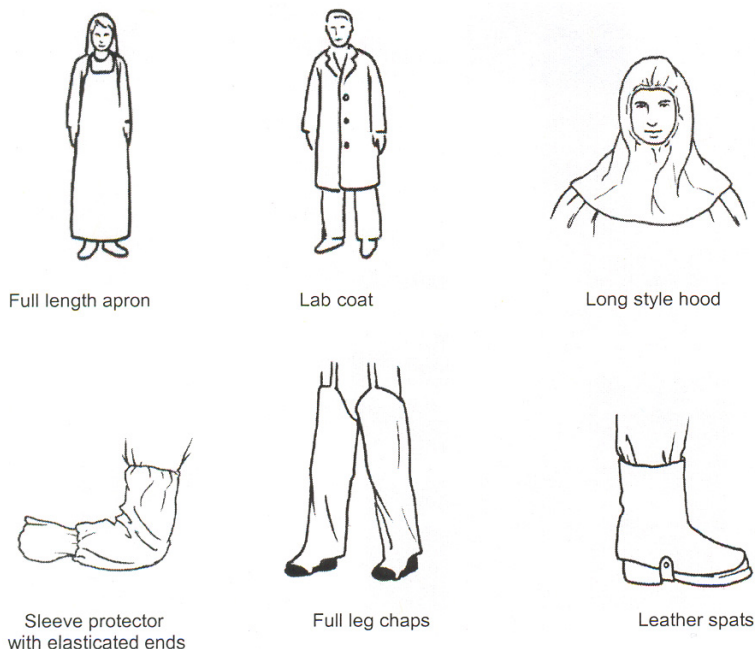
Foot and leg protection

To protect the feet and legs from falling or rolling objects, sharp objects, molten metal, hot surfaces, and wet slippery surfaces, workers must use protective footwear meeting

the requirements of section 233. Appropriate footguards, boots, leggings and chaps protect the legs and feet from molten metal or welding sparks.

Aluminum alloy, fibreglass, or galvanized steel footguards can be worn over work shoes, although they may catch on objects and cause workers to trip. Heat-resistant soled shoes protect against hot surfaces like those found in the roofing, paving, and hot metal industries. See Figure 18.10 for examples of foot and leg protection.

Figure 18.10 Examples of torso and foot and leg protection



Section 243 Skin protection

If a worker must handle substances that may damage the skin on contact or be absorbed through the skin, the employer and supervisor are responsible for making sure that the worker uses effective and appropriate protective clothing or equipment. The performance characteristics of gloves must match the specific hazard(s) that workers will encounter, e.g., exposure to chemicals, heat or flames. For example, for protection against chemical hazards, the toxic properties of the chemical(s) must be known, particularly the ability of the chemical(s) to pass through the skin and affect the worker.

Respiratory Protective Equipment

Section 244 Respiratory dangers

Subsection 244(1) Need for hazard assessment

If a worker is or may be exposed to one or more of the listed conditions (1) exposure to an airborne contaminant (usually a chemical) exceeding the contaminant's OEL; (2) an oxygen deficient atmosphere; or (3) exposure to an airborne biohazardous material, the employer must assess the work site to determine if workers need to use respiratory protective equipment. Subsection (2) lists the factors that the employer must consider when doing this assessment.

Subsection 244(2) Factors to consider

This subsection lists the factors to be considered when performing the assessment required by subsection (1). In previous editions of the *OHS Code*, the inclusion of biohazardous materials was implied. This edition of the *OHS Code* explicitly requires the employer to take into account the nature and exposure circumstances of airborne biohazardous materials.

Examples of situations in which workers may require respiratory protection against exposure to airborne biohazardous materials include

- (a) sewage plant workers exposed to aerosols created during effluent processing or during equipment maintenance,
- (b) laboratory workers exposed to aerosols while handling biohazardous materials,
- (c) health care workers exposed to airborne biohazardous materials,
- (d) rendering plant workers exposed to aerosols created during materials processing,
- (e) workers involved in renovations removing mouldy building materials, and
- (f) workers stirring up dusts containing waste products from animals such as birds, bats and mice. These contaminated dusts may contain materials that could cause disease in humans.

The *OHS Code* defines a "biohazardous" material as a pathogenic organism, including a blood-borne pathogen, that, because of its known or reasonably believed ability to cause disease in humans, would be classified as Risk Group 2, 3 or 4 as defined by the Public Health Agency of Canada, or any material contaminated with such an organism.

Subsections 244(3) and 244(4) Nature and exposure circumstances of airborne biohazardous materials

Many factors affect the nature and exposure circumstances of a worker's exposure to an airborne biohazardous material. These include

- (a) the type of biological agent,
- (b) the route of transmission,

- (c) the pathogenicity of the agent,
- (d) concentration of the agent,
- (e) size of airborne particles,
- (f) duration of exposure,
- (g) work activity, and
- (h) work practices and procedures for which exposure to biohazardous material is possible.

Item (e), size of airborne particles, deserves additional discussion. Droplets are relatively large particles which, because of their size and mass, travel a short distance through air, usually no further than 2 metres. Most droplets land on inanimate objects and do not pose a respiratory hazard.

Inhalable infectious airborne particles that remain aloft because of their small size and low mass do present a potential respiratory hazard to workers. These particles may be generated during coughing and sneezing, during some medical procedures, and by the aerosolization of liquids and stirring up of dusts containing biohazardous materials.

The presence of an airborne biohazardous material is not, of itself, sufficient to cause illness in an exposed worker. The pathogenicity of the material, the exposure concentration, the health status of the exposed worker and the presence of a respiratory route of transmission need to be evaluated.

The following factors should be considered when determining the need for respiratory protective equipment:

- (a) who is potentially exposed to the biohazardous material as part of their work?
- (b) what are the potential sources and routes of transmission to workers?
- (c) which job tasks increase the potential for worker exposure to biohazardous material at the workplace? and
- (d) can the biohazardous material be spread to workers through airborne transmission?

Subsection 244(3) Provide and ensure availability

Based on the employer's assessment required by subsection (1), the employer is responsible for providing workers with the appropriate respiratory protective equipment. The employer must also ensure that the equipment is available to workers who need to use it.

Paragraph (b) explicitly deals with airborne biohazardous materials. The *OHS Code* relies on CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*, for establishing the criteria to be used by employers to select respirators. Unfortunately, the CSA Standard does not specify selection criteria for biohazardous materials, hence the need for paragraph (b) and its cross-reference to section 247 and the CSA Standard.

Paragraph (b) specifically requires that respiratory protection be provided and made available when the effects of worker exposure to airborne biohazardous materials are unknown, i.e., the health effects and mechanism of transmission have not yet been characterized, and no procedures are in place to effectively limit exposure. Unknown exposure effects include adverse health effects such as an acute or chronic illness, acute or chronic disease, or death.

This approach to respiratory protection is based on the principle that precautions need to be taken until sufficient information is available to indicate that different precautions are acceptable or necessary. The worker's "exposure circumstances" may influence the type of respiratory protection required.

A worker's "exposure circumstances" may be such that respiratory protective equipment is unnecessary because exposure is effectively limited through the use of one or more of the control strategies listed in subsection (3.1), or other equally effective strategies. Readers are directed to the previous explanation dealing with the *Nature and exposure circumstances of airborne biohazardous materials* for additional discussion regarding "exposure circumstances."

Subsection 244(3.1) Procedures to limit exposure

If the employer has developed and implemented procedures and safe work practices that effectively limit exposure to the biohazardous material, respiratory protective equipment is not required. Examples of how exposure can be effectively limited include

- (a) containment of the source biohazardous material to prevent airborne spread,
- (b) collection of airborne materials at their source of generation, i.e., local exhaust system or laboratory fume hood that redirects airborne materials away from workers,
- (c) isolating workers from the biohazardous material by distance, time or a combination of both,
- (d) dust suppression equipment and wetting, and
- (e) isolation or negative pressure containment rooms, etc.

The employer must be able to demonstrate that exposure to airborne biohazardous material has been effectively limited.

Subsection 244(4) Worker responsibility

The worker is required to use the appropriate respiratory protective equipment provided by the employer.

For more information



Respiratory Protective Equipment: An Employer's Guide, Safety Bulletin, Government of Alberta

Section 245 Code of practice

Subsection 245(1)

Whenever the atmospheric concentration of a dust, vapour, mist or gas requires the use of respiratory protective equipment, a code of practice describing the selection, use and maintenance of that equipment must be developed. As required by section 62 of the *OHS Act*, the procedures contained in the code of practice must be readily available to workers and other persons at the work site; and all workers' to whom it applies must receive training to enable them to comply with the code of practice. Section 200 of the *OHS Code* also requires the employer, contractor or prime contractor (if there is one) to consult and cooperate with the joint work site health and safety committee or health and safety representative, as applicable, to develop codes of practice.

For more information



Guideline for the Development of a Code of Practice for Respiratory Protective Equipment,
Government of Alberta

Subsection 245(2)

Where health care workers may be exposed to airborne biohazardous material, an employer must ensure that the code of practice required by subsection (1) includes annual training. The training should include:

- (a) information about the airborne biohazardous materials that workers may be exposed to including their potential health effects,
- (b) an explanation of why the particular respiratory protective equipment being used was chosen, including information about its capabilities and limitations and how to test for a satisfactory fit, and
- (c) an explanation of how to properly put on and take off the respiratory protective equipment without contaminating oneself or other workers.

Section 246 Approval of equipment

Respiratory protective equipment must be selected, used, maintained and cared for in the proper manner. Only approved respirators may be used. Approved respirators are those that have undergone testing and have been approved

- (a) by NIOSH, or
- (b) by another standards setting and equipment testing organization, or combination of organizations, approved by a Director of Occupational Hygiene.

For enforcement purposes, respirators approved by an agency subject to (a) and (b) must bear the registered identifying logo or mark of the agency or organization. All NIOSH-approved respirators, respirator cartridges and filters bear a sequence of approval numbers beginning with "TC."

Employers having respiratory protective equipment approved for use by a Director of Occupational Hygiene must have in their possession written permission from the Director indicating that the equipment is acceptable.

For more information



Certified Equipment List

Provided by NIOSH, the *Certified Equipment List* (CEL) is a database of all certified respirators and coal mine dust personal sampler units.

According to NIOSH, particulate respirators are categorized on the basis of efficiency and on their resistance to penetration by oil. Oil degrades and reduces the filtering efficiency of the filter material. NIOSH certifies the following three classes of particulate filters:

- (1) N-series (not resistant to oil);
- (2) R-series (resistant to oil); and
- (3) P-series (oil proof).

Each of these three classes of particulate filters is also certified according to its level of filter efficiency (rated as 95 percent, 99 percent or 99.97 percent efficient) at removing particles 0.3 micrometres in diameter. For example, a filter marked N95 means that the filter is not resistant to oil and is at least 95 percent efficient at removing particles 0.3 micrometres in diameter. Nine classes of filters are certified as shown in Table 18.3.

Table 18.3 Classes of filters certified by NIOSH

Filter series	Filter type designation	Minimum efficiency (%)	Comments
"N" Series	N100	99.97	May be used for any solid or non-oil containing particulate.
	N99	99	
	N95	95	
"R" Series	R100	99.97	May be used for any particulate contaminant. May only be used for one shift if used for an oil-containing particulate.
	R99	99	
	R95	95	
"P" Series	P100	99.97	May be used for any particulate contaminant.
	P99	99	
	P95	95	

Section 247 Selection of equipment

Respiratory protective equipment must be selected in accordance with CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*. There are a number of factors that need to be considered when selecting the appropriate respiratory equipment:

- (a) identity of the airborne contaminants;
- (b) concentration of airborne contaminants;

- (c) oxygen concentration in the air;
- (d) physical form of the contaminant;
- (e) occupational exposure limits;
- (f) length of time that the respirator will need to be worn;
- (g) toxic or pathogenic properties of the contaminants;
- (h) warning properties of the contaminants; and
- (i) need for emergency escape.

These same factors apply whether an employer is dealing with an airborne contaminant, typically a chemical, or an airborne biohazardous material.

More details regarding the selection of respiratory protective equipment are provided in the publication shown below.

For more information



Respiratory Protective Equipment: An Employer's Guide, Safety Bulletin, Government of Alberta

Section 248 Storage and use

Storage

Respirators must be stored in a clean location, preferably in a plastic bag in a locker or on a shelf. They should be stored away from sunlight, solvents and other chemicals, extreme cold or heat, and excessive moisture. Respirators must not be left out on a bench or hanging on a nail in the shop where they can gather dust and dirt or be damaged or abused. The employer should check with the manufacturer for proper storage requirements.

Inspection

Regular cleaning and inspection of respirators is extremely important and must be done according to the manufacturer's specifications. Respirators need to be cleaned and inspected *daily* by routine users, and *before and after* each use by occasional users. If shared by different people, respirators must be sanitized between uses.

Prior to cleaning a respirator, each part of the respirator must be inspected. Defective parts must be replaced before the respirator is used. The face piece must be checked for cuts, tears, holes, melting, stiffening or deterioration. If the unit is damaged, it must be replaced. Headstraps must be checked for breaks, frays, tears or loss of elasticity. Cartridge sockets can be inspected by removing the cartridges. Special attention must be given to the rubber gaskets located at the bottom of the cartridge sockets. Cracks or flaws may contribute to an ineffective seal.

The cover on the exhalation valve must be removed and the rubber valve carefully examined to ensure it seals properly and has not become brittle. The edge of the valve must be examined for holes, cracks and dirt that may interfere with a proper seal. The exhalation valve is a critical component of the respirator and must be replaced if there is any doubt about its ability to function properly. The valve cover is also important and must not be damaged or fit too loosely.

Finally, the interior of the face piece and inhalation valves must be examined. Dust or dirt accumulating on inhalation valves can interfere with their operation. Inhalation valves should be soft, pliable and free of tears or cuts to the flaps.

Cleaning

Following inspection, the respirator must be cleaned according to the manufacturer's specifications. Strong detergents, hot water or household cleaners or solvents must not be used because they may damage rubber parts and face piece. A stiff bristle brush (not wire) can be used to remove dirt if necessary. The respirator can be sanitized using a weak bleach and water solution or by using appropriate wipes. The respirator should then be rinsed thoroughly in clean, warm water. This is important because detergents or cleaners that dry on the facepiece may later cause skin irritation.

The respirator can be hand-dried with a clean, lint-free cloth, or air-dried and then reassembled. The respirator should be tested to ensure all parts work properly before being used.

Maintenance

All respirator manufacturers suggest regular maintenance and parts replacement. Respirators must be maintained and inspected according to the instructions provided with each respirator. Only replacement parts approved by the manufacturer should be used. Mixing and matching of parts from one respirator brand or model to another must never be allowed. Makeshift parts for respirators must never be installed.

Section 249 Quality of breathing air

The air delivered to a person wearing a self contained breathing apparatus or remote supplied air apparatus must be as free of contaminants as possible. Contaminants may harm the person breathing the air or may damage the respiratory protective equipment being used. As a result, the employer must ensure the air is of a quality that complies with Table 1 of CSA Standard Z180.1-00 (R2005), *Compressed Breathing Air and Systems*, shown as Table 18.4.

Table 18.4 Allowable concentrations of components for compressed breathing air (by volume, measured at 21°C (69.8°F) and 101.3 kPa (14.7 psia))

Component	Allowable concentration
Oxygen	20-22%
Nitrogen	78-80%
Carbon monoxide	≤ 5 ml/m ³ *(ppm)
Carbon dioxide	≤ 500 ml/m ³ *(ppm)
Methane	≤ 10 ml/m ³ *(ppm)
Volatile non-methane hydrocarbons	≤ 5 ml/m ³ *(ppm) as methane equivalents
Volatile halogenated hydrocarbons	≤ 5 ml/m ³ *(ppm)
Oil, particulate, and condensate	≤ 1 mg/m ³ *(ppm)
Water—compressed breathing air pipelines or accepted respirators at pressures less than 15.3 MPa (2216 psig)	The pressure dew point of compressed breathing air at a pressure of less than 15.3 MPa (2216 psig) must be at least 5°C (9°F) below the lowest temperature to which any part of the compressed breathing air pipeline or the accepted respirator may be exposed at any season of the year. The air delivered by an ambient air system operating at pressure at or below 103.4 kPa (15 psig) is not required to meet the pressure dew point requirement. [Refer to Table 3 of the CSA Standard for typical pressure dew point requirements from 103.4 kPa (15 psig) to 861.9 Kpa (125 psig)]
Water—cylinders and piping at or above 15.3 MPa (2216 psig)	Compressed breathing air in cylinders and piping operating at pressures equal or to greater than 15.3 MPa (2216 psig): (a) must have an atmospheric dew point not exceeding -53°C (-63°F) for a water vapour concentration not exceeding 27 ppm ± 10%; and (b) should have a pressure dew point not exceeding 5°C (9°F) below the lowest temperature to which the cylinder and piping may be exposed at any season of the year. (See Table 4 of the CSA Standard)
Odours	Any pronounced odour detected by smell in a compressed breathing air sample being analyzed is cause for failure of the sample. The source and nature of the odour must be investigated and resolved.

* 1 ml/m³ = 1 ppm by volume; ml/m³ = millimetres per cubic metre; ppm = parts per million; mg/m³ = milligrams per cubic metre

Note: The values in this Table have been chosen to ensure the quality of compressed breathing air would be comparable to that of good-quality outdoor air.

Despite the table, the employer must also ensure that the air does not contain a substance in a concentration greater than 10 percent of its occupational exposure limit as listed in Table 2 of Schedule 1 of the *OHS Code* unless it is already listed in Table 1 of the CSA Standard. So, in the case of carbon monoxide, this means an allowable concentration of $\leq 5 \text{ ml/m}^3$ (ppm) even though 10 percent of the 25 ppm occupational exposure limit would be 2.5 ppm.

Section 250 Effective facial seal

Subsection 250(1)

Respiratory protective equipment must be fit tested in accordance with CSA Standard Z94.4-02, *Selection, Care and Use of Respirators*. Whether the fit test method is qualitative or quantitative determines the respirator's assigned protection factor. The respirator seal check—a "user seal check"—must be done prior to fit testing and before each use of the respirator. Fit testing must be done

- (a) when the respirator is first issued and then at least every two years thereafter,
- (b) if the respirator type changes,
- (c) if conditions at the workplace change, or
- (d) if the worker's facial features change, e.g., scarring from an injury.

The CSA standard requires that workers who use respirators be free from any physiological or psychological condition that may prevent them from using a respirator. In other words, the worker must not have a medical condition that, when combined with respirator use, could endanger their health and safety at the work site.

Evaluation of a worker's medical fitness to wear a respirator must be done before the worker is fit tested. The evaluation should be appropriate to the level of respirator use and take into consideration

- (a) the type of respirator being used,
- (b) the type and concentration of contaminant the worker will be exposed to,
- (c) the amount of time that the respirator must be worn, and
- (d) the activities the worker must do while wearing a respirator.

The employer should develop a procedure describing how the medical assessment requirement is met. An occupational health nurse or physician can assist the employer with this.

For example, if a worker must only wear a dust mask periodically, a checklist completed with a health care professional will be sufficient. For a worker who must wear a supplied air respirator while working in a confined space, a complete medical assessment will be needed.

Qualitative fit test

Qualitative fit testing consists of relatively quick and simple tests to confirm that the worker has an effective seal. This testing consists of an odourous chemical or irritant smoke test.

Chemical or irritant smoke tests involve the release of an odourous chemical inside a test chamber (enclosure head) or irritant smoke around the edges of the respirator while it is being worn. The wearer performs actions that simulate movements typically made during work activities such as talking, bending, reaching, nodding, etc. If the wearer detects the chemical or irritant smoke, the respirator must be re-adjusted or exchanged and the test repeated until no odours, tastes or smoke are detected.

Commonly used test agents include banana oil (isoamyl acetate), irritant smoke (stannic chloride or titanium tetrachloride), artificial sweetener (saccharin) and a bitter compound (Bitrex™). The respirator must be equipped with organic vapour cartridges when administering the banana oil test agent; high efficiency particulate filters must be used for the irritant smoke agent; particulate filters must be used for the saccharin and Bitrex™ agents.

Depending on the test agent, the wearer will either detect the smell of banana, will sense irritation of the nose and throat due to the irritant smoke, taste the sweetness of the saccharin or the bitterness of the Bitrex™ if there is leakage. The person administering the test relies on the wearer's ability to smell, notice, or taste the test agent. A properly administered qualitative fit test takes a minimum of 15 to 20 minutes to do, assuming a perfect fit during the first attempt. Additional information describing fit testing can be found in CSA Standard Z94.4-02, *Selection, Use, and Care of Respirators*.

Quantitative fit test

Quantitative fit tests are more sophisticated and involve measurement of actual respirator leakage by monitoring leakage inside the face piece. Unlike qualitative fit testing, this testing does not depend on a person's sense of smell or taste to tell whether or not the face piece leaks. Portable computerized equipment accurately measures leakage of contaminant into the respirator during various test exercises.

According to CSA, when a respirator undergoes quantitative fit testing, the resulting protection factor must be at least 10 times the assigned protection factor of the respirator. If this condition is not met, the fit of the respirator is inadequate and the respirator should be readjusted or a different respirator selected and tested.

Regardless of the protection factor determined by quantitative fit testing, it is the assigned protection factor that determines the conditions under which the respirator is used for selection purposes. For more information about quantitative fit testing procedures, refer to CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*.

Protection Factor

Respirators offer varying degrees of protection against airborne contaminants. The degree of protection is described by the concept of Protection Factor (PF). Protection factor is defined as the concentration of an airborne contaminant in the worker's breathing zone outside the respirator face piece divided by the concentration of contaminant inside the respirator face piece:

$$PF = \frac{\text{concentration of airborne contaminant outside respirator face piece}}{\text{concentration of airborne contaminant inside respirator face piece}}$$

The higher the protection factor, the greater the degree of protection provided by the respirator. The actual protection factor provided by a respirator depends on the fit of the mask to the wearer's face. This can vary with the worker's activities, facial movements and shaving habits.

Assigned protection factors have been developed for different respirators based on extensive research. These protection factors are used to select a respirator that maintains the concentration of airborne contaminant inside the face piece at an acceptable level.

For more information



Respiratory Protective Equipment: An Employer's Guide, Safety Bulletin, Government of Alberta

Subsection 250(2)

A major limitation of the protection provided by a respirator is the effectiveness of the seal between the face piece and the wearer's skin. Persons who are or may be required to wear a respirator must ensure they have an effective facial seal each time they put on their respirator. This is done by performing a user seal check following the manufacturer's specifications. Two types of seal checks are commonly used:

- (1) *negative pressure check*—wearing the respirator, the wearer places the palm of each hand over the cartridge assemblies or inhalation points and inhales. The facepiece should collapse slightly as one breathes in, and no inward rush of air should be felt against the wearer's face; and
- (2) *positive pressure check*—wearing the respirator, the wearer places the palm of their hand over the exhalation valve and presses lightly while exhaling gently into the facepiece. The fit is satisfactory if no air escapes around the edges of the respirator.

Various factors affect the facial seal of a respirator, including

- (a) *facial hair*—facial hair, even a single days' growth of stubble, can seriously reduce the effectiveness of the facial seal. Whiskers lying between the sealing edge of the respirator face piece and the skin can break the seal and cause leakage. An employer must ensure that if a worker is or may be required to wear respiratory protective equipment and the effectiveness of the equipment depends on an effective facial seal,

the worker is clean shaven where the face piece of the equipment seals to the skin of the face;

- (b) respirator design—since respirators are designed and constructed differently, they tend to fit differently. A proper fit can be difficult to achieve if the face piece material is too soft or too hard, if the face piece straps are improperly adjusted, or if the wrong size of face piece is selected;
- (c) headstrap tension—some respirator wearers tighten headstraps as much as possible in the belief that doing so provides a better seal and fit. The exact opposite is often the result, the shape of the face piece becoming distorted in such a way as to break the seal. Headstraps should be snug, yet comfortable, and fit testing will demonstrate just how tight or loose the straps must be;
- (d) facial shapes—the sizes and shapes of human heads vary widely. High cheek bones, a narrow face, a double chin and a broad nose mean that one size and one design of respirator cannot possibly fit everyone; and
- (e) other factors—facial scars, eyeglasses, wrinkles and dentures can also affect the seal obtained with certain respirators. Prescription eyeglasses cannot be worn with a full face piece respirator as the arms of the eyeglasses will break the seal. Alternatives such as eyeglass inserts should be considered for those who require prescription glasses.

Section 251 Equipment for immediate danger

The employer is responsible for ensuring that workers are adequately protected from respiratory hazards at the work site. If the employer determines that the worker must wear an air-supplying respirator due to the nature of the atmosphere in which the worker works, the employer must ensure that the appropriate respiratory protective equipment is provided.

Some air supplying respirators are designed to constantly maintain a positive pressure in the face piece. The pressure ensures that if there are any leaks in or at the seal of the face piece, contaminants cannot enter the face piece against the outward flow of air resulting from the positive pressure. These respirators are called positive pressure, pressure demand, or continuous flow respirators. Pressure demand respirators maintain a negative pressure in the face piece and air is not supplied unless the wearer inhales.

In a demand or negative pressure type regulator, air flows into the face piece when the wearer inhales. Inhaling creates a negative pressure that opens a valve, allowing air to flow, i.e., air flows into the face piece only on “demand” by the wearer, hence the name. Demand type respirators cannot be used in conditions that are immediately dangerous to life and health.

Some open-circuit SCBAs can be switched from demand to pressure-demand operation. The demand mode should be used only for donning and adjusting the apparatus in

order to conserve air and should be switched to “positive pressure” or “pressure demand” for actual use.

Different types of air supplied respirators are designed to provide worker protection for various periods of time. The minimum capacity must be 30 minutes—the employer’s hazard assessment may indicate the need for greater capacity. The actual amount of time a worker can work wearing an air-supplied respirator depends on a number of factors such as the intensity of the work being performed, i.e., light versus heavy work, environmental conditions, i.e., hot and humid, and the worker’s level of emotional stress.

Some vapours, gases, fumes and dusts are very irritating and harmful to the eyes. In situations where a worker is exposed to such substances, the employer must ensure that the worker is provided with full-face protection.

If workers work in an area where air to their facepieces is delivered by an air hose from another area, workers must be provided with an alternate means of respiratory protection in the event that their primary source of air fails or the delivery hose gets pinched or severed. This auxiliary supply of respirable air must be of sufficient quantity to permit workers to escape from their work areas in the event of an emergency.

Self-contained breathing apparatus must be fitted with a low-pressure alarm. This signals to the worker using the apparatus that the air supply has been depleted and the worker must leave the work area.

Section 252 Equipment—no immediate danger

This section applies when conditions at the work site are not or cannot become immediately dangerous to life or health, yet there is still a hazard to workers. The section applies if the equipment required by section 254 is not provided and

- (a) the oxygen content of the atmosphere is or may be less than 19.5 percent by volume, presenting an oxygen deficient atmosphere, or
- (b) the concentration of airborne contaminants exceeds or may exceed that specified by the manufacturer for air purifying respiratory equipment.

If the section applies, the employer must ensure that workers wear self-contained breathing apparatus or an air line respirator having a capacity of at least 30 minutes.

Section 253 Air purifying equipment

Adequate respiratory protection can also be provided to workers by air purification or filtration equipment if there is enough oxygen in the atmosphere and the concentration of airborne contaminants does not exceed the equipment’s capacity to filter them.

For contaminants with poor warning properties, i.e., a contaminant at or above its occupational exposure limit that cannot be detected by smell or nose/throat irritation, the use of an air supplied respirator is recommended. Air purifying respirators may only be used if

- (a) the respirator cartridge is equipped with an end-of-life indicator, or
- (b) a change-out schedule is calculated by a competent person. The change-out schedule must be based on product information from the manufacturer or estimates based on knowledge of the effectiveness of the cartridge to remove the contaminant. The method used to calculate the change-out schedule must be the one developed by the U.S. Occupational Safety and Health Administration (OSHA) [see below], or an equivalent method.

For more information



Respirator Change Schedules—OSHA

Section 254 Emergency escape equipment

Normal operating conditions at a work site or work area may not require respiratory protective equipment to be worn. However, emergency conditions may develop that require a worker to use respiratory protective equipment while the worker evacuates the work area. This section describes the types of respiratory protective equipment considered acceptable for this purpose.

In cases like this where the employer's hazard assessment has identified that a contaminant may suddenly enter a work area, the nature of the contaminant must be known and workers in that area must be provided with appropriate protection from that contaminant.

Section 255 Abrasive blasting operations

Workers performing abrasive blasting operations must wear a protective hood that supplies air at a positive pressure of not more than 140 kilopascals (20 pounds/square inch). No minimum pressure is specified for the hood. However, a positive pressure should always be maintained in the hood to prevent dust from entering the hood and being inhaled.

Part 19 Powered Mobile Equipment

Highlights

- Section 256 summarizes all major operator responsibilities.
- Section 263 presents requirements for leaving equipment unattended or suspended.
- Section 267 permits employers to use various approaches to warn workers of the presence and movement of powered mobile equipment.
- Section 269 recognizes the need for employers to protect equipment operators from intruding or airborne objects.
- Section 270 requires employers to equip ride-on lawnmowers weighing more than 700 kilograms with a rollover protective structure (ROPS). Where the hazard assessment indicates that powered mobile equipment (not otherwise required to be equipped with a ROPS) might roll during use, the employer must provide the equipment with a ROPS or must introduce safe-work procedures to eliminate the possibility of rollover. (Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.)
- Section 272 requires employers to ensure that equipment is equipped with a falling object protective structure (FOPS) if the equipment operator is exposed to the hazard of falling objects.
- Section 276 prohibits anyone from riding on a load while it is being moved.
- Sections 280 through 282 present requirements applicable to all-terrain vehicles and snow vehicles.
- Sections 285 through 290 present requirements specific to pile driving equipment and practices, including crane-boom inspection and certification intervals.
- Section 290.1 presents licensing and mechanical inspection requirements applicable to personal vehicles used for work purposes.
- Section 290.2 introduces requirements specific to concrete pump trucks.

Requirements

Section 256 Operator responsibilities

Subsection 256(1)

This subsection describes a worker's responsibilities prior to actually operating powered mobile equipment. Emphasis is placed on the worker being trained and competent to operate the equipment safely. Competency can be demonstrated by operating the equipment to a level considered satisfactory by another worker who is competent in the operation of that same or similar equipment and who has been designated by the employer to assess this competency. Section 15 of the *OHS Regulation* specifies what, at a minimum, must be covered in the worker's training.

To operate the equipment safely, the worker must understand the equipment's operating instructions. Only workers authorized by the employer may operate powered mobile equipment. How a worker becomes "authorized" depends on the employer. Some employers may provide verbal authorization while others may do so in writing following an evaluation of the worker's operating skills.

Subsection 256(2)

This subsection allows a worker in training to operate powered mobile equipment as long as the worker does so under the direct supervision of a competent worker designated by the employer.

The term "direct supervision" is defined in the *OHS Code* and has special meaning. In particular,

- (a) direct supervision means that the worker who is not competent must be under the personal and continuous visual supervision of a competent worker—the two workers must be capable of interacting with one another on a one-on-one basis and must maintain visual contact with one another throughout the performance of the work for which direct supervision is required; and
- (b) the two workers must be able to readily and clearly communicate with each other—in noisy or distracting circumstances, hand signals may be appropriate. These signals must be clearly understood by both workers. If communication devices such as portable two-way radio headsets are used within protective headwear for example, transmissions must be clear and reliable for the duration of the work.

Subsection 256(3)

The operator is the worker most familiar with the performance of the powered mobile equipment. As such, the operator is responsible for reporting to the employer any condition that may affect the safe operation of that equipment. Serious problems should be reported immediately. Problems that do not present an immediate danger can be

recorded and reported by any designated method appropriate to the particular situation. Systems such as a vehicle log book, maintenance work order, or central dispatching system can be used to record problems requiring future attention. The problems must, however, be reported in a way that ensures they are addressed in an appropriate timeframe.

Operators are responsible for ensuring that they operate powered mobile equipment safely. In particular, full control of the equipment must be maintained at all times to prevent near misses and accidents.

An operator must use the equipment's seat belt and all other safety equipment provided, e.g., restraining devices, guardrails, operator protective structures, etc. The operator is also responsible for making sure that passengers use their seat belts and any other safety equipment provided.

Since poor housekeeping can affect worker safety, the operator must maintain the equipment in a reasonable condition. The cab, floor and deck must be kept free of material, tools or other objects, including spills of lubricant or fuel, which could create a safety hazard to the operator or other occupant(s). Objects such as lunch boxes, flashlights, tools, first aid kits, etc., can get jammed under control pedals or become airborne during an accident. Such objects must be appropriately stored and secured.

Subsection 256(4)

For farming and ranching operations, a worker operating powered mobile equipment and passengers of the powered mobile equipment must use the equipment's seat belt and all other safety restrain equipment (e.g., restraining bars, guardrails, operator protective structures) unless it is not reasonably practicable.

Reasonably practicable is a recognized term that is assessed using the reasonable person test, that is, what would a dozen of your peers consider reasonable in similar circumstances. Your peers would likely review what you did and compare it to what they do in their own operations. Some might do more, others less.

Section 257 Visual inspection

Subsection 257(1)

The operator of powered mobile equipment must perform a visual inspection of the equipment before starting it up. It is critical that a walk-around be done to check for obvious mechanical problems, equipment clearances, closeness to other equipment or structures, and other workers who may be at risk when the equipment is moved. Typically, this can be done at the start of the operator's work shift.

Subsection 257(2)

In addition to a start-up inspection, the operator must perform periodic inspections as required by the manufacturer's specifications or the employer's operating procedures. The focus of these inspections is equipment safety. Since the number of items to be checked can be considerable, it is suggested that a checklist be developed. Items that can be included on the checklist include tires, wheel lugs, suspension, engine/hydraulic system/fuel levels, fluid leaks, operating and marking lights, cleanliness of windshield and cab windows, condition of installed safety devices such as back-up alarms, flashers, turn signals, seat belts, parking brake, etc., and any other item that can affect operating safety.

Subsection 257(3)

Situations may arise in which an operator cannot perform a pre start-up inspection, e.g., equipment operated on a continuous 24-hour basis or is not shut down at the end of a shift. This subsection allows an operator to perform the required visual inspection at some time during the shift or work period other than at its start. As described in the employer's operating procedures, an alternate time for the visual inspection could be during a period of production delay or a defined equipment fuelling period. The time and date of all inspections should be recorded.

Subsection 257(4)

No one is allowed to start the powered mobile equipment until a complete visual inspection as required by subsection (1) is done.

Section 257.1 Visual inspection on a farm or ranch

For farming and ranching operations, before starting powered mobile equipment, the worker operating the powered mobile equipment must identify whether a hazard exist that requires a visual inspection of the equipment and surrounding area. The visual inspection is intended to prevent possible injuries or illnesses to the worker operating the equipment or other workers. If a hazard exists, the worker operating the powered mobile equipment must comply with the requirements of section 257.

Section 258 Dangerous movement

Subsections 258(1) and 258(2)

The movement of powered mobile equipment can present a danger to workers located within range of moving loads or moving parts. These subsections require that

- (a) the employer not permit any worker to remain within range of a moving load or part;

- (b) the operator, who has control over the equipment, must not move the load or equipment when any worker is in range of the moving load or equipment part; and
- (c) workers are responsible for moving themselves out of range of a moving load or part.

Subsection 258(3)

Being crushed between a stationary object or obstacle and moving equipment is a frequent cause of worker injury and death. This subsection requires the employer to identify such hazards. The employer must then prevent workers from entering the pinch point or provide a minimum clearance distance of 600 mm between the obstacle and the powered equipment. Guarding or the placement of barricades to prevent access to identified pinch points are approaches that are often used. Where machines swivel in the middle as part of their steering mechanism and operators need to grease the centre pin, shutting down the machine and applying the brakes may be the best way to prevent potential operator injury.

Section 259 Pedestrian traffic

Subsection 259(1)

At many worksites pedestrians can move about in close proximity to operating powered mobile equipment. To prevent accidents involving pedestrians, the employer must, if reasonably practicable, designate walkways that separate pedestrians from areas in which powered mobile equipment is operated. The employer must ensure that workers use the designated walkways.

Subsection 259(2)

Recognizing that it may not always be practicable to provide pedestrians with designated walkways, alternative safe work procedures may be used. Example include:

- (a) the use of a traffic control system;
- (b) the enforcement of speed limits for powered mobile equipment;
- (c) a requirement for the powered mobile equipment operator to acknowledge the pedestrian's presence before the pedestrian proceeds through the hazardous area,
- (d) high visibility vests; and
- (e) other equally effective means.

Section 260 Inspection and maintenance

Subsections 260 (1) and 260(2)

Powered mobile equipment must be inspected according to the manufacturer's specifications. Inspection intervals and what should be inspected are usually described

in the specifications. Only competent persons are allowed to perform the inspection activities.

Subsection 260(3)

If an inspection reveals a defect or unsafe condition that could create a hazard to a worker(s), the powered mobile equipment should be immediately removed from service and, if appropriate, measures put in place to protect worker(s). Once this has been done, and if appropriate, the equipment can continue to be operated until the problem is corrected. For example, if the back-up alarm of a dump truck stops working, the truck can continue to be operated if another worker acts as a look-out during all backing-up activities.

Subsection 260(4)

If the powered mobile equipment is potentially hazardous but can be operated safely, the employer must make sure that the operator is aware of the potential hazard. The employer must also ensure that the defect or condition is repaired as soon as reasonably practicable. The defect or condition may worsen over time, posing an increased danger of injury to workers.

Subsection 260(5)

Records of the inspections and maintenance performed on powered mobile equipment must be kept at the work site. These records must be available to the equipment operator so that the operator is aware of the equipment's condition.

Subsection 260(6)

An employer must ensure a competent worker inspects powered mobile equipment for defects and conditions that are hazardous or may create a hazard. On farming and ranching operations, this inspection does not need to be performed in accordance with the equipment manufacturer's specifications.

Section 261 Maintenance on elevated parts

Elevated parts of powered mobile equipment can pose a serious hazard to workers performing maintenance and repairs. Elevated parts must be securely blocked to prevent their movement. In some cases, the equipment may also need to be locked out to ensure that it will not move and endanger workers. As an example, numerous workers have been killed or seriously injured while repairing or maintaining forklift trucks. Elevated forks can drop if they are not properly blocked to prevent unintended downward motion.

Section 262 Starting engines

Subsections 262(1) and 262(2)

Powered mobile equipment can move unexpectedly if a worker tries to start the equipment while any drive mechanism or clutch is engaged. Training, worker competency and following the manufacturer's specifications are key to preventing the equipment from moving unexpectedly.

Subsection 262(3)

It may not be possible to disengage the drive mechanism or clutch before starting up some types of powered mobile equipment. In such cases, the employer should identify the related startup hazards and ensure that workers are protected from injury. Restricting worker access or blocking and safeguarding the immediate area during startup may be one approach.

Section 263 Unattended equipment

Subsection 263(1)

Powered mobile equipment can pose a serious risk of injury to workers and damage to property if it is not properly secured against unexpected movement. Unexpected movement could be caused by any number of factors such as sloping ground, changes in air or hydraulic pressure, slippery ground conditions, equipment parked incorrectly, etc.

The operator must ensure that powered mobile equipment is prevented from moving unintentionally. Examples of how to do this include engaging any movement safety device and placing the transmission in the manufacturer's "park" position. Where necessary, the wheels of the equipment should be blocked with wheel chocks. On equipment like graders and dozers, ground-engaging implements provide additional braking and help to prevent unexpected movement.

Subsection 263(2)

Air and hydraulic pressures can bleed off over time. Suspended machinery or ground engaging implements such as rippers, blades, buckets, etc., must therefore be lowered to the ground or otherwise secured in a safe position before the equipment controls are left unattended.

Elevated manlift booms are often seen at worksites and especially rental yards stored in an elevated position. A recent (June 2009) review by Occupational Health and Safety of written instructions from all of the major manlift manufacturers has confirmed that this is an acceptable practice from the manufacturer's perspective. Manufacturers regard booms in this position as having been "secured in a safe position," thereby complying

with this subsection. Manufacturers further agree that the equipment is safest when the boom is in its retracted position. An employer is considered to be in compliance with this subsection if

- (a) a manlift boom stored in an elevated position is fully retracted; and
- (b) the employer meets all of the manufacturer's other conditions for storage.

Section 264 Lights

If earthmoving construction machinery is operated during "hours of darkness" as defined in the *OHS Code* and described in this section, it must be equipped with lights that comply with SAE Standard J1029 (2007), *Lighting and Marking of Construction, Earthmoving Machinery*. The lights must illuminate the direction of travel, the working area around the equipment, and control panel instruments.

SAE Standard J1029 (2007) specifies requirements for lighting and marking earthmoving construction machinery. At least two headlamps are required for lighting the area directly ahead of the machine when operated in its normal direction of travel. Minimum lighting levels are specified for these headlamps.

For rear lighting, machines must have two tail lamps and two stop lamps. The performance of these lamps is specified through other referenced SAE standards. The Standard requires two red reflectors on the back of the machine, as low in height as practical and spaced as far apart from the centerline of the machine as practical. Rubber tired machines more than 6 m long require yellow reflectors on each side of the machine. These reflectors must be placed as low as practical and as far forward and rearward as practical.

The Standard also recommends flood lamps for general illumination of the work tool area of a machine. General service lamps are recommended for general illumination of areas a short distance from the machine.

Section 265 Windows and windshields

Subsections 265(1) and 265(2)

The glazing of powered mobile equipment must be approved to ANSI Standard Z26.1. Alternatively, non-shattering materials that provide at least equivalent protection can also be used.

ANSI Standard ANSI/SAE Z26.1 (1996), *Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways — Safety Standard*, specifies performance criteria and the methods for testing safety glazing material used for windshields, windows, and partitions of land and marine vehicles and aircraft. Compared to ordinary sheet glass, plate glass, or float glass, safety glazing materials

complying with the Standard reduce the likelihood of injury or the severity of injury should the materials break.

Six types of glazing are described in the Standard: laminated glass, tempered glass, wire glass, plastic, multiple glazed units, and bullet-resisting glazing. Glazing materials complying with the Standard are marked with the words “American National Standard” or the characters “AS,” a model number identifying the type of construction of the glazing material, and the manufacturer’s distinctive designation or trademark.

Subsection 265(3)

Cracked or broken glazing that obstructs or impairs an operator’s view creates a safety hazard and must be replaced as soon as practicable.

If cracks are present but do not obstruct the operator’s view, they may become a safety hazard over time and the employer should take this into consideration. Changing weather conditions, vibration, and flexing of the cab structure can cause a crack to spread or cause the entire glazing to shatter unexpectedly. These factors should be considered when deciding if cracked glazing that does not obstruct an operator’s view should be replaced.

Subsection 265(4)

Proper windshield wipers are mandatory on all powered mobile equipment equipped with a windshield. The wipers must be of sufficient size and the drive-motor strong enough to remove debris from the windshield under expected operating and weather conditions. For Alberta weather conditions, a properly operating cab / windshield heater can maintain wiper effectiveness and the operator’s view.

Section 266 Other safety equipment

Subsection 266(a)

Situations may arise in which the best way to prevent worker injury or damage to equipment and property is to shut down equipment quickly. This subsection requires that the equipment be equipped with a control device that permits the operator to do so. The device must be able to stop the unit of powered mobile equipment or any ancillary (accessory) equipment driven from the powered mobile equipment. The control device must be within easy reach of the operator and might take the form of a red-coloured emergency off button, a pull cord, or other similar device.

Subsection 266(b)

The presence, general dimensions or movement of powered mobile equipment may present a danger to workers. Where this is the case, the employer must ensure that the

equipment is equipped with effective means of warning workers of the danger.

Examples of effective means include

- (a) audible warning systems,
- (b) clearance or marker lights that outline the width, length, and height of the equipment, and
- (c) flashing lights under some circumstances.

Subsection 266(c)

Powered mobile equipment must be equipped with seats or other installations sufficient to ensure that all workers authorized by the employer to be on the equipment are safe while the equipment is in motion. Equipment equipped with ROPS must also be fitted with seat belts, or another equally acceptable restraining device. Examples of common practices in violation of this requirement are workers riding in the boxes of trucks and on the forks of forklift trucks.

Subsection 266(d)

For powered mobile equipment equipped with a trailer hitch, the employer must ensure that safety clips are installed on the connecting pins. The safety clips prevent unintended disconnection of the trailer from the powered mobile equipment.

Section 267 Warning signal

Subsection 267(1)

The large size of some powered mobile equipment makes it impossible for the operator to have a clear view around the equipment. This view can be directly with the eyes or indirectly with a mirror, closed circuit television, or other effective means. A serious hazard can result if the equipment is moved in a direction that the operator cannot see clearly.

If the operator cannot see what is in the direction of travel, the powered mobile equipment must be equipped with one or more of three acceptable alternatives:

- (a) an automatic audible warning device—the audible warning must be loud enough to be heard above other noise in the immediate area. For most equipment this is the familiar “back-up alarm”;
- (b) an alternate warning device or method appropriate to the hazards of the work site—this may include flashing/rotating lights, strobe lights, or other effective means; or
- (c) an automatic stopping system—this system may use motion, thermal or other detectors to sense the presence of a worker or obstruction in the path of travel and automatically stop the equipment.

This subsection is not intended to have employers install warning devices or automatic systems on all powered mobile equipment. The requirement applies only if an

equipment operator's view of the equipment's path of travel is obstructed or cannot be seen directly or indirectly in a direction. Putting audible warning devices on all powered mobile equipment at a work site, for example, could create a greater hazard due to confusion resulting from multiple alarms going off simultaneously.

Subsection 267(2)

Where it is impracticable to install a warning device or automatic stopping system (perhaps due to noise by-laws that restrict the operation of audible warning devices), the operator is not allowed to move the equipment until precautions are taken to prevent operator and worker injury. Examples of acceptable precautions include

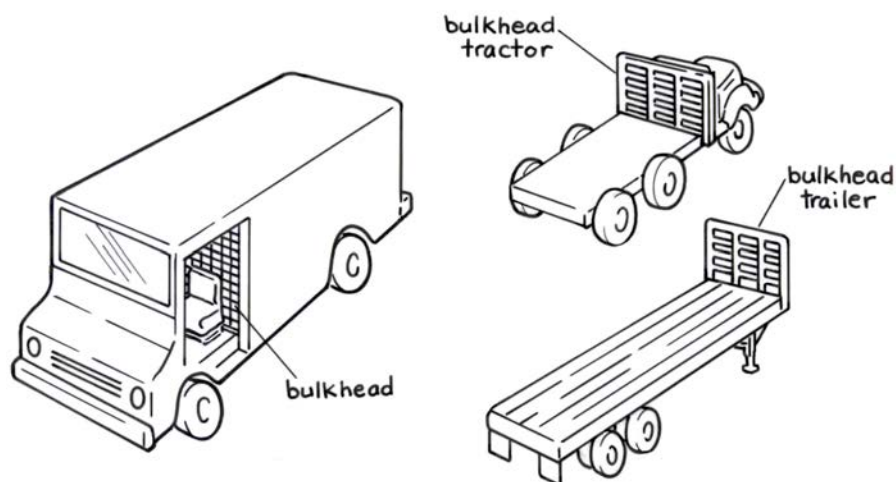
- (a) a detailed inspection of the travel path by the equipment operator,
- (b) direction by a designated signaller or other worker who is in continuous view of the operator and has a complete view of the area into which the equipment will move,
- (c) direction by a traffic control or warning system, or
- (d) ensuring that all other workers are removed from the area into which the equipment will move.

In all cases the control must be appropriate for the conditions at the work site.

Section 268 Bulkheads

Material or equipment can shift during a sudden or emergency stop, presenting a significant hazard to a powered mobile equipment operator. The employer must install a physical barrier such as a bulkhead (see Figure 19.1) or other protective device such as a cargo net to protect the operator. Because the bulkhead or protective device can be subjected to significant dynamic forces during an emergency stop, it must be properly designed and installed.

Figure 19.1 Examples of bulkheads



The reader is also referred to the *Alberta Cargo Securement Regulation* (AR 1/2005) under the *Traffic Safety Act*. This Regulation establishes a standard for properly securing a load on a commercial vehicle.

Section 269 Guards and screens

Activities such as brush clearing or the collection of golf balls at a driving range may expose powered mobile equipment operators to injury as intruding or flying objects, e.g., branches, rocks, etc., may enter the operator cab. Where there is a significant potential for operator injury, i.e., the nature of the work or work area make it highly likely that such objects will enter the cab, the employer must ensure that the operator is protected. The section lists several methods of protecting the operator.

Section 270 Rollover protective structures

Subsection 270(1)

Rollover protective structures (ROPS) are strong cages, frames, roll bars, or other structures attached to certain types of powered mobile equipment. ROPS systems are designed and built to provide crush protection for an operator during a rollover or accidental upset. Figures 19.2 through 19.10 show examples of the powered mobile equipment listed.

This section includes industrial ride-on lawnmowers weighing 700 kilograms or more. Rollovers involving industrial ride-on lawnmowers are most often the result of the lawnmowers hitting bumps, wheels dropping into holes, ditches, or structures such as swimming pools, wheels dropping off terraces, embankments, or retaining walls, and operating at full speed on steep slopes or during tight cornering. Rollovers have also occurred when machines have slid down slippery slopes.

Figure 19.2 Examples of a tracked dozer and tracked loader

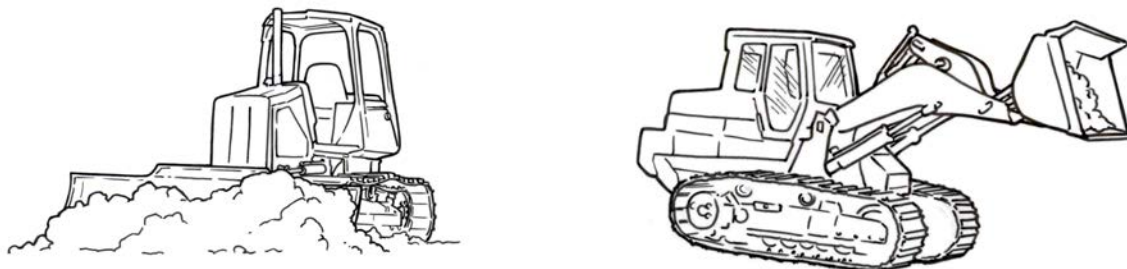


Figure 19.3 Examples of wheeled dozer and wheeled loader

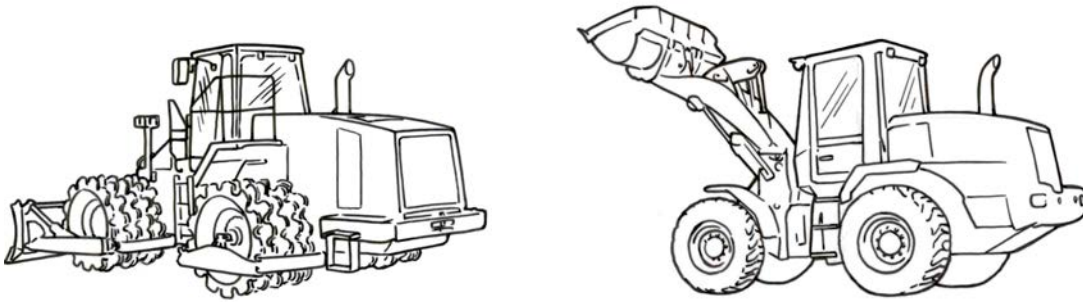


Figure 19.4 Example of a skidder



Figure 19.5 Example of a backhoe with limited horizontal swing



Figure 19.6 Example of a motor grader

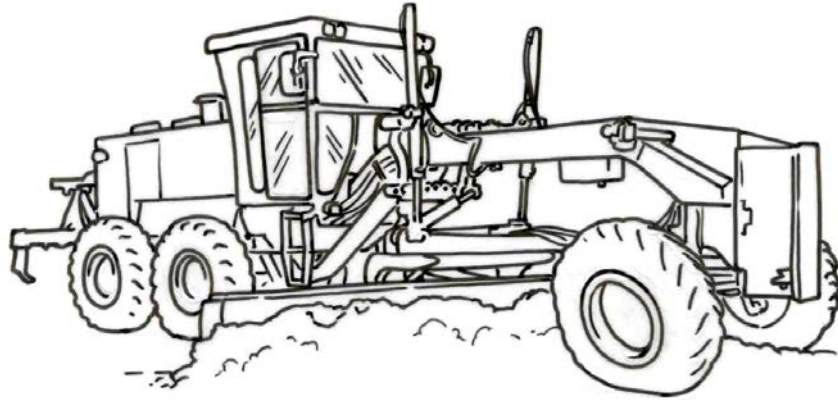


Figure 19.7 Example of a self-propelled wheeled scraper



Figure 19.8 Examples of agricultural tractors

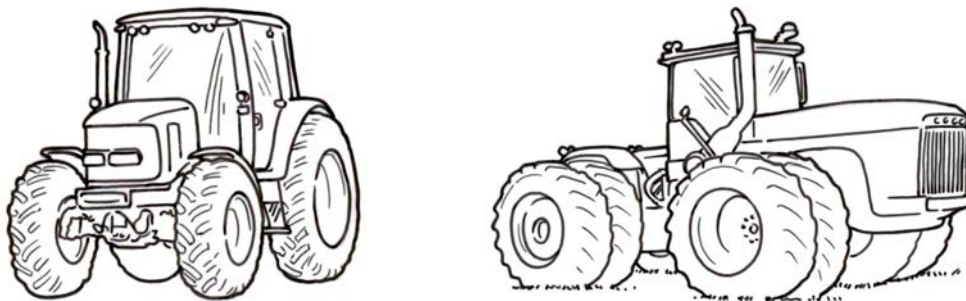


Figure 19.9 Examples of industrial tractors

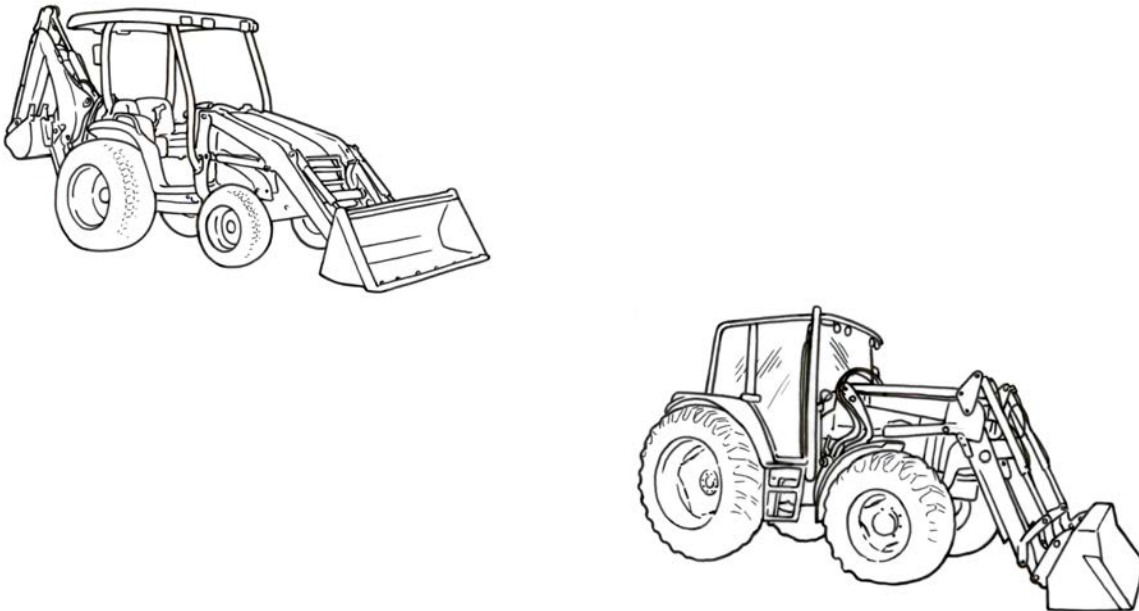
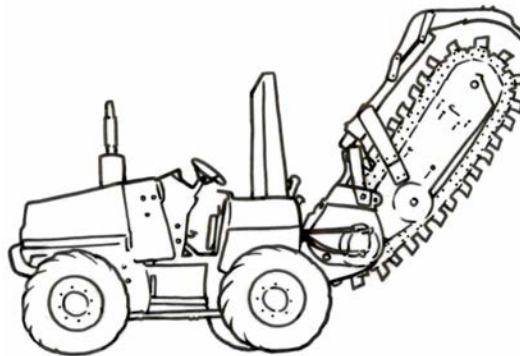


Figure 19.10 Example of a wheeled trencher



Subsection 270(2)(a)

CSA Standards B352.0-95 (R2006), B352.1-95 (R2006), and B352.2-95 (R2006) detail the design, testing, performance and safety requirements for rollover protective structures (ROPS) for certain types of self-propelled machines for agricultural, construction, earthmoving, forestry, industrial, and mining operations.

CSA Standard B352.1 covers the performance requirements, based on destructive testing, for ROPS on wheeled agricultural tractors with a mass greater than 800 kilograms. It may also be used to evaluate general-purpose industrial tractors.

CSA Standard B352.2 covers the performance requirements, based on destructive testing, for ROPS on industrial tractors, motor graders, prime movers, skidders, tracked dozers, tracked loaders, wheeled dozers, wheeled loaders, backhoe loaders, rigid-frame dumpers, compactors, or rollers, with machine mass greater than 700 kilograms.

A ROPS complying with the referenced CSA standards will have a permanently attached label that includes the following information:

- (a) name of the ROPS manufacturer;
- (b) ROPS identification number;
- (c) the Canadian standard to which the ROPS was certified; and
- (d) machine make and models for which the ROPS is designed.

Subsection 270(2)(b)

SAE Standard J1042 (2003), *Operator Protection for General-Purpose Industrial Machines*, establishes performance requirements for protective systems that provide operator protection from hazards of machine rollover and/or falling objects. The Standard does so by recommending certain design features that reduce the likelihood of operator injury, e.g., construction and location of batteries, fuel tanks, oil reservoirs, etc., and eliminating edges, corners and sharp projections that an operator might contact. The Standard also makes direct reference to other SAE Standards that present specific construction and performance criteria for ROPS and falling object protective structures (FOPS).

Checking the manufacturer's specifications and/or checking to see if the ROPS bears a label referring to the Standard can verify compliance with the Standard.

Subsection 270(2)(c)

SAE Standard J1194 (1999), *Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*, establishes the test and performance requirements of a rollover protective structure (ROPS) designed for wheel-type agricultural tractors to minimize the frequency and severity of operator injury resulting from accidental upsets.

Checking the manufacturer's specifications and/or checking to see if the ROPS bears a label referring to the Standard can verify compliance with the Standard.

Subsection 270(2)(d)

ISO Standard 3471: 2000, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements*, establishes consistent and reproducible means of evaluating the load-carrying characteristics of roll-over protective structures under static loading conditions. The Standard applies to the following seated design operator-controlled machines:

- (a) crawler tractors and loaders;
- (b) graders;
- (c) wheeled loaders and wheeled tractors;
- (d) wheeled industrial tractors;
- (e) prime movers;
- (f) rollers and compactors; and
- (g) rigid frame dumpers.

Subsection 270(2)(e)

OSHA Standard 1928.52, *Protective Frames for Wheel-type Agricultural Tractors—Tests, Procedures and Performance Requirements*, applies primarily to tractors used as ride-on lawnmowers. A protective frame is a structure comprised of uprights mounted to the tractor, extending above the operator's seat to form what looks like a roll bar.

Checking the manufacturer's specifications and/or checking to see if the ROPS bears a label referring to the Standard can verify compliance with the Standard.

Subsection 270(2)(f)

This subsection recognizes that some equipment remains in service for many years, sometimes well beyond the lifetime of the referenced standards. Equipment having a ROPS designed or manufactured to comply with a previous edition of one of the referenced standards continues to be acceptable for use.

Subsection 270(3)

The powered mobile equipment listed in subsection (1) must be ROPS equipped. However, other equipment may also be subject to rollover because of how or where it is used. Section 7 of the *OHS Code* requires that the employer assess the work site for hazards. In the case of equipment that may roll over because of how or where it is used, the employer's hazard assessment should consider the manufacturer's specifications, stability data for the equipment, hazards presented during loading and unloading of the equipment, the type of work being performed with the equipment, and the conditions under which the equipment is being operated.

In cases where the possibility of rollover is present, the employer must either equip the equipment with an appropriate ROPS or implement safe work procedures that eliminate the possibility (Section 14 of the *OHS Act* requires that the procedures be in writing and available to workers). The ROPS must either be supplied by the manufacturer (the ROPS can meet any standard the manufacturer specifies and need not be limited to one of those listed in subsection (1)), or be certified by a professional engineer as being suited to that equipment.

Safe work procedures are a set of rules that must be followed. Using these procedures eliminates the need to equip the equipment with a ROPS by eliminating any possibility of the equipment rolling over during operation. The procedures may limit or restrict where the equipment can be used. For example, restrictions may include

- (a) the slope on which equipment can be operated, e.g., the equipment cannot be operated across a slope or up and down a slope exceeding so many degrees of incline;

- (b) the terrain over which the equipment is operated, e.g., the equipment cannot be operated in areas where it is possible for it to rollover because a wheel or wheels can drop into a hole, ditch, etc., or drop off an edge such as an embankment, retaining wall, etc.;
- (c) maximum operating speed while cornering; and
- (d) marking off areas where slopes exceed the maximum slope angle, where terrain features are capable of causing a rollover, and where other hazards are present that could cause a rollover. Barricades, flagging, or similar means of warning may be needed to alert the operator of the hazard.

Subsection 270(4)

Employers of farming and ranching operations must comply with the requirements of Section 270.1, Rollover protective structures on farm and ranch.

Section 270.1 Rollover protective structures on farm or ranch

Subsection 270.1(1)

Rollovers are one of the leading causes of injuries and fatalities on farming and ranching operations. When used in conjunction with seat belts or other restraining devices, rollover protective structures are a proven safety system that protect powered mobile equipment operators and passengers.

On farming and ranching operations, the employer must complete a written hazard assessment related to the potential for powered mobile equipment to roll over. This section is limited to the following powered mobile equipment weighing 700 kilograms or more, but should be performed on all powered mobile equipment regardless of weight:

- (a) tracked (crawler) or wheeled bulldozers, loaders, tractors or skidders, other than those operating with side booms;
- (b) back hoes with a limited horizontal swing of 180 degrees;
- (c) motor graders;
- (d) self-propelled wheeled scrapers;
- (e) industrial, agricultural and horticultural tractors, including ride-on lawnmowers, and
- (f) wheeled trenchers.

Subsection 270.1(2)

When performing a hazard assessment to determine the potential for a piece of powered mobile equipment to roll over, the employer of a farming and ranching operation must base the hazard assessment on

- (a) the stability of the powered mobile equipment, taking into account such factors as the configuration of the equipment and any attachments mounted on or pulled or pushed by the equipment during operation,
- (b) the ground conditions where the powered mobile equipment will be operated, including the presence of ditches, drop-offs, and ground irregularities such as holes, soft spots or mounds,
- (c) the grades on which the powered mobile equipment will be operated,
- (d) the nature of the activities to be performed with the powered mobile equipment,
- (e) the training and experience of the operator, and
- (f) the presence or absence of a supervisor.

An employer of a farming and ranching operation should keep a copy of the written hazard assessment showing that each of these factors were reviewed and any conclusions.

Subsection 270.1(3)

Where a hazard assessment identifies a potential roll over hazard, the employer of a farming and ranching operation has two options:

- (a) equip the powered mobile equipment with a rollover protective structure
 - (i) that is supplied by the manufacturer, or
 - (ii) that a service provider or a person who is competent has stated in writing will provide adequate protection to workers, or
- (b) institute safe work procedures to eliminate the possibility of rollover.

If a rollover protective structure is installed, the employer must ensure that seat belts or other effective restraining devices are installed.

Section 271 Equipment with rollover protection

If powered mobile equipment is equipped with a rollover protective structure (ROPS), it must be equipped with some way of keeping the operator and passengers inside the ROPS in case of equipment upset. Restraining devices are designed to prevent occupants from being thrown outside of the ROPS and crushed or otherwise injured. Two approaches are acceptable:

- (1) seat belts that comply with the requirements of one of the listed standards; or

- (2) where the work process makes wearing seat belts impracticable, alternate restraining devices may be used. To be acceptable, the alternate restraining device(s) must prevent the operator and any passengers from being thrown outside the ROPS. Shoulder belts, bars, grates, screens or other restraining devices are considered acceptable.

SAE Standard J386 (2006), *Operator Restraint System for Off-Road Work Machines*, provides performance and test requirements for pelvic restraint systems (seat belt assembly, seat system, anchorages) provided for off-road self-propelled work machines fitted with ROPS. Such machines are commonly used in construction, earthmoving, forestry, mining, and other industrial applications. A seat belt assembly complying with the standard will be permanently and legibly labelled with a statement that it complies with SAE Standard J386.

SAE Standard J2292 (2006), *Combination Pelvic/Upper Torso (Type 2) Operator Restraint Systems for Off-Road Work Machines*, provides performance and test requirements for combination pelvic/upper torso (3-point and 4-point) operator restraint systems for off-road, self-propelled work machines fitted with ROPS. A seat belt assembly complying with the standard will be permanently and legibly labelled with a statement that it complies with SAE Standard J386/J2292.

Section 272 Falling objects protective structures

Subsection 272(1)

Operators of powered mobile equipment may be exposed to falling objects under some working situations. Examples include warehouse operations where items are stacked on high shelves, where a shaft or tunnel is being excavated, and where building demolition is taking place. Where a falling object hazard is present, the powered mobile equipment must be equipped with a falling object protective structure (FOPS).

Subsections 272(2) and 272(3)

To comply with this section, the FOPS must meet the requirements of the appropriate referenced standard or be certified by a professional engineer as providing equivalent or better protection. Readers are also referred to section 3.1 for additional information.

SAE Standard J167 (2002), *Overhead Protection for Agricultural Tractors — Test Procedures and Performance Requirements*, establishes test and performance requirements for overhead protection to minimize the frequency and severity of operator injury due to falling objects encountered during normal operation of a wheeled agricultural tractor. The cover mounted over the operator's seat may be solid, or a grid or mesh meeting the criteria for openings listed in the Standard. The overhead cover is expected to provide reasonable protection from such objects as bricks, concrete blocks, and small hand tools that may fall from heights of up to 9 metres (30 feet).

SAE Standard J/ISO 3449 (2005), *Earthmoving Machinery—Falling-Object Protective Structures—Laboratory Tests and Performance Requirements*, provides performance criteria for falling object protective structures (FOPS) installed on the types of earthmoving machinery specified in the Standard. A FOPS meeting the requirements of the Standard will have a label attached to it indicating the standard number and the performance level that the structure meets.

The Standard recognizes two levels of FOPS protection. Level I is intended to provide protection from falling bricks, small concrete blocks and hand tools encountered in operations such as highway maintenance, landscaping, and other construction site services. Level II is intended to provide protection from falling trees or rocks for machines involved in site clearing, overhead demolition, or forestry.

SAE Standard J1042 (2003), *Operator Protection for General-Purpose Industrial Machines*, establishes performance requirements for protective systems that provide operator protection from hazards of machine rollover and/or falling objects. The Standard does so by referencing other SAE Standards that present specific construction and performance requirements for falling object protective structures. The required overhead protective structures are expected to provide reasonable protection from such objects as bricks, concrete blocks, and small hand tools that may fall from heights of up to 9 metres (30 feet).

Section 273 Recertification after modification

Modifications or repairs to a rollover protective structure or a falling objects protective structure must be performed according to instructions provided by the manufacturer or a professional engineer. Since it is critical that the structure be restored to its original design strength, the structures must be re-certified by the equipment manufacturer or a professional engineer once repaired or modified.

Section 274 Fuel tank in cab

Vapours from powered mobile equipment fuel are a hazard having the potential to cause serious harm if not properly controlled. Vapours could overcome an operator, causing the operator to lose control of the equipment. A fire or explosion could result from vapour build-up if an ignition source is present. For these reasons, filler spouts and vents must extend outside the cab and must be sealed or covered to prevent vapours from entering the enclosed cab area.

Section 275 Worker transportation

Subsection 275 (1)

While operating or being transported, no part of a worker's body can protrude beyond the side of the vehicle. Protruding body parts can be injured if they strike stationary or other moving objects or equipment.

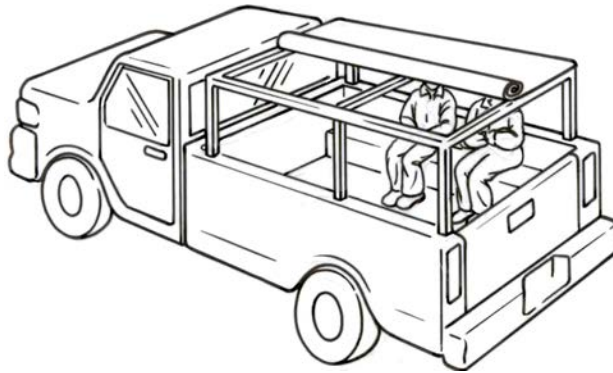
Subsection 275(2)

Unsecured equipment or materials can become dangerous projectiles or airborne objects during quick operating maneuvers or sudden stops. All equipment or materials must be positioned or secured to prevent injury to the operator or any other worker being transported.

Subsection 275(3)

Inclement weather can create uncomfortable and unsafe operating conditions due to reduced visibility or exposure to extremes of temperature. Workers being transported must be provided with sufficient protection against inclement weather. This does not mean that all powered mobile equipment must be equipped with a cab. Figure 19.11 shows a vehicle designed to transport workers and that provides protection against inclement weather.

Figure 19.11 Example of protection against inclement weather



Subsection 275(4)

Engine exhaust contains carbon monoxide gas that can build up in an enclosed body and be dangerous to workers. The powered mobile equipment's exhaust outlet must be located to prevent exhaust gases from entering the enclosed body.

Section 276 Riding on loads

A person attempting to ride on a moving load is at considerable risk of injury, including the hazard resulting from the load shifting. No person is allowed to ride on top of a load that is being moved. The prohibition also includes riding on the sides of a load.

Section 276.1 Transportation on mobile equipment on a farm or ranch

Subsection 276.1(1)

Farming and ranching operations sometimes use slow moving vehicles to transport workers and or products to a worksite or as part of common farming and ranching activities. For example, workers may be required to distribute hay bails to cattle or horses from a slow moving trailer towed by a tractor.

On a farming and ranching operation, a worker may be transported on mobile equipment not designed or intended for the transportation of workers if

- (a) the worker is safely positioned,
- (b) the mobile equipment is operated at a speed of no more than 10 km/h, and
- (c) the terrain is suitable to enable the worker to be safely transported.

Subsection 276.1(2)

Despite subsection (1), due to the high risk of injury a worker must not be transported on certain components of mobile equipment, including

- (a) a tongue or drawbar connecting mobile equipment together, or
- (b) a fork or other mobile equipment implements that pose a risk of injury to the worker.

Section 277 Hazardous loads

To prevent a fire or explosion, workers are restricted to performing only basic vehicle service and maintenance activities while flammable, combustible or explosive materials are

- (a) being loaded or unloaded, or
- (b) while such materials are in or on the vehicle and are not in a ULC-approved storage tank.

Section 278 Tank trucks

Subsection 278(1)

Fuel vapours created during refueling can create a fire and or explosion hazard if a source of ignition is present. During the transfer of fuel, static electricity can be created

that can cause an electrostatic discharge resulting in the ignition of the fuel vapours. To reduce the buildup of static electricity, employers must ensure that a tank truck containing flammable, combustible or explosive materials is bonded and grounded while the load lines are connected or disconnected and while the contents of the tank truck are being transferred.

Subsection 278(1.1)

On a farming and ranching operation, tanker trucks are often used to fuel powered mobile equipment while in the field. During the transfer of fuel, static electricity can build up and produce an electrostatic discharge igniting the fuel vapours.

Both bonding and grounding the tanker truck to the powered mobile equipment during fuel transfer is the safest means of controlling the buildup of static electricity and should be performed whenever possible.

Under ideal conditions, an effective ground might be achieved by dropping down one of the powered mobile equipment's implements onto or into the earth, such as the bucket of a tractor. However, to ensure an effective ground, a grounding electrode, typically a grounding rod, must be driven deep into the earth and then tested to ensure good conductivity.

Installing and removing a grounding rod in the field at each fueling location would not be reasonably practicable. Leaving the grounding rod in the earth could create a potential impact hazard to equipment or a tripping hazard to workers.

Despite subsection (1), on a farming or ranching operation, the operator is only required to ensure that a conductive tank truck is bonded if the truck is being used to transfer flammable, combustible or explosive materials directly to powered mobile equipment.

Subsection 278(1.2)

In the case of a stationary storage container, a grounding electrode, such as a grounding rod or plate, must be installed and connected to the storage container through a grounding conductor. During a delivery of fuel, the tanker truck must be bonded to the grounded storage container.

Subsection 278(2)

Section 277 does not apply to commercial tank trucks designed to transport flammable, combustible or explosive materials. To eliminate static discharge as a potential source of ignition, a commercial tank truck must be bonded and grounded during connection and disconnection of its loading lines and while its contents are being transferred.

Section 279 Refuelling

Subsections 279(1) and 279(2)

Fuel vapours can create an explosion hazard if a source of ignition is present. While being refuelled, no worker is permitted to smoke within 7.5 metres of a vehicle. The definition of “vehicle” includes powered mobile equipment. Similarly, no worker can refuel a vehicle if the vehicle is within 7.5 metres of any source of ignition.

A motor vehicle or watercraft cannot be refuelled while its engine is running unless, as permitted by subsection 279(4), a manufacturer designs, or a professional engineer certifies a fuelling system and safe work practices that allow the engine to be left running during refuelling.

Subsection 279(3)

Properly dispensing flammable fuel can significantly reduce the hazard to which workers might otherwise be exposed. This subsection specifies precautions that must be taken to minimize the potential for fuel spillage and/or inadvertent overfilling of fuel tanks. In general, the employer must ensure that workers maintain direct control when fuelling and do not use an object or device that is not an integral part of the hose nozzle valve assembly to block flow control devices in the “open” position.

Subsection 279(4)

As mentioned in subsection 279(1), a vehicle’s engine can be left running during refuelling if the fuelling system and related safe work practices have been designed by the manufacturer or certified by a professional engineer.

All-Terrain Vehicles and Snow Vehicles

Section 280 Three-wheeled all-terrain cycles

Three-wheeled all-terrain cycles present a recognized rollover hazard and cannot be used at any work site.

Section 281 Operator’s manual

Improper operation of an all-terrain vehicle or snow vehicle can be dangerous—the vehicle must be operated according to the manufacturer’s instructions. Such instructions are found in the operator’s manual. For this reason, the manual must be kept in a secure location on the vehicle or at another location that makes the manual readily accessible to the operator.

Section 282 Load and slope limitations

Subsection 282(1)

As with all powered mobile equipment, all-terrain vehicles or snow vehicles must be operated according to the manufacturer's specifications. If attempting to carry an excessive load, the entire balance and centre of gravity of the machine can be affected. Top-heavy loads can cause the unit to over-balance or rollover when operated on uneven or sloping ground. Similarly, overloading, combined with a sudden change of direction, could cause the unit to roll over.

Subsection 282(2)

The employer is ultimately responsible for ensuring that powered mobile equipment is operated safely. In cases where the manufacturer has not specified the operational limitations for an all-terrain vehicle or snow vehicle on sloping ground, the employer must develop and implement safe work procedures. Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. Those procedures must address the hazards to which workers will be exposed during machine operation.

Forklift Trucks

Section 283 Load chart

A load rating chart is essential for operators. The chart specifies the maximum load that can be lifted and carried under different operating conditions. Preventing excessive loading of the forklift truck limits the possibility of rollover or upset. The load chart must be readily available to the operator, e.g., fixed to the machine, in a compartment or location on the machine itself, or at a nearby location where it can be quickly accessed when needed.

Section 284 Seat belt

Seat belts are an important piece of safety equipment. If a forklift truck is equipped with a seat belt by the original equipment manufacturer or a seat belt is added to the equipment at some later date, an employer must ensure that the seat belt is present on the forklift truck and in useable condition. Subsection 256(3)(d) required that the seat belt be used.

Pile Driving Equipment and Practices

Section 285 Chocking

To protect workers from the hazard created by a falling pile hammer, the operator must ensure that the hammer is securely chocked while suspended and not in use.

Section 286 Pile hoisting

To prevent worker injury, the operator must ensure that pilings are not hoisted in the leads when

- (a) workers not directly involved in the piling hoisting operation are on the superstructure; or
- (b) within range of a falling pile.

Because of the potential for injury, workers must not remain on or ride on any load while it is being moved, raised, or lowered. Unless a worker is directly involved in the piling hoisting operation, the worker must not be on the superstructure or within range of a falling pile.

Section 287 Restraining hoses and connections

If a pressure hose connection fails, the hose can flail wildly and seriously injure workers. To minimize the potential for such an incident, the employer must ensure that hoses on the pressure side of a connection are secured with safety chains or safety ropes.

Section 288 Brake bands and clutches

The failure of a brake or clutch mechanism can result in uncontrolled movement of pile driving equipment. The employer must therefore ensure that such components are inspected at the start of each work shift. A competent worker designated by the employer must perform the inspection.

Brake bands and clutches contaminated with oil or grease can cause these components to operate ineffectively or fail completely. The employer must ensure that contaminated units are dismantled and cleaned or, if necessary, replaced before further use.

Section 289 Using timber piles

Wood fragments from a shattered pile, as well as debris, bark and splintered wood on a timber pile about to be driven, can create hazards to workers. If airborne, these materials and debris can strike workers and injure them. Workers can be protected from dangers resulting from a pile shattering by maintaining a safe distance from the pile, being inside

or behind a protective structure (including the cab of machinery), having the pile capped, or other equally effective means.

Section 290 Crane boom inspection

Driving piles with a vibratory hammer can be very hard on a crane boom. So can using the crane boom with a vibratory pile extractor or for dynamic compaction. Given the critical nature of the boom, it must be

- (a) inspected
 - (i) at intervals specified in the manufacturer's specifications or specifications certified by a professional engineer;
 - (ii) annually or every 600 operating hours while being used for driving piles with a vibratory hammer; or
 - (iii) annually or every 200 operating hours if used with a vibratory pile extractor or for dynamic compaction, and
- (b) certified by a professional engineer as safe for continued used.

The inspection must be a structural examination, including non-destructive testing if necessary, of the boom and boom suspension system, i.e., any part of the boom and its supporting structures that are subjected to the vibration and shock of driving piles, extracting piles, and compacting. A professional engineer must certify the inspection.

Section 290.1 Licensing and mechanical inspection

Some workers use a personal vehicle for work purposes. This section introduces licensing and mechanical inspection requirements that apply to workers who use a personal vehicle for work purposes.

Subsection 256(1) states that a worker must not operate powered mobile equipment, which includes vehicles, unless the worker

- (a) is trained to safely operate the equipment;
- (b) has demonstrated competency in operating the equipment to a competent worker designated by the employer;
- (c) is familiar with the equipment's operating instructions; and
- (d) is authorized by the employer to operate the equipment.

These requirements are considered to have been met once an employer ensures that the worker has met the appropriate licensed driver requirements of provincial legislation applicable to the type of personal vehicle being used.

To make sure that the personal vehicle is mechanically sound and therefore safe to use for work purposes, the worker must ensure that the vehicle is maintained in sound mechanical condition. This requirement can be met by the worker following the maintenance requirements specified by the vehicle manufacturer.

Concrete Pump Trucks

Section 290.2 Safety requirements

The 2009 edition of the *OHS Code* marks the first time that requirements specific to concrete pump trucks have been included. Their inclusion reflects ongoing safety issues with these relatively new pieces of equipment. In Alberta and British Columbia for the period 2001 to 2004, 20 incidents involving truck-mounted concrete pumping units happened, including one fatality in Alberta.

Seventeen of the reported incidents involved equipment failures and three incidents involved power line contacts. The equipment failure incidents were further classified as follows:

- 14 failures resulted from design or manufacturing deficiencies;
- two failures were due to inadequate inspection and maintenance; and
- one failure was reported to be the result of unsafe operating practices.

The failures occurred in rotation drive components, an outrigger, a boom linkage, elbows, boom rods, cylinders, welded connection points, a pedestal and a king post tube failure. Most of the equipment failures were on machines that were less than one year old with many only a few months old. The incidents reported were not limited to one manufacturer.

In addition, a survey of recently reported incidents elsewhere in Canada and the United States shows that concrete pumping trucks are involved in overhead power line contacts and loss of stability due to improper placement of outriggers on unstable soil.

As a result,

- (a) all load bearing components must undergo non-destructive testing at 12-month intervals;
- (b) operators must visually inspect all load bearing components and safety and control devices before each use;
- (c) outriggers must be extended according to the manufacturer's instructions;
- (d) no worker or other person can be positioned under a distribution boom or mast. The person handling the concrete delivery hose must therefore stand beside it or change the work process so that the worker pushes the hose as the operator booms in (rather than the common practice of pushing the hose as the operator booms out). This requirement also refers to other workers at the work site. No worker or other person can be allowed to be under the boom or mast; and
- (e) the concrete pump truck cannot be moved when the distribution boom or mast is partially or fully extended, unless the truck has been designed to allow this.

Part 20 Radiation Exposure

Highlights

Requirements involving exposure to ionizing radiation have been, and continue to be, part of Alberta's *Radiation Protection Regulation*.

- Section 291 complements the *Radiation Protection Regulation* and brings the employer's responsibilities to the attention of employers and workers.

Requirements

Section 291 Prevention and protection

This section applies only to workers who may be exposed to ionizing radiation. No requirements are specified for exposure to non-ionizing radiation.

Employers are required to develop and implement safe work practices and procedures that are to be used when workers deal with or approach a radiation source. If practicable, workers are to be involved in developing and implementing the safe work practices and procedures. As required by section 8 of the *OHS Regulation*, the procedures must be in writing. The employer must inform the workers of the potential hazards of ionizing radiation and the radiation source.

The remainder of the explanation to this Part presents information about both ionizing and non-ionizing radiation.

Overview

The term "radiation" includes many different types of electromagnetic radiation, both ionizing and non-ionizing. It can range from extremely high frequency/short wavelength radiation such as cosmic rays, through the visible light spectrum and on to extremely low frequency/long wavelength radiation such as electrical power.

Ionizing radiation

What is it?

Ionizing radiation is high-energy electromagnetic radiation that is capable of disrupting the structure of atoms or molecules. When ionizing radiation penetrates living tissues, the chemical structure of living cells may be changed. If enough radiation is absorbed, cells may be altered or destroyed. In some cases, these cellular changes could develop

into cancer, or cause genetic damage or birth defects. Sources of ionizing radiation encountered at the workplace may include x-ray and radioactive material.

Federal regulations

In Canada, ionizing radiation is regulated both federally and provincially. At the federal level, the Canadian Nuclear Safety Commission (CNSC), formerly known as the Atomic Energy Control Board of Canada, focuses primarily on the control of nuclear activities. *The Nuclear Safety and Control Act* (Canada) limits the health and safety risks to persons and the environment that are associated with the development, production and use of nuclear energy, and the production, possession and use of nuclear substances that are products of the nuclear fuel cycle. Regulations under that *Act* deal with general nuclear safety and control, radiation protection, nuclear substances and radiation devices, and the packaging and transport of nuclear substances.

Provincial regulations

At the provincial level, the *Radiation Protection Act* and the *Radiation Protection Regulation* deal with radiation equipment and sources other than man-made radioactive sources, mainly ionizing radiation from x-ray equipment.

According to the *Radiation Protection Act*,

- (a) persons responsible for a radiation facility, radiation equipment or radiation source must take all reasonable precautions to protect persons from radiation injury;
- (b) employers must ensure that workers are informed of the potential hazards of the radiation and of the precautions to be taken to protect workers and other persons from those hazards; and
- (c) employers must ensure that the installation, maintenance, repair, testing, use or operation of radiation equipment is done by a competent worker.

The *Radiation Protection Regulation* designates certain radiation equipment as requiring registration certificates, describes protective measures for the use of ionizing radiation equipment, and specifies maximum exposure limits for ionizing radiation. Protective measures for the use of ionizing radiation are addressed by referencing existing Health Canada Safety Codes for x-ray equipment used in medical, dental and veterinary facilities, as well as analytical, industrial and baggage inspection x-ray equipment.

Exposure limits

One of the guiding principles of radiation protection is the ALARA principle. According to the principle, exposure of radiation workers and other persons to ionizing radiation is kept “As Low As Reasonably Achievable—economic and social factors being taken into consideration.”

The *Radiation Protection Regulation* specifies maximum exposure limits for ionizing radiation. The exposure limits represent international consensus on radiation protection standards. The maximum exposure limits include exposure from all sources of ionizing radiation except medical or dental radiation when the person is a patient, or natural background radiation. Radiation workers who use or are exposed to the operation of certain types of ionizing radiation equipment require personal exposure monitoring. Also, specific maximum exposure limits are applicable to pregnant radiation workers.

For more information



Radiation Protection Act (Alberta) and Radiation Protection Regulation
www.qp.alberta.ca/570.cfm?frm_isbn=9780779753338&search_by=link



Canadian Nuclear Safety Commission
www.nuclearsafety.gc.ca



Nuclear Safety and Control Act (Canada)
laws-lois.justice.gc.ca/eng/acts/N-28.3



Health Canada Safety Codes
www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation

Naturally Occurring Radioactive Materials

In addition to radioactive sources and x-ray equipment, another source of ionizing radiation is naturally occurring radioactive materials (NORM). These are radioactive materials that have always been present in various concentrations in the environment and in the tissues of every living animal, including people. Such materials have the potential to cause cancer in persons exposed to them.

Although the concentration of NORM in most natural substances is so low that this risk is generally regarded as negligible, higher concentrations may arise as the result of industrial operations such as

- *mineral extraction and processing*—NORM may be released or concentrated in a process stream during the processing of ore, such as in the phosphate fertilizer industry and the abrasives and refractory industries;
- *oil and gas production*—NORM may be found in the fluids and gases from hydrocarbon-bearing geological formations;
- *metal recycling*—NORM-contaminated materials are redistributed to other industries resulting in the formation of new NORM-contaminated products;
- *forest products and thermal-electric production*—mineral ashes left from combustion may concentrate small amounts of NORM naturally present in plant material and coal;

- *water treatment facilities*—fresh or waste water is treated through sorptive media or ion-exchange resins to remove minerals and other impurities from the water being treated and may release radon (geothermal sources, fish hatcheries);
- *tunneling and underground working*—in areas where small amounts of indigenous radioactive minerals or gases may be present, such as underground caverns, electrical vaults, tunnels or sewer systems.


The concentration of radioactive substances in these materials may increase to levels at which special precautions are needed for handling, storing, transporting, and disposing of material, by-products, end-products or process equipment.


NORM is not regulated in Canada because its source is natural background radiation. However, guidelines describing safe work practices and procedures to be followed when dealing with NORM are available. The maximum exposure limits to NORM are the same as the exposure limits for all sources of ionizing radiation.

For more information

 *Canadian Guidelines for Management of Naturally Occurring Radioactive Materials (NORM)* published by Health Canada
www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/environmental-contaminants/canadian-guidelines-management-naturally-occurring-radioactive-materials-norm-health-canada-2000.html

 *Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada*
www.alberta.ca/radiation-health-safety-resources.aspx

 *Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM)*
www.arpsa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series/guides-and-recommendations/rps15

 *Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry*
www-pub.iaea.org/MTCD/publications/PDF/Pub1171_web.pdf

 *Guidelines for the Management of Naturally Occurring Radioactive Material (NORM) in the Oil and Gas Industry*
www.rp-alba.com/resources/412.pdf

 *NORM Waste Management*
www.evs.anl.gov/research-areas/highlights/norm.cfm

Non-ionizing radiation

General

Non-ionizing radiation does not have enough energy to disrupt the structure of atoms or molecules. However, it may have biological effects such as heating or initiating photochemical reactions. Non-ionizing radiation includes ultraviolet light, visible light, infrared light, microwaves, radiowaves and electricity. Some of the most common sources of non-ionizing radiation encountered at the workplace are listed in Table 20.1.

Table 20.1 Common sources of non-ionizing radiation at the workplace

Type of radiation	Source/uses	Workers exposed
Ultraviolet light	<ul style="list-style-type: none">▪ welding▪ sunlight▪ fluorescent lamps▪ mercury & xenon lamps	<ul style="list-style-type: none">▪ welders▪ outdoor workers▪ lighting technicians▪ laboratory personnel
Infrared light	<ul style="list-style-type: none">▪ industrial heaters & dryers▪ sunlight▪ welding▪ lasers	<ul style="list-style-type: none">▪ welders▪ glass factory workers
Microwaves	<ul style="list-style-type: none">▪ radar▪ cooking▪ communication ¹▪ microwave diathermy▪ telemetry	<ul style="list-style-type: none">▪ broadcasting and communication workers▪ medical personnel▪ physiotherapists▪ marine personnel
Radiofrequency	<ul style="list-style-type: none">▪ industrial heating (induction & dielectric), sealing, glueing, melting, tempering, welding, polymerization and sterilization▪ communication ²▪ metallurgy▪ medical and short wave diathermy▪ cellular telephones	<ul style="list-style-type: none">▪ broadcasting and communication workers▪ factory workers▪ plastic sealer operators▪ medical personnel▪ air crews▪ engineers/mechanics/technicians/maintenance workers
Extremely low frequency (ELF)	<ul style="list-style-type: none">▪ electricity transmission▪ induction heaters▪ steel and aluminum industry	<ul style="list-style-type: none">▪ electrical utility workers▪ factory workers
Static magnetic fields	<ul style="list-style-type: none">▪ magnetic resonance imaging▪ nuclear magnetic resonance	<ul style="list-style-type: none">▪ medical personnel▪ laboratory personnel

Notes:

¹ Microwave communication—television, weather radar, satellite communication, marine navigation, taxi, police/fire/ambulance, CB radios, microwave relay towers, radio navigation

² Radiofrequency (RF) communications—radio navigation, AM/FM radio, marine broadcasting, CB radios, television, air traffic control, police/fire/ambulance

Except for lasers, there are no provincial regulations for specific types of non-ionizing radiation. However, under the *OHS Act*, if an OHS Officer believes that radiation is creating unhealthy or unsafe conditions for workers, the officer may issue an order prohibiting use of the equipment or requiring remedial action. Also, Part 2 of the *OHS Code* requires employers to conduct written hazard assessments of work sites to identify existing or potential hazards.

In the absence of specific rules, maximum exposure limits for non-ionizing radiation, other than for lasers or radiofrequency and microwave radiation, should be taken from levels published in the book *“Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents & Biological Exposure Indices (BEIs),”* published annually by the American Conference of Government Industrial Hygienists (ACGIH).

Ultraviolet radiation

The most common and well-known hazards of ultraviolet light are

- (a) sunburn, which can lead to premature skin aging and skin cancer;
- (b) kerato-conjunctivitis, commonly known as welder’s flash;
- (c) macular degeneration of the eye; and
- (d) possible cataract formation.

For more information



Ultraviolet Radiation in the Workplace

www.labour.gov.on.ca/english/hs/pubs/uvradiation/

Lasers

The most common and well-known hazards of lasers are eye injuries and skin burns.

The *Radiation Protection Regulation* designates Class 3b and 4 lasers as requiring registration certificates. The *Regulation* further describes protective measures for the use of all classes of lasers by referencing CSA Standard CAN/CSA-Z386-14, *Safe Use of Lasers in Health Care*, and ANSI Standard ANSI-Z136.1-2014, *American National Standard for the Safe Use of Lasers*.

Maximum exposure limits for non-ionizing radiation from lasers are also specified in the *Regulation* by reference to ANSI Standard Z136.1. These exposure limits do not include exposure from non-ionizing medical or dental radiation when the person is a patient.

Information specific to laser pointers can be found at the following websites:



Lasers—Health Care Facilities

www.ccohs.ca/oshanswers/phys_agents/lasers.html



Lasers in Ontario Workplaces

www.labour.gov.on.ca/english/hs/pubs/gl_lasers.php



Laser Hazards

www.osha.gov/SLTC/laserhazards/



Laser Pointer Safety

www.laserpointersafety.com

Radiofrequency and microwave radiation

Radiofrequency and microwave radiation span the frequency range from 3 kHz to 300 GHz, which includes wireless telecommunications devices such as cellular telephones. The main health concern with this type of radiation is its thermal effects, i.e., induced tissue heating.

In Canada, Health Canada publishes Safety Code 6, *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. Industry Canada requires all operators of radio and television broadcast stations, cellular, land, mobile, amateur radio and other radiofrequency emitters to adhere to Safety Code 6. Operators must ensure that the radiofrequency fields produced by their installations do not exceed the maximum levels listed in the Safety Code. Industry Canada licenses this radiocommunication equipment, approves where cellular telephone base stations are located, and conducts compliance assessments of both cellular telephones and base stations.

Many studies into the relationship between radiofrequency electromagnetic fields and cancer have been completed. The results have been both contradictory and inconclusive. Research in this subject areas continues.

For more information



Safety Code 6: Health Canada's Radiofrequency Exposure Guidelines

www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-6-health-canada-radiofrequency-exposure-guidelines-environmental-workplace-health-health-canada.html



Radiofrequency Fields

www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/consumer-radiation/radiofrequency-fields



Radiofrequency

www.bccdc.ca/health-info/health-your-environment/electro-magnetic-exposures/radiofrequency?utm_campaign=2016JuneEn&utm_medium=email&utm_source=NewsletterSubscribers



Facts about towers

www.ic.gc.ca/eic/site/ic-gc.nsf/eng/07422.html



Radiofrequency and Microwave Radiation in the Workplace

www.labour.gov.on.ca/english/hs/pubs/radiation/index.php



Radiofrequency and Microwave Radiation

www.osha.gov/SLTC/radiofrequencyradiation/index.html



RF Safety FAQ

www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety

Extremely low frequency (ELF) radiation

Alternating current (a.c.) electricity in Canada operates at a power line frequency of 60 Hz. As electrical current flows through wires, electric and magnetic fields are created that fluctuate at this frequency. The electric and magnetic fields produced are referred to as extra low frequency (ELF) radiation.

The most common hazards of ELF radiation are contact electrical shock and the induction of weak electrical currents in the body. Many studies into the relationship between ELF magnetic fields and cancer have been completed. The results have been both contradictory and inconclusive. Research in this subject area continues.

For more information



Electric and Magnetic Fields

www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/consumer-radiation/electric-magnetic-fields.html



Electromagnetic Fields

www.who.int/topics/electromagnetic_fields/en/index.html



Extremely Low Frequency (ELF) Radiation

www.osha.gov/SLTC/elfradiation/index.html



EMF (Electric and Magnetic Fields)

www.cdc.gov/niosh/topics/emf

Part 21 Rigging

Highlights

- Section 292 recognizes fatigue rating according to a specified European standard, as well as safety factors for specific wire rope rigging components.
- Section 297 requires employers to ensure that slings meet the requirements of the American Society of Mechanical Engineers (ASME) Standard B30.9-2006, *Safety Standard for Cableways, Cranes, Derricks, Hoists, Jacks and Slings*. Section 297 also requires that below-the-hook lifting devices meet the requirements of ANSI Standard B30.20, *Below the Hook Lifting Devices*.
- Section 298 requires the employers to ensure that synthetic slings are marked with the maximum load rating for the types of hitches permitted.
- Section 303 prohibits the use of makeshift fittings or attachments that are load bearing.
- Sections 305 through 309 present rejection criteria for synthetic fibre slings, wire rope, metal mesh slings and hooks.

Requirements

Section 292 Breaking strength

Subsection 292(1)(a)

To guard against failure of a rigging component due to shock load, overload, wear, etc., the load being lifted should not exceed the Safe Working Load (SWL). The SWL is calculated as a fraction of the weakest component's actual breaking strength. Breaking strength is the measured load required to "break" the component. SWL is calculated by dividing that breaking strength, as identified by the manufacturer or a professional engineer, by a "factor of safety."

Subsections 292(1)(b) and 292(1)(c)

"Fatigue" is the tendency of material to break under repeated stress. "Fatigue rating" means that the rigging will provide improved fatigue resistance when rated in accordance with CEN Standard EN 1677-1: 2000, *Components for slings—Part 1: Forged steel components grade 8*. This standard specifies mechanical properties and test procedures for forged steel components to be "fatigue rated."

Fatigue rated rigging components can be subjected to increased loads when compared to rigging components that have not been fatigue rated. This provision permits the use of lifting chain and other hardware at a design factor of 25 percent (4:1), provided fatigue testing has been done by the manufacturer according to CEN Standard EN1677-1: 2000 Part 1.

Section 292.1 lists minimum safety factors that apply to specific wire rope rigging components. For all other components, the safety factor is

- (a) 20 percent of the component's ultimate breaking strength if the component is *not* fatigue rated according to EN standard 1677-1: 2000—a safety factor of 5:1, or
- (b) 25 percent of the component's ultimate breaking strength if the component *is* fatigue rated according to EN standard 1677-1: 2000 and not used to raise or lower a worker—a safety factor of 4:1.

Subsection 292(2)

The factors of safety specified in subsection (1) can be modified for a dedicated rigging assembly, the use of which is restricted to a specific lift and is designed and certified by a professional engineer as safe for that lift. Once the specific lift is completed, the dedicated rigging assembly must be re-rated according to subsection (1) if it is to be used again.

Section 292.1 Safety factors

Subsection 291.1(1)

The total stress in a wire rope, in service, is composed of several separate elements. These are reduced to a single tensile load value (working load). When this value exceeds the breaking strength of the wire rope, a failure occurs.

The factor to provide a margin of safety between the applied tensile forces and the breaking strength of the rope is defined as the safety factor.

Except as provided in section 292, the safety factor for wire rope used in various applications is as follows:

Running line (also known as hoisting line) (Running line on overhead cranes is typically 5:1)	3.5 to 1
Non-rotating line (often used as a single part hoisting line)	5 to 1
Tugger lines (lines on a small drum winch), for <u>pulling only</u> (Tugger lines used for hoisting must be 5:1)	3 to 1
Pendant lines (attached to and support the boom head) Guy lines (stabilizing structures, etc.)	3 to 1
Winch lines (typically mounted on a truck or crawler tractor)	2 to 1

Subsection 292.1(2)

Impacts or sudden “jolting” when towing can pull rigging components and lines into yield (stretching). Yield reduces ultimate breaking strength which may reduce the factor of safety necessary for lifting service.

Section 293 Load ratings

Subsection 293(1)

The “maximum load rating” is the maximum weight that a piece of rigging is authorized by the manufacturer or a professional engineer to support. It is also known by a variety of other terms such as Working Load Limit (WLL), Safe Working Load (SWL), rated load value, resultant safe working load, rated capacity, and maximum working load.

The maximum load rating is not the breaking strength of the piece of rigging. An employer must ensure that the load rating of the piece of rigging is based on the appropriate factor of safety.

Components can be marked in a variety of ways, i.e., stamping, etching, embossing, printing, tagging. When choosing a particular marking system, consideration should be given to legibility and durability.

Subsection 293(2)

If the maximum load rating cannot be marked on a rigging component, information about the component’s maximum load must be made available to the lifting supervisor and to the operator before commencing the lifting operation. This information must also be readily available to other workers involved in the lifting operation.

Section 294 Inspection

The rigging assembly must be thoroughly inspected before each period of continuous use during the shift. Refer to ASME Standard B30.9-2006 for detailed information regarding initial, frequent and periodic inspections. This inspection should be done by a competent worker and should include, but not be limited to:

- (a) inspection of wire rope for wear, elongation, damage, i.e., bird caging, kinks, core protrusion, cuts, etc., signs of overloading, corrosion and pitting;
- (b) inspection of slings for abrasion, cuts/tears, melting or burn marks, bleaching/corrosion, increased stiffness of material;
- (c) inspection of sheaves and hooks for deformation, cracks, wear;
- (d) inspection of shackles for crown (bow) wear, cracks, chips, gouges, deformation, and pin wear, deformation, thread damage;
- (e) inspection of eye bolts and lift rings for gouges, cracks, wear, deformation; and

- (f) inspection of spreader bars, lift beams, equalizer beams, beam clamps, beam trolleys, plate clamps for wear, excessive movement, cracks, broken/worn teeth, loose components, deformation, integrity of connection points.

The criteria for rejection are more fully described in sections 305 through 309. If no criteria are mentioned, reference should be made to manufacturer's specifications or the specifications of a professional engineer. Rejection criteria for slings are also described in ASME Standard B30.9-2006, *Safety Standard for Cableways, Cranes, Derricks, Hoists, Jacks and Slings*.

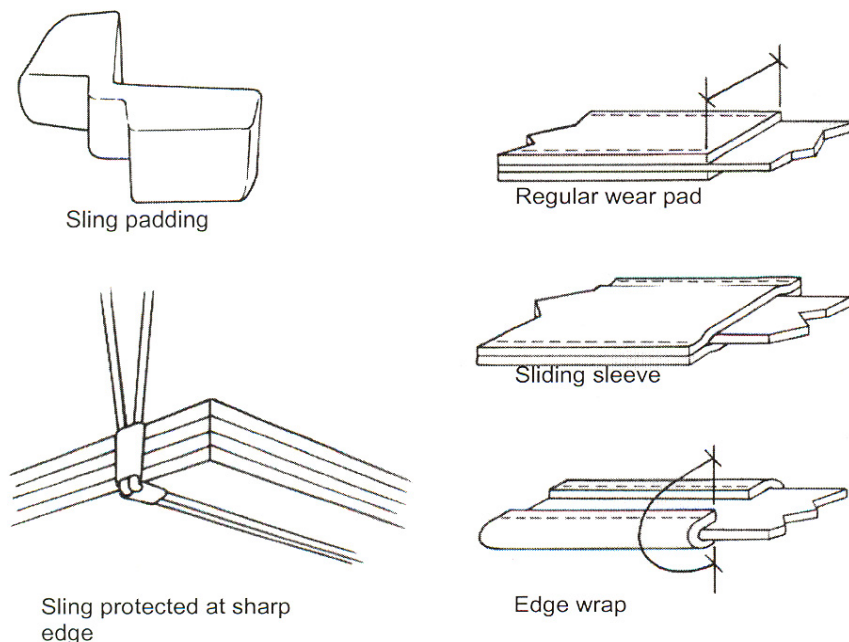
Section 295 Prohibition

A worker must not use rigging that does not comply with the requirements of this Part of the *OHS Code*.

Section 296 Rigging protection

To minimize damage to a sling, sharp corners of the load that are in contact with the sling must be guarded to prevent damage to the slings or straps of the rigging, e.g., padded with protective material of sufficient strength and thickness, or with prefabricated protective devices as shown in Figure 21.1. The padding or protective device can be placed on the load itself or affixed to the sling.

Figure 21.1 Examples of prefabricated protective devices



Section 297 Sling standard

Subsection 297(1)

ASME Standard B30.9-2006, *Safety Standard for Cableways, Cranes, Derricks, Hoists, Jacks and Slings*, applies to slings intended for lifting, made from alloy steel chain, sewn synthetic webbing, wire rope, metal mesh and synthetic fibre rope. The Standard describes technical requirements for construction, load rating, proof testing, identification, maintenance, environmental effects, end attachments, inspection, repair and use. Figures 21.2 to 21.7 show a variety of different types of slings. The Standard specifies that inspections be conducted as described in Table 21.1.

Figure 21.2 Example of metal mesh fabric

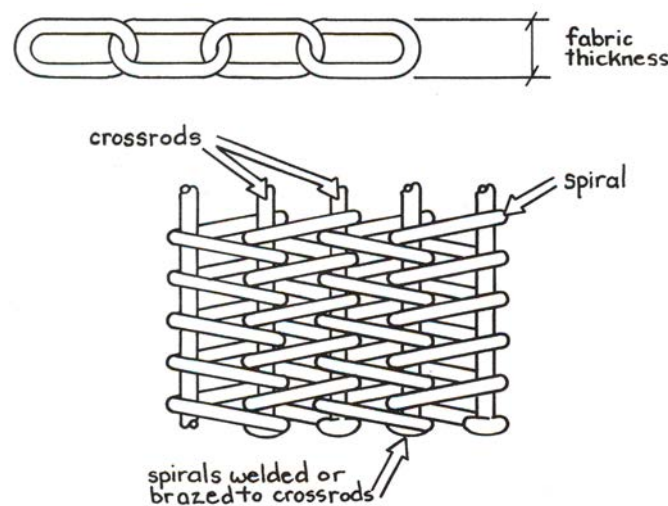


Figure 21.3 Example of metal mesh sling

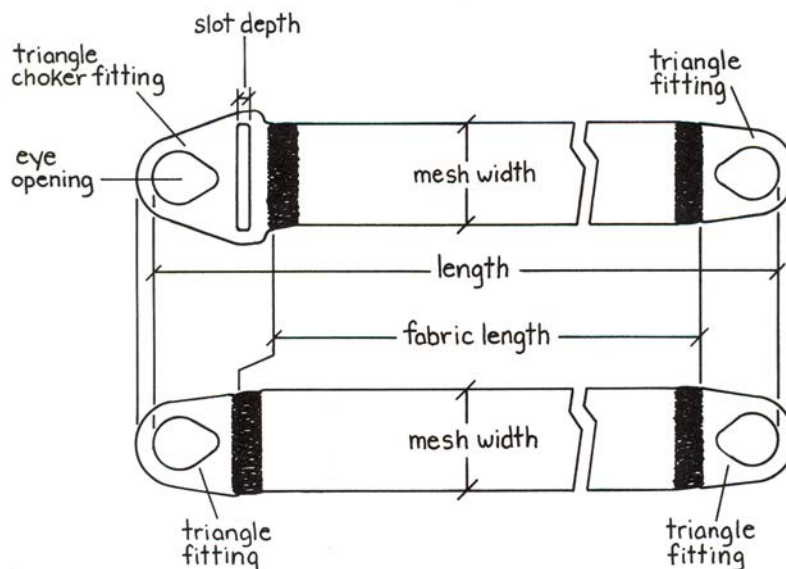
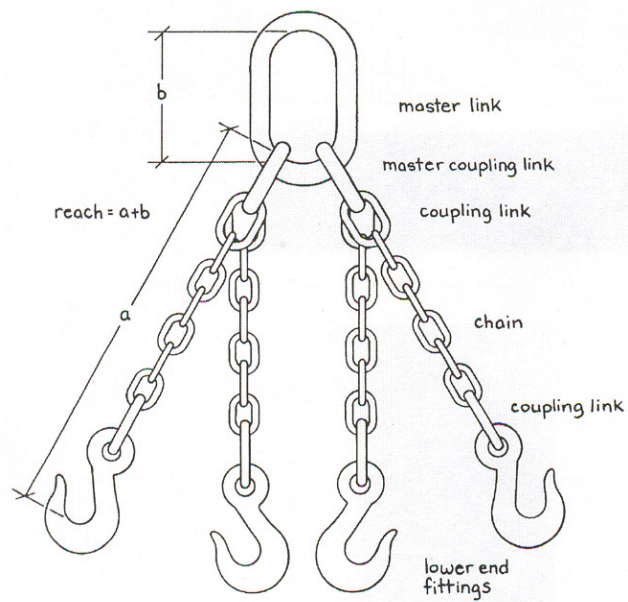


Figure 21.4 Chain sling major components

Quadruple leg slings



Single leg slings

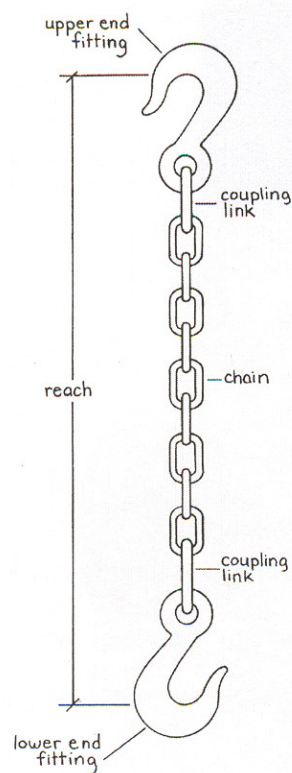
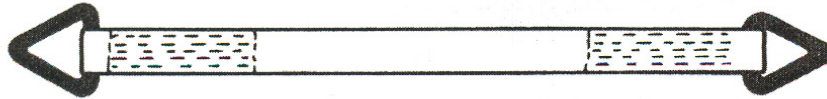


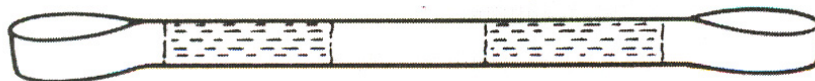
Figure 21. 5 Synthetic webbing slings



Type I — Sling made with a triangle fitting at one end and a slotted triangle choker fitting at the other end. It can be used in a basket hitch or choker hitch.



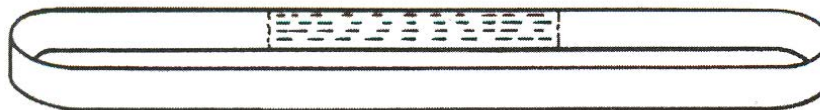
Type II — Sling made with a triangle fitting at both ends. It can be used in a vertical or basket hitch only.



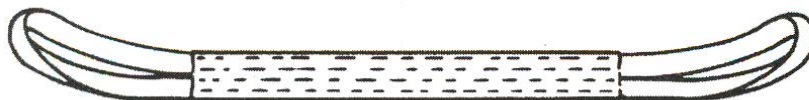
Type III — Sling made with a flat loop eye at each end with loop eye opening on same plane as sling body. This type is sometimes called a flat eye and eye, eye and eye, or double eye sling.



Type IV — Sling made with both loop eyes formed as in Type III, except that the loop eyes are turned to form a loop eye at a right angle to the plane of the sling body. This type is commonly referred to as a twisted eye sling.



Type V — Endless sling, sometimes referred to as a grommet. It is a continuous loop formed by joining the ends of the fabric with a splice.



Type VI — Return eye (reversed eye) sling is formed by using multiple widths of webbing held edge to edge with an assembly. A wear pad is attached to one or both sides of the sling body and on one or both sides of the loop eyes to form a loop eye at each end which is at a right angle to the plane of the sling body.

Figure 21.6 Wire rope slings

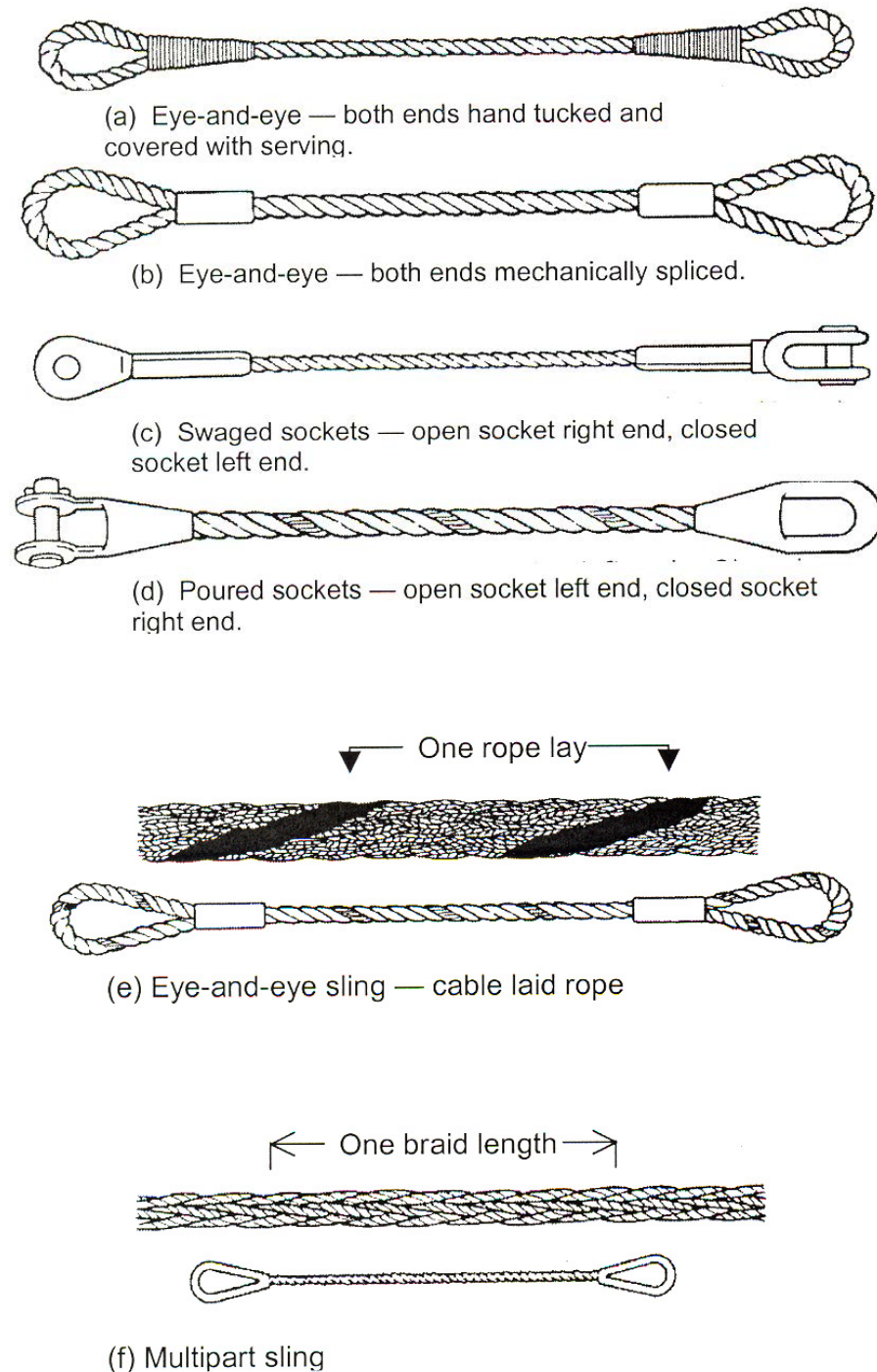


Figure 21.7 Synthetic roundsling configurations

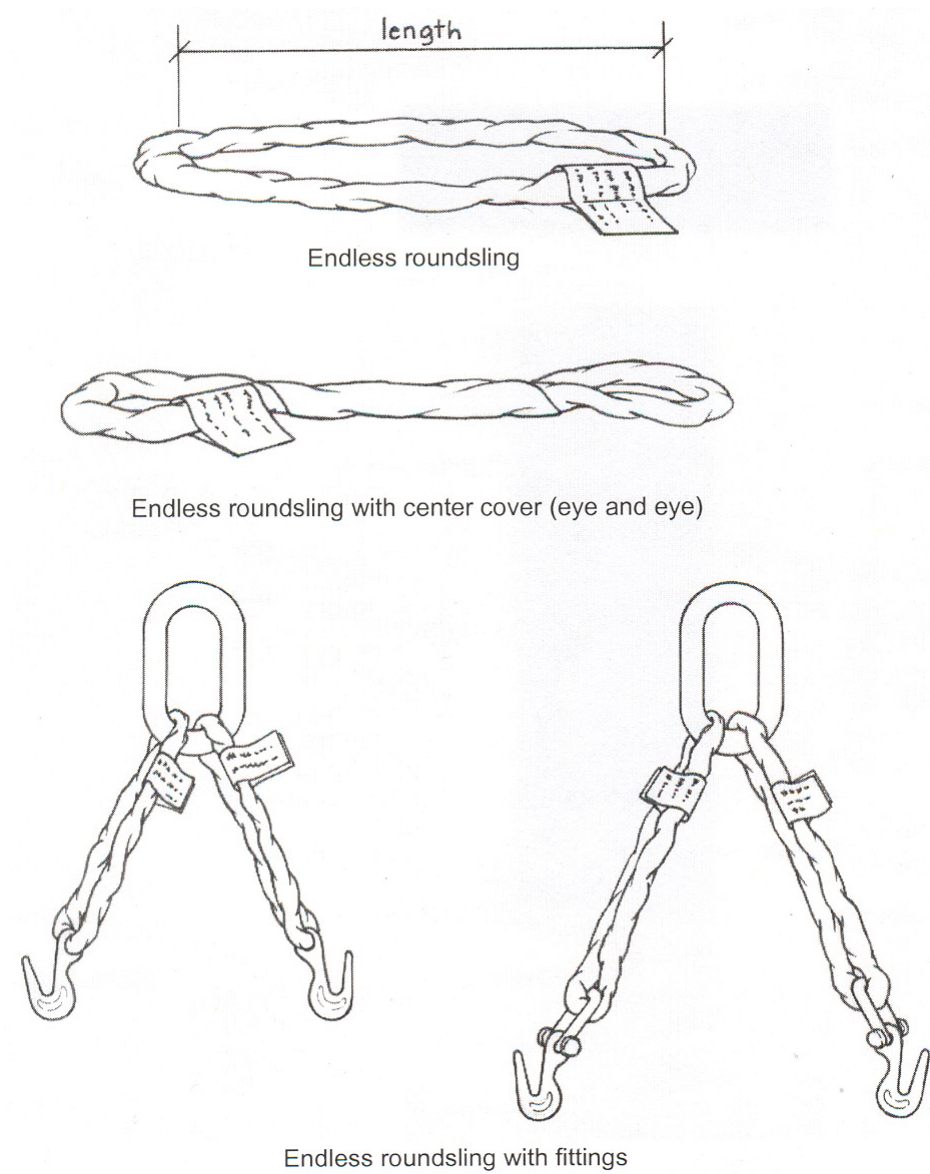


Table 21.1 Sling inspections based on sling type

Type of sling	Inspection		
	Type	What to look for	How often
Chain	Frequent	<ul style="list-style-type: none"> Chain and attachments for wear, nicks, cracks, breaks, gouges, stretch, bends, weld splatter, discoloration from excessive temperature, and throat opening of hooks Missing/illegible markings Seating, free hinging, distortion of hooks/latches 	<ul style="list-style-type: none"> *Normal service—monthly *Severe service—daily to weekly *Special service—as recommended by qualified person
	Periodic	<ul style="list-style-type: none"> Same as “Frequent” inspection, link by link Inner surfaces of each link Wear not to exceed manufacturer’s specifications 	<ul style="list-style-type: none"> *Normal service—annually *Severe service—monthly to quarterly *Special service—as recommended by qualified person
Wire rope	Frequent	<ul style="list-style-type: none"> Distortion such as kinking, crushing, unstranding, birdcaging, main strand displacement, core protrusion, loss of rope diameter, unevenness of outer strands General corrosion Broken or cut strands Number/distribution/type of visible broken wires Missing/illegible markings 	<ul style="list-style-type: none"> Daily
	Periodic	<ul style="list-style-type: none"> Deterioration warranting removal 10 randomly distributed broken wires in one rope lay, or 5 broken wires in one strand in one rope lay severe localized abrasion or scraping kinking, crushing, birdcaging, or other distortion evidence of heat damage cracked, deformed, worn attachments severe corrosion 	<ul style="list-style-type: none"> Based on how often the sling is used and severity of service conditions, but at least annually
Metal mesh	Initial	<ul style="list-style-type: none"> Verify correct sling is being used 	<ul style="list-style-type: none"> Prior to first use as new or repaired

Type of sling	Inspection		
	Type	What to look for	How often
	Frequent	<ul style="list-style-type: none"> ▪ Broken weld or brazed joint along edge ▪ Broken wire in mesh ▪ Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion ▪ Distortion in the mesh ▪ Distortion of the slot in choker fitting by more than 10 percent ▪ Distortion of end fittings ▪ 15 percent reduction of original cross-sectional area at any point around hook opening or end fitting ▪ Cracked or visibly distorted end fittings ▪ Missing/illegible markings 	<ul style="list-style-type: none"> ▪ Daily
	Periodic	<ul style="list-style-type: none"> ▪ Same as for “Frequent” inspection 	<ul style="list-style-type: none"> ▪ Based on how often the sling is used and severity of service conditions, but at least annually
Synthetic rope	Initial	<ul style="list-style-type: none"> ▪ Verify correct sling is being used 	<ul style="list-style-type: none"> ▪ Prior to first use as new or repaired
	Frequent	<ul style="list-style-type: none"> ▪ Cuts, gouges, extensive fibre breakage along the length, abraded areas ▪ Reduction of rope diameter by more than 10 percent ▪ Uniform fibre breakage along major part of the length of the rope such that the entire rope appears covered with “fuzz” or “whiskers” ▪ Fibre breakage or melted fibre involving 10 percent of the fibre in the strand at any point ▪ Discolouration, brittle fibres, chemical or ultraviolet damage ▪ Foreign matter permeated in the rope attracting and holding grit ▪ Kinks/distortion ▪ Melted or charred areas that affect more than 10 percent of rope diameter or affect several adjacent strands to more than 105 of individual diameters ▪ Corrosion, cracks, distortion, localized wear of thimbles or other fittings ▪ Other visible damage ▪ Missing/illegible markings 	<ul style="list-style-type: none"> ▪ Daily

Type of sling	Inspection		
	Type	What to look for	How often
	Periodic	<ul style="list-style-type: none"> Same as for “Frequent” inspection 	<ul style="list-style-type: none"> Based on how often the sling is used and severity of service conditions, but at least annually
Synthetic webbing	Initial	<ul style="list-style-type: none"> Verify correct sling is being used 	<ul style="list-style-type: none"> Prior to first use as new or repaired
	Frequent	<ul style="list-style-type: none"> Acid or caustic burns Melting or charring Holes, tears, cuts, snags Broken/worn stitching in load-bearing splices Excessive abrasive wear Knots Excessive pitting or corrosion, or cracked, distorted or broken fittings Other visible damage Missing/illegible markings 	<ul style="list-style-type: none"> Daily
	Periodic	<ul style="list-style-type: none"> Same as for “Frequent” inspection 	<ul style="list-style-type: none"> Based on how often the sling is used and severity of service conditions, but at least annually
Synthetic roundsling	Initial	<ul style="list-style-type: none"> Verify correct sling is being used 	<ul style="list-style-type: none"> Prior to first use as new, altered, modified or repaired
	Frequent (records not required)	<ul style="list-style-type: none"> Melting or charring Holes, tears, cuts, abrasive wear, snags, exposed core yarns Damaged, stretched, cracked, worn, pitted, distorted fittings Knotting Other visible damage Missing/illegible markings 	<ul style="list-style-type: none"> *Normal service—daily *Severe service—each use *Special service—as recommended by qualified person
	Periodic (recorded as basis for continued use)	<ul style="list-style-type: none"> Same as for “Frequent” inspection 	<ul style="list-style-type: none"> *Normal service—daily *Severe service—each use *Special service—as recommended by qualified person

* Type of sling service:

- Normal—involves use of loads within maximum load rating
- Severe—involves normal service coupled with abnormal operating conditions
- Special—involves operation, other than normal or severe, that is recommended by a “qualified person” (a person who, by possession of a recognized degree in a relevant field or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject).

Subsection 297(2)

A below-the-hook lifting device is a device used for attaching loads to a hoist. ASME Standard B30.20-2006, *Below the Hook Lifting Devices*, presents requirements that apply to the marking, construction, installation, inspection, testing, maintenance, and operation of such devices. These include

- structural and mechanical devices e.g. plate clamps, bar tongs, spreader bars,
- vacuum devices, e.g., single pad, multiple pad,
- close-proximity operated machines, e.g., electrically-controlled, manually-controlled,
- remotely operated magnets, e.g., circular, rectangular, and
- scrap and material-handling grapples, e.g., orange peel grapple, magnetic grapple.

The Standard requires that each device be marked with its related load limit, manufacturer name and address, serial number, lifter weight and other information as noted, directly on the device or on a tag attached to it.

The Standard specifies the following inspection intervals:

- Visual examination before and during each lift:
 - Surface of the load for debris
 - Condition/operation of controls
 - Condition/operation of indicators or meters
- Frequent visual examinations reflecting the degree of use:
 - Normal service—monthly
 - Heavy service—weekly to monthly
 - Severe service—daily to weekly

Inspectors are to look for the following:

- (a) deformation, cracks, or excessive wear in structural members;
- (b) loose or missing guards, fasteners, covers, nameplates;
- (c) proper function/alignment of operating mechanisms;
- (d) proper operation of vacuum generators;
- (e) vacuum pad seals for cracks, tears, excessive wear, leakage, cuts, kinks of vacuum lines and connections;
- (f) appropriate levels in the entire vacuum system;
- (g) condition of magnetic device face, lifting bails, control handles, indicators, electrical conductors, battery (where applicable); and
- (h) condition of hydraulic lines and cylinders.

The Standard requires complete inspection based on the degree of use:

- Normal service—yearly
- Heavy service—semiannually (quarterly on magnetic devices and grapples)
- Severe service—quarterly (monthly on magnetic devices and grapples)
- Other as noted in the Standard or in the manufacturer's specifications or instructions

Inspectors are to look for the following:

- (a) all items under “Frequent” inspections;
- (b) loose bolts, fasteners;
- (c) cracked/worn gears, pulleys, sheaves, sprockets, bearings, chains, belts;
- (d) excessive wear at hoist hooking points and support shackles or pins;
- (e) damage to motors, controls, auxiliary components;
- (f) condition of electrical motors and components;
- (g) condition of hydraulic motor; and
- (h) other components as noted in the Standard or in the manufacturer’s specifications or instructions.

Subsection 297(3)

Many spreader bars are extendable and their load capacity varies with their length. Table 21.2 provides an example of a capacity data sheet for a spreader bar. If such a data sheet is not available from a device manufacturer, it is important to have one prepared by a professional engineer.

Subsection 297(4)

Where a capacity data sheet is used in accordance with subsection (3), an employer must ensure that the correct and corresponding sheet is used with each spreader bar. This is accomplished by ensuring that the data sheet and corresponding spreader bar are identified by a unique numbering system. Procedures for use of the bar should include an initial check to ensure that the correct data sheet is being followed.

Table 21.2 Spreader bar capacity data sheet

XYZ Engineering Ltd. Spreader Bar Capacity/Load Chart For the exclusive use of XYZ Crane									
Load Chart: XXXX-xx (Rev.1)					Date:				
Model Number: XX-xxxx This chart applies to serial numbers: XX-xxxx thru XX-zzzzz					Certification drawing reference: YY-yyy rev 0				
General information: Bar weight (without rigging): 675 lbs Shackle size: 35 ton SWL									
Sling Length	Bar Capacity at Listed Length in Tons (1 Ton = 2000 lbs)								
	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"	16'-0"	17'-0"	18'-0"	19'-0"
8'	32	0	0	0	0	0	0	0	0
10'	46	40	35	30	0	0	0	0	0
12'	58	52	46	41	37	33	27	0	0
15'	64	63	62	56	52	47	39	31	25`
20'	66	66	65	65	64	63	58	46	38
25'	67	67	67	66	66	66	65	60	51
30'	67	67	67	67	67	67	66	66	63

Notes:

- Capacities shown below the bold line indicate bar length/sling length combinations with sling angles of 60 degree or greater. Sling angle measured from horizontal spreader bar and the diagonal sling.
- Use only shackles as listed above.
- This load chart applies to only the models and serial numbers listed above.
- If no rating is available for 6" increments, use rating for the next longer length.
- All rigging and crane use must be in accordance with applicable CSA standards and provincial OHS legislation.
- Any incident, deviation from normal operation or unauthorized structural repairs will void the certification of the bar.
- Do not exceed rated capacity.
- In addition to the annual certification by a professional engineer, this rigging shall be visually inspected prior to each use by qualified rigging personnel or crane operators.
- Use capacity for next shorter sling length if actual sling length is not listed in table.



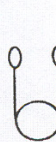


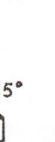
Section 298 Slings

Subsection 298(1)

Synthetic fibre web slings are constructed of flat webbing. This webbing is typically layered into plies with more plies meaning a stronger sling. To ensure that the sling and the way it is used is appropriate for the load, working load limits and the information listed in this section must be permanently and legibly marked on the sling (See Figures 21.8 and 21.9).

Figure 21.8 Example of manufacturer's load limits for synthetic web slings

type of fibre

NYLON EYE / EYE FLAT (EEF) AND EYE/EYE TWIST (EET) SLINGS								
TYPE '3'	WIDTH	PLY	VERTICAL CAPACITY	CHOKER CAPACITY	BASKET CAPACITY	60 DEGREE HITCH	45 DEGREE HITCH	30 DEGREE HITCH
EYE & EYE FLAT (EEF) & EYE & EYE TWIST (EET)								
EEF-1-601	1"	1	1,200	960	2,400	2,100	1,700	1,200
EEF-1-901	1"	1	1,600	1,300	3,200	2,800	2,300	1,600

Example of manufacturer's load limits for synthetic web slings

stock no.

load limit

size grade
serial no. _____

Figure 21.9 Example of a tag used to mark a sling

Subsection 298(2)

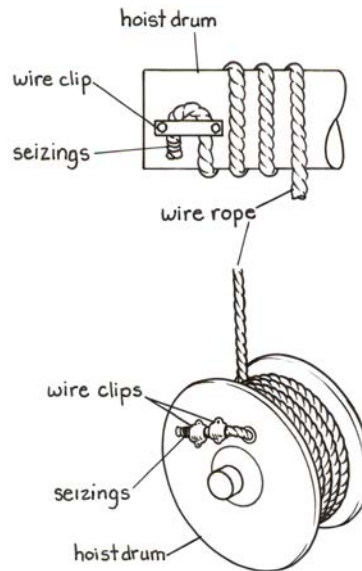
Typically, sling manufacturers verify sling load ratings by pull-testing in excess of 100 percent of the rated capacity. This is often done in accordance with a technical standard such as ASME Standard B.30.9-2006. Pull-testing for recertification purposes must be done this way as well.

If improperly pull-tested or pulled repeatedly beyond rated capacity, a sling's safety factor can be reduced to an unsafe level, leading to premature failure due to undetected fatigue damage. The pull testing described in this subsection refers to pull testing conducted at a work site, perhaps as part of an inspection or quality assurance program. This pull testing does not apply to manufacturers. Subsection 297(1) applies to manufacturers.

Section 299 Ropes wound on drum

Figure 21.10 shows examples of acceptable methods of securely fastening rope to a winding drum. The purpose of having not less than 5 full wraps on a drum is to reduce the force on the dead end attachment.

Figure 21.10 Example of acceptable methods of fastening rope to a winding drum



Section 300 Cable clips

Subsection 300(1)

Cable clips, also known as “cable clamps,” can be used safely for lifts up to 80 percent of line strength. Commonly used types include the U-bolt clamp (see Figure 21.11), the double-saddle clamp (see Figure 21.12) and the double-base clamp (see Figure 21.13). New bolts should always be used. Cable clips should be used in accordance with ASME Standard B30.26-2004, Rigging Hardware Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks and Slings.

Figure 21.11 Example of a U-bolt clamp

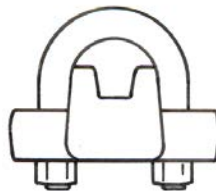
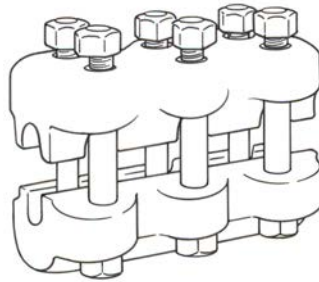


Figure 21.12 Example of a double-saddle clamp

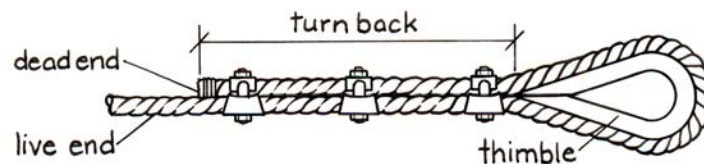


Figure 21.13 Example of a double-base clamp



“Never saddle a dead horse.” This means that the “saddle” part of the clip must not bear on the short or “dead” side of the rope (see Figure 21.14). Applying the clip incorrectly can reduce the effectiveness of the connection.

Figure 21.14 Example of “dead horse” clip



Subsection 300(2)

If the clips are tightened beyond specified torque values, the hoisting cable will be crushed and its strength reduced.

Subsection 300(3)

Double-saddle clamps can produce greater efficiency in the connection by applying a greater clamping force on the rope without damaging it.

Subsection 300(4)

Spacing of clamps should not exceed six to seven times the diameter of the rope.

Section 301 Ferrules

Subsection 301(1)

In a wire rope, a splice is made by joining interweaving strands or by overlapping and binding. Three types of common splices for creating an eye loop are the Flemish eye splice (see Figure 21.15), the tuck splice (see Figure 21.16), and the fold-back splice (see Figure 21.17).

Figure 21.15 Example of Flemish eye splice

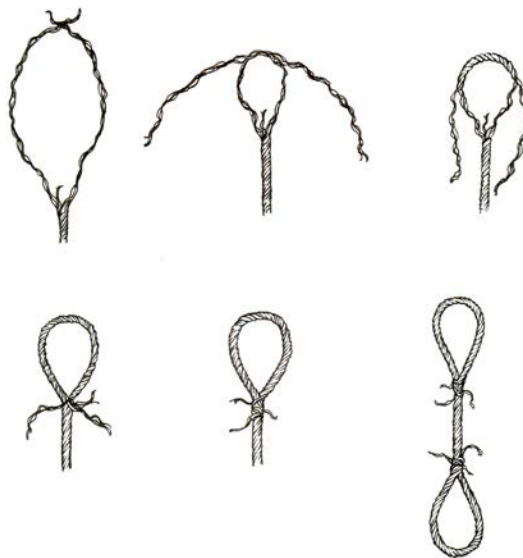


Figure 21.16 Example of a tuck splice



Figure 21.17 Example of a fold-back splice



A splice can be covered by a clamp (see Figure 21.18), a pressed sleeve or ferrule (see Figure 21.19), or wrapped with wire serving (see Figure 21.20).

Figure 21.18 Example of a splice covered by a clamp

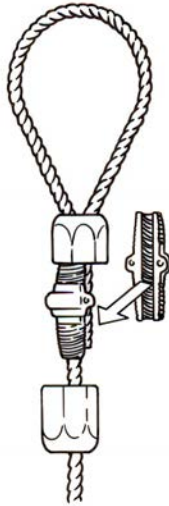


Figure 21.19 Example of a pressed sleeve

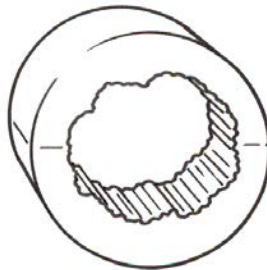
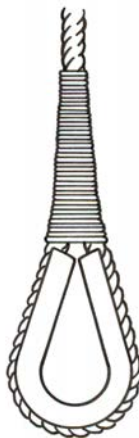


Figure 21.20 Example of a clamp wrapped with wire, serving



The most common splice is the Flemish eye splice with a pressed (swaged) ferrule. Swaging is the process of applying great pressure such that the metal of the ferrule flows into the crevices between wires and their strands. This makes a permanent bond and develops almost 100 percent of the breaking strength of the rope.

The ferrule is not covering the entire splice if splice ends are visible. To ensure adequate strength, the ferrule must be of steel and properly swaged onto the splice. When a Flemish splice is used to form an eye loop in a wire rope, the steel ferrule must identify the splice as being a Flemish eye splice.

Subsection 301(2)

Aluminum alloy ferrules are not suitable if exposed to temperatures greater than 204°C or where caustic conditions are present. To avoid the possibility of aluminum alloy ferrules being used under such conditions, they must be identified as made of aluminum alloy and must be commercially manufactured and properly swaged onto the splice.

Commentary about “commercially manufactured”

In general, a commercially manufactured product has the following qualities:

- (a) it is designed and built to some standard or generally accepted engineering principles that make it safe for use;
- (b) it is designed and built by person(s) with the skill or competence to be able to make the product safe;
- (c) it is produced with the intention of being generally available to anyone who wants to buy it—normally there is an exchange of money;
- (d) it is normally supported by the manufacturer with a warranty, guarantee, and product support; and
- (e) liability and safety issues related to its use have been addressed by the manufacturer.

It is implied by the *OHS Code*, that a product that is “commercially manufactured” is “safe” because it has been produced by a “manufacturer” that has the skills and competencies to do so.

Criterion (a) refers to the product being designed and built to some “generally accepted engineering principles.” It is expected that a “manufacturer” is able to provide drawings or sketches of the product that include an assessment of the product’s strength, load-bearing capacity, etc. Further, criterion (d) mentions “product support.” This may include, among other elements, the availability of written manufacturer specifications.

Section 302 Matching components

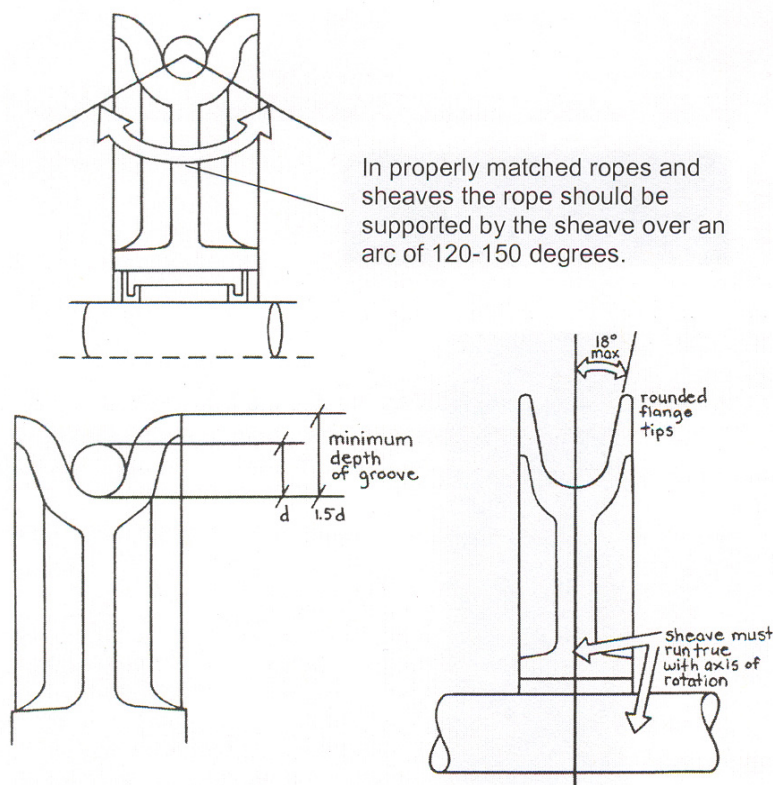
Subsections 302(1) and 302(2)

Unless otherwise specified by the manufacturer, the diameter of winding drums should not be less than 20 times the diameter of the rope. This will reduce the likelihood of weakened rope caused by excessive bending stresses.

Subsection 302(3)

Wire rope can be damaged if the angle and width of the sheave groove is incorrect for that wire rope. Too narrow a groove will pinch and bind the rope, causing excessive abrasion and fatigue leading to shortened rope life (see Table 21.3). A groove that is too wide will not properly support and guide the rope, causing the rope to flatten (see Figure 21.21).

Figure 21.21 Example of a sheave providing a proper arc of support to a rope



The condition and contour of sheave grooves have a major influence on rope life. The grooves must be smooth and slightly larger than the rope to prevent the rope from being pinched or jammed in a groove. The bottom of the groove should have an arc of support of at least 120 to 150 degrees and the sides of the groove should be tangent to the arc.

The depth of a sheave groove should be at least 1.5 times the rope's diameter and the tapered side walls of the groove should not make an angle of more than 18 degrees from the centre line.

Table 21.3 Example of manufacturer's specifications matching wire rope diameter with sheave characteristics

Nominal Outside Diameter	Stock Number	Pattern Number	Wire Line Size	Bore Size	Hub Width	Groove Rim Width	Nominal Hub Outside Diameter	Nominal Tread Diameter	Material	Approximate Weight
3	905051	1161	3/16	3/8	25/32	3/4	1	2-3/8	P.M.	1.00
3	905079	1161	3/16	1/2	25/32	3/4	1	2-3/8	P.M.	1.00
3	905097	1161	3/16	5/8	25/32	3/4	1	2-3/8	P.M.	1.00
3	905024	1161	1/4	3/8	1/2	1/2	1	2-5/8	P.M.	.75
3	905042	1161	1/4	1/2	1/2	1/2	1	2-5/8	P.M.	.75
3	15410	1161	3/8	3/8	25/32	3/4	1	2-3/8	P.M.	1.00
3	905088	1161	3/8	1/2	25/32	3/4	1	2-3/8	P.M.	1.00
3	905104	1161	3/8	5/8	5/8	3/4	1	2-3/8	P.M.	.60

Subsection 302(4)

Figures 21.22, 21.23 and 21.24 show examples of end fittings.

Figure 21.22 Example of socketing operation

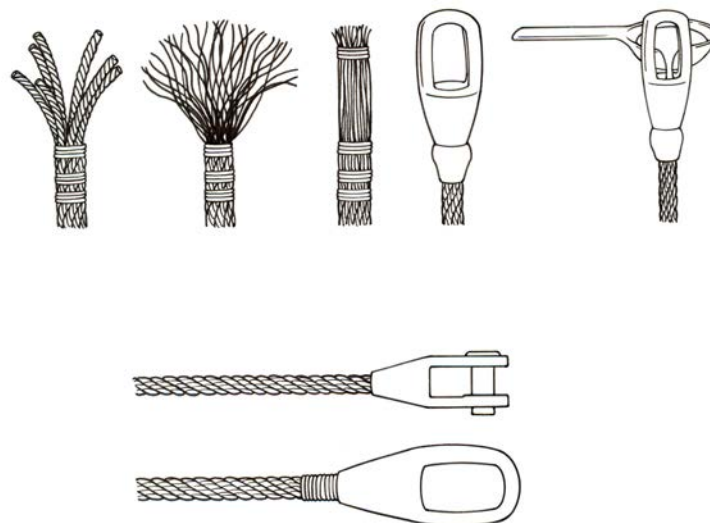


Figure 21.23 Example of swaged sockets

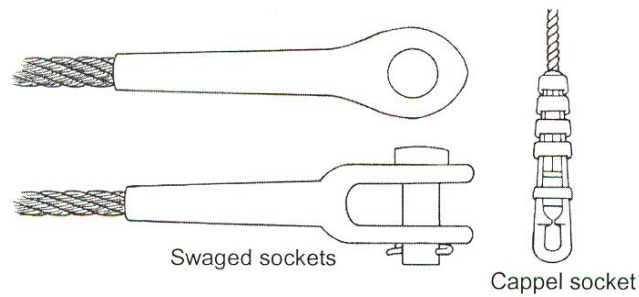
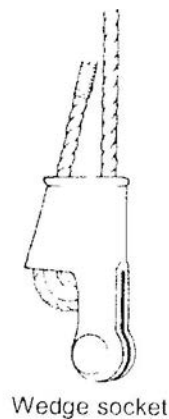


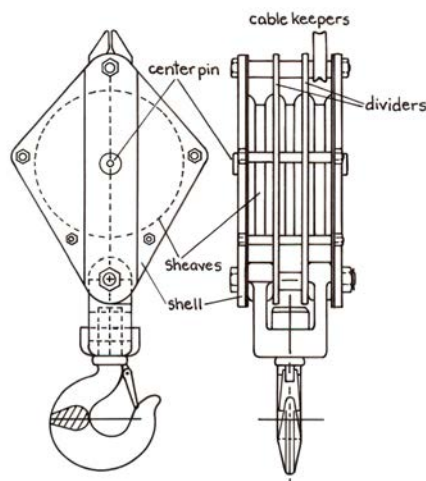
Figure 21.24 Example of wedge socket



Subsection 302(5)

Figure 21.25 shows a sheave with cable keepers, dividers and shell (guard) in place. Combined, the keepers, dividers and shell prevent wire rope from leaving the sheave groove and must not be removed except for maintenance, inspection or adjustment, and then immediately replaced.

Figure 21.25 Example of a sheave with dividers and shell in place



Section 303 Safety latches

Subsection 303(1)

If a hook is used in any circumstances during which dislodgement could injure workers, the hook must be replaced with

- (a) a hook with a safety latch (see Figure 21.26),
- (b) an anchor-type shackle with a bolt, nut, and retaining pin (see Figure 21.27), or
- (c) the hook must be “moused,” i.e., a method of covering the throat opening of a hook by wrapping it with soft wire, rope, heavy tape or similar materials.

Figure 21.26 Examples of hooks with safety latches

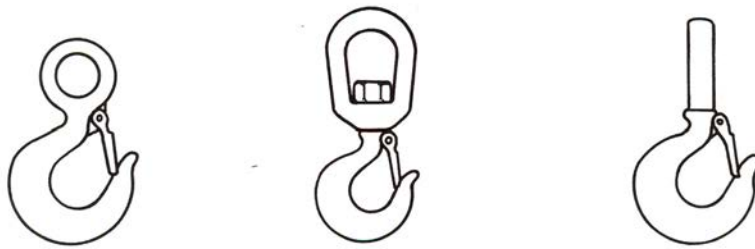
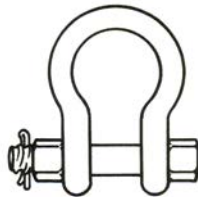


Figure 21.27 Example of an anchor-type shackle with a bolt, nut and retaining pin



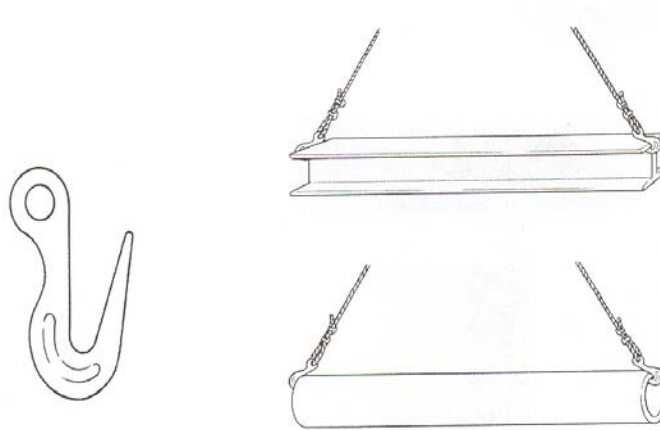
Subsection 303(2)

A safety latch is not required where a hook is used in an application where manipulation of the latch may pose a hazard to a worker. This might be the case, for example, where the load is awkwardly shaped and the only way a worker could release the safety latch is to climb onto the load.

Subsection 303(3)

A safety latch, mousing or shackle is not required if a sorting hook is used to lift components of a skeleton steel structure or during a similar operation (see Figure 21.28).

Figure 21.28 Example of sorting hooks and how it might be used



Subsection 303(4)

Figure 21.29 shows an example of a spring-loaded safety latch. Hoisting operations in a caisson must be foolproof—a load cannot be allowed to drop because of a safety latch that binds. A shackle assembly as described in this subsection must be used.

Figure 21.29 Example of spring-loaded safety latch



Examples of acceptable and unacceptable shackles are shown in Figures 21.30 and 21.31.

Figure 21.30 Example of an acceptable shackle

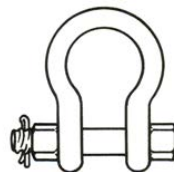
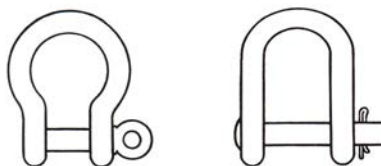


Figure 21.31 Examples of unacceptable shackles



Section 304 Makeshift rigging and welding

Subsection 304(a)

All rigging components that carry any portion of a load must be commercially manufactured. These components are engineered and typically certified to comply with various standards. Makeshift rigging components (see Figure 21.32) are not permitted.

Figure 21.32 Examples of makeshift rigging



Subsections 304(b) and 304(c)

Any rigging components that have been repaired by welding must be certified by a professional engineer as safe for use before the components are put back into service.

Annealing is the process by which metal is heated and then cooled, softening it and thus making it less brittle. Subjecting metal to non-uniform temperature change as in welding or annealing produces thermal stress in the metal. This stress can weaken the metal and lead to its premature failure.

Rejection Criteria

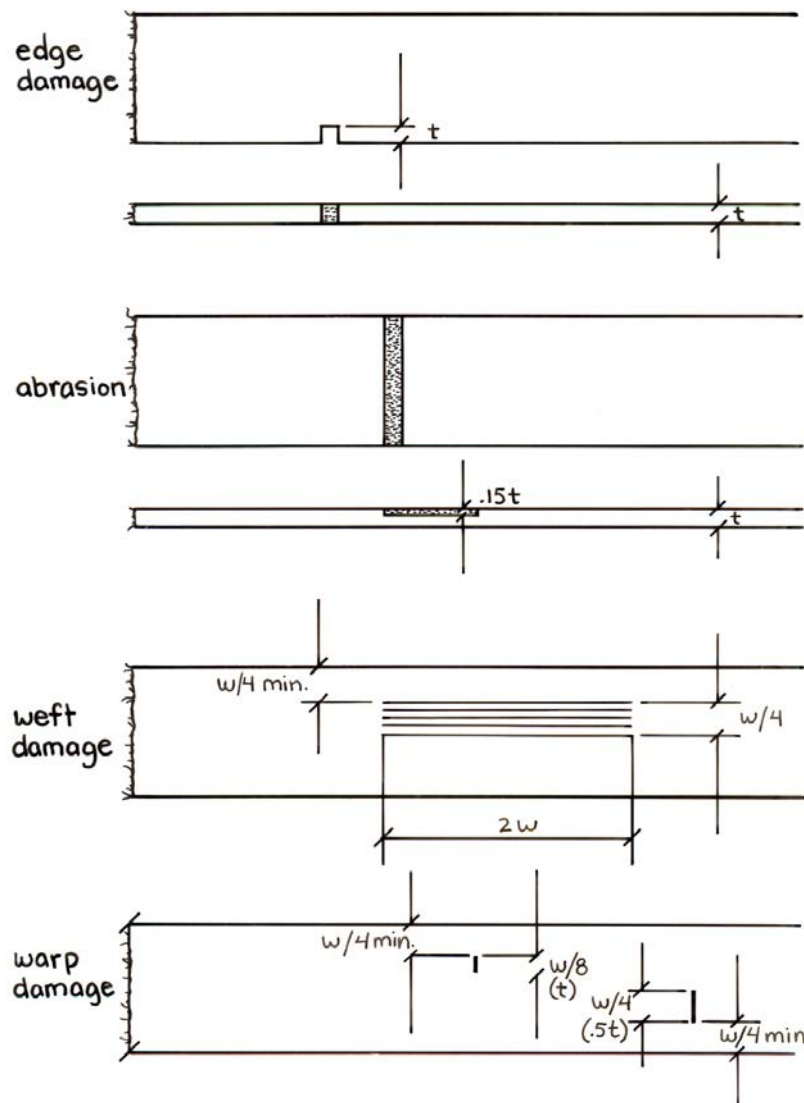
Section 305 Synthetic fibre slings

Synthetic fibre web slings are easily cut and have poor abrasion resistance when compared with chain and wire rope slings. It is important to use slings made of the right material for the job. Nylon slings are damaged by acids, but resist caustics. Polyester slings are damaged by caustics, but resist acids. Sunlight, moisture and temperatures above 90°C damage both nylon and polyester slings.

Subsection 305(1)

Figure 21.33 visually shows the rejection criteria stated in this subsection. Damaged slings must be permanently removed from service to prevent further use.

Figure 21.33 Examples of synthetic web sling rejection criteria



Subsection 305(2)

Acid and caustic heat burns, broken stitching in load-bearing splices, and damaged eyes and end fittings all affect the load-carrying capability of slings. Damaged slings must be permanently removed from service and physically altered to prevent further use.

Subsection 305(3)

If no single type of damage exceeds the specified limits, the employer must consider the sum of the individual effect of the various types of damage. If this is approximately equivalent to the effect from a single type of damage, the sling must be permanently removed from service and physically altered to prevent further use.

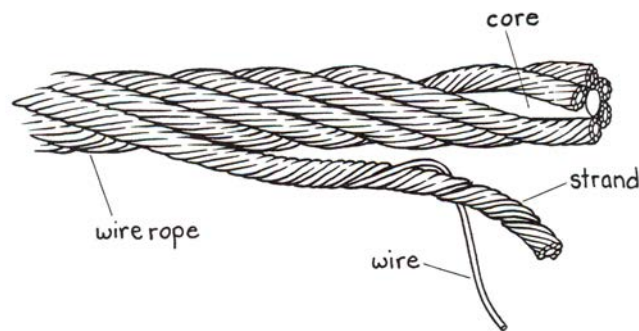
Subsection 305(4)

A synthetic fibre web sling that is permanently removed from service must be physically altered to prevent its further use. The simplest way to do this is to cut the sling into many small, unusable pieces. The pieces should be disposed of immediately.

Section 306 Wire rope

In applying the requirements of this section, it is helpful to understand how a wire rope is constructed. As shown in Figure 21.34, wire rope is made of three parts: wires, strands and core.

Figure 21.34 Example of wire rope



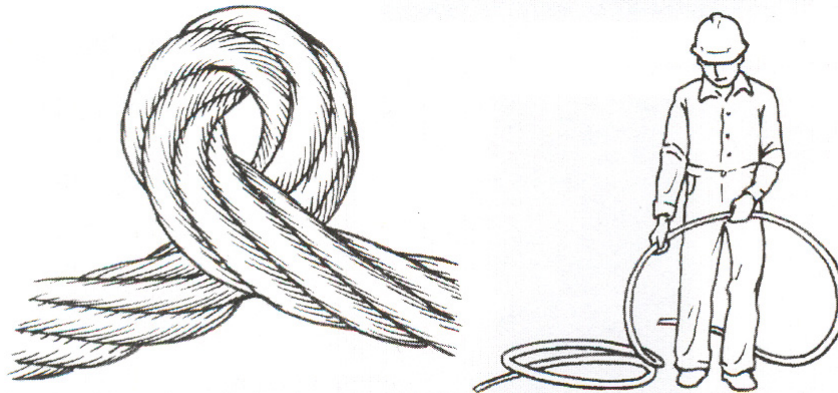
Rope lay describes the direction the strands rotate around the core:

- regular lay rope—the strands rotate in the direction opposite to which the wires rotate. This is to counteract the torque in the rope and prevent unwinding under load;
- lang lay (non-rotating)—the strands rotate in the same direction as the wires. These ropes are used in special applications where torque would cause the line to twist in one direction, e.g., single line lifts, but are approximately 20 percent weaker than regular lay ropes.

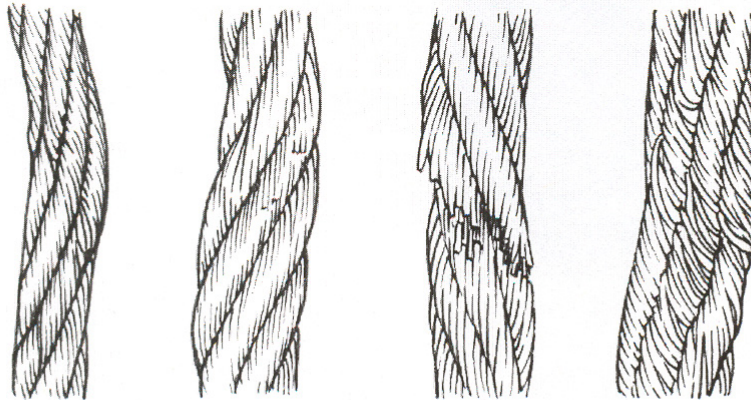
A “lay” is the distance it takes one strand to make a complete revolution around the rope.

Figures 21.35 through 21.39 show examples of various types of wire rope damage.

Figure 21.35 Examples of rope damage due to kinking

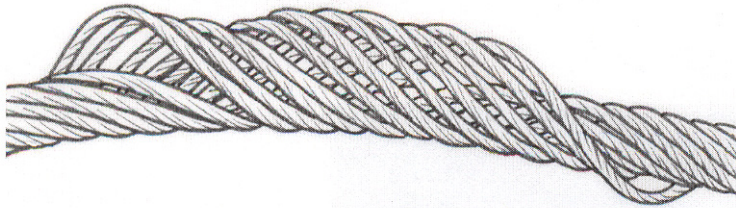


An open kink such as this is often caused by improper handling and uncoiling as shown

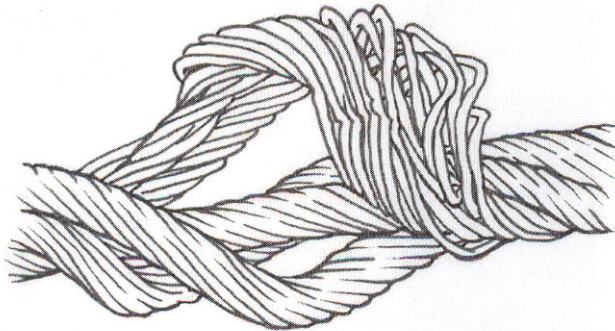


These ropes show the severe damage that results when kinked ropes are used.
Local wear, distortion, misplaced wires and early failure are inevitable.

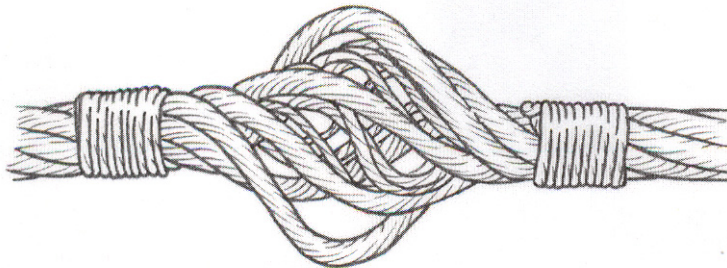
Figure 21.36 Examples of birdcaging



Multi-strand rope "bird cages" due to torsional unbalance. Typical of build up seen at anchorage end of multi-fall crane application.



A "bird cage" which has been forced through a tight sheave.



A "bird cage" caused by sudden release of tension and resultant rebound of rope from overloaded condition. These strands and wires will not return to their original positions.

Figure 21.37 Examples of wire rope damage

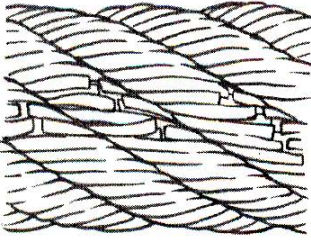
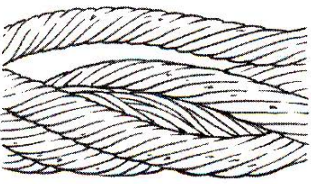

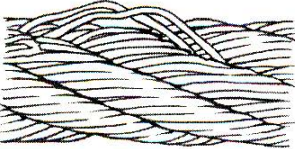



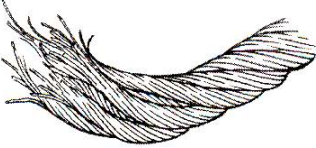
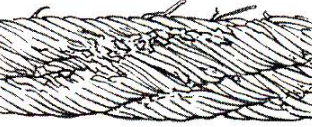
 <p>Narrow path of wear resulting in fatigue fractures, caused by working in a sheave groove that was too wide or over small support rollers.</p>	 <p>Break up of strands resulting from high stress application. Note nicking of wires in outer strands.</p>	 <p>Two parallel paths of broken wires indicative of bending through a sheave groove that was too narrow.</p>
 <p>Wire fractures at the strand, or core interface, as distinct from crown fractures, caused by failure of core support.</p>	 <p>An example of fatigue failure of a wire rope that has been subjected to heavy loads over small sheaves. The usual crown breaks are accompanied by breaks in the valleys of the strands, these breaks being caused by strand nicking resulting from the heavy loads.</p>	 <p>Wire rope that shows wear and fatigue from operating over small sheaves with heavy load and severe abrasion.</p>
 <p>A rope failing from fatigue after bending over small sheaves.</p>	 <p>A wire rope that has jumped a sheave. The rope itself is deformed into a "curl" as if bent around a round shaft. Close examination of the wires shows two types of breaks – normal tensile "cup and cone" breaks and shear breaks which give the appearance of having been cut on an angle with a cold chisel.</p>	 <p>Mechanical damage due to rope movement over sharp edge projection while under load.</p>

Figure 21.37 continued

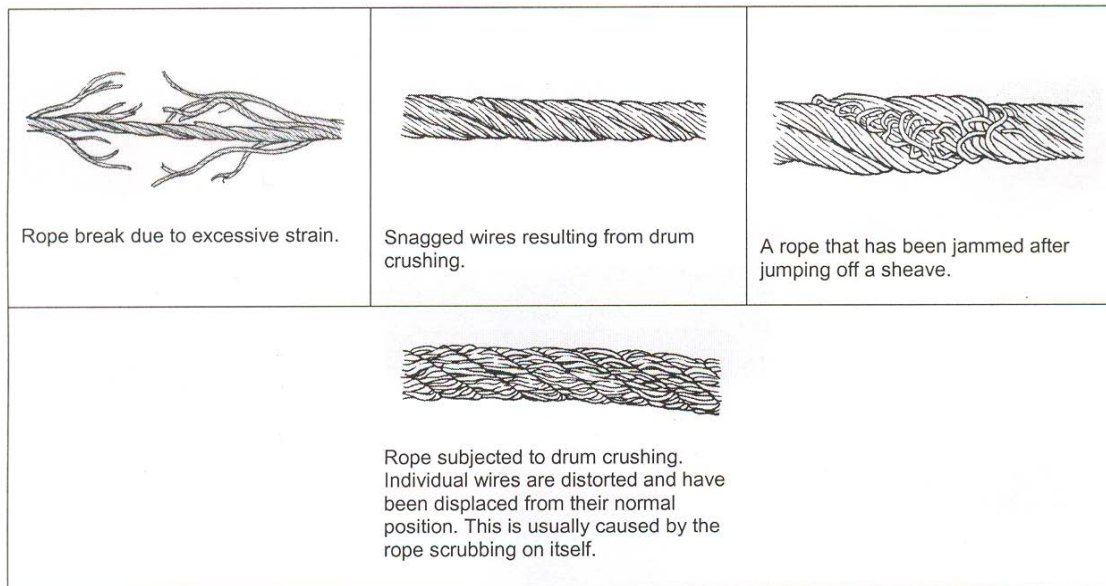


Figure 21.38 Reduction of normal rope diameter

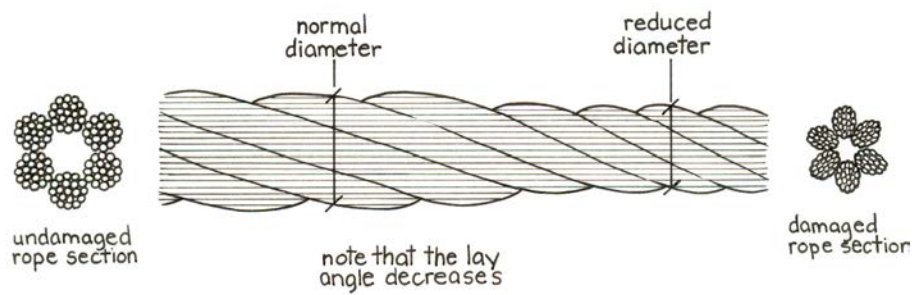
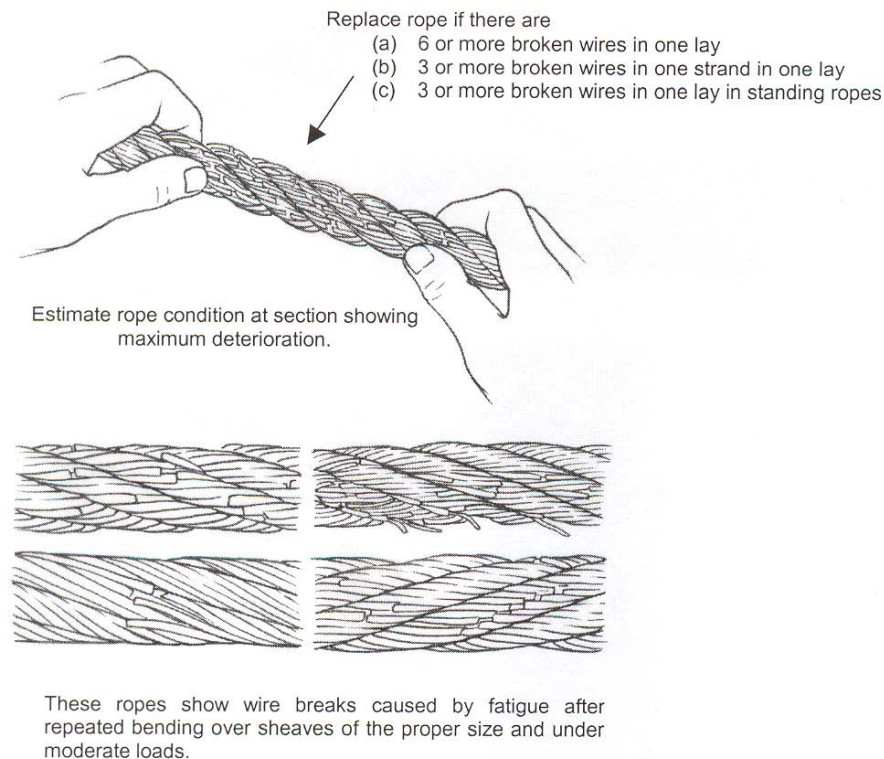


Figure 21.39 Examples of wire rope with broken wires



Section 307 Metal mesh slings

See Table 21.1 for inspection information. Only a metal mesh sling manufacturer is able to undertake repairs to a damaged sling. Repaired slings must be proof-tested to a minimum of 2 times their vertical hitch rated load.

Section 308 Electric arc damage

Electric arc contact can result in burn damage or removal and weakening of material. A rigging component that has been contacted by an electric arc must therefore be removed from service unless a professional engineer certifies that it is safe to use.

Section 309 Damaged hooks

Unless otherwise specified by the manufacturer, a worn or damaged hook must be permanently removed from service if

- (a) the throat opening, measured at the narrowest point, has increased by more than 15 percent of the original opening,
- (b) the hook has twisted more than 10 degrees from the original plane of the hook,
- (c) the hook has lost 10 percent or more of its cross-sectional area, or
- (d) the hook is cracked or otherwise defective.

Part 22 Safeguards

Highlights

- Section 310 states general conditions that apply to safeguards.
- Section 321 limits to no more than 6 millimetres the height of the gap between a walking or working surface and the bottom of the toe board.

Requirements

Section 310 Safeguards

Subsection 310(1)

Repealed

Subsection 310(2)

Employers provide safeguards that eliminate contact by workers with the categories of hazard listed in the section. Written as a performance standard, the section requires that some type of safeguard be provided but does not specify its design or how it should be implemented.

In meeting the requirement, employers must recognize the hazards to workers resulting from the design, location and nature of powered machinery or energy sources.

Employers must also understand how close workers get to the hazards and what they are doing while there.

Crushed hands and arms, severed fingers, irreversible eye injuries—these are injuries preventable through appropriate safeguarding of machines and equipment. Any machine part, function or process that may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or other workers in the vicinity, the hazards must be eliminated or controlled.

Where mechanical hazards occur

Dangerous moving parts in three basic areas require safeguarding:

- (1) *the point of operation*—that point where work such as cutting, shaping, boring, etc., is done on the material;
- (2) *power transmission apparatus*—all components of the mechanical system that transmit energy to the part of the machine performing the work. These components include flywheels, bullwheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks and gears; and

- (3) *other moving parts*—all parts of the machine that move while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

Hazardous mechanical motions and actions

A variety of mechanical motions and actions can present hazards to workers. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear. The basic types of hazardous mechanical motions and actions that must be recognized are:

Motions

- (a) *rotating, including in-running nip points*—even smooth, slowly rotating shafts can grip clothing, and through mere skin contact, force an arm or hand into a dangerous position. Injuries due to contact with rotating parts can be severe (see Figures 22.1 through Figure 22.4).

Figure 22.1 Examples of hazardous projections on rotating parts

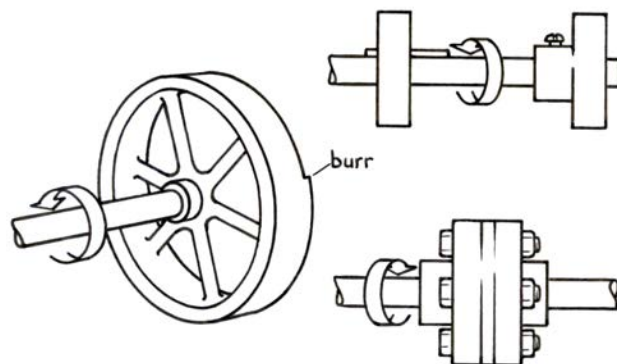


Figure 22.2 Common nip points on rotating machinery

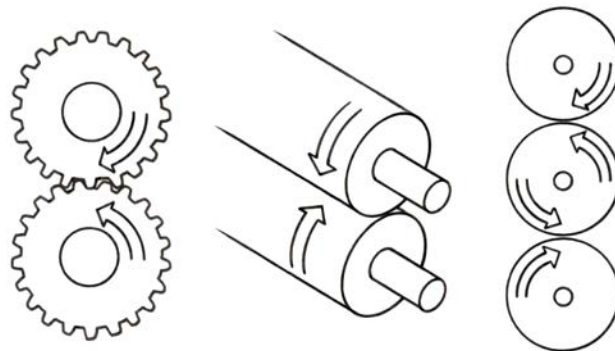


Figure 22.3 Nip points between rotating parts and parts with linear motion

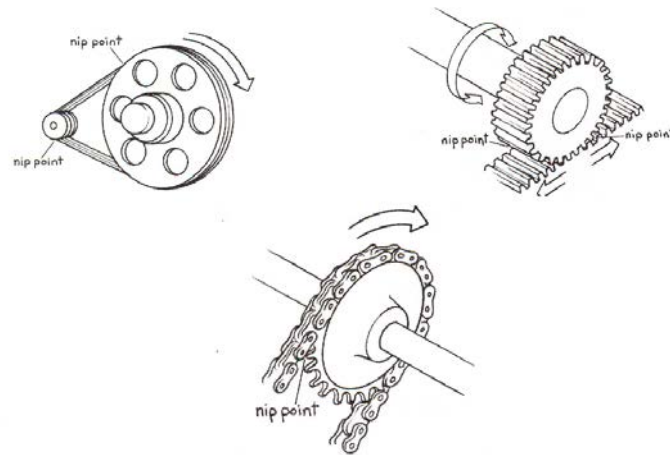
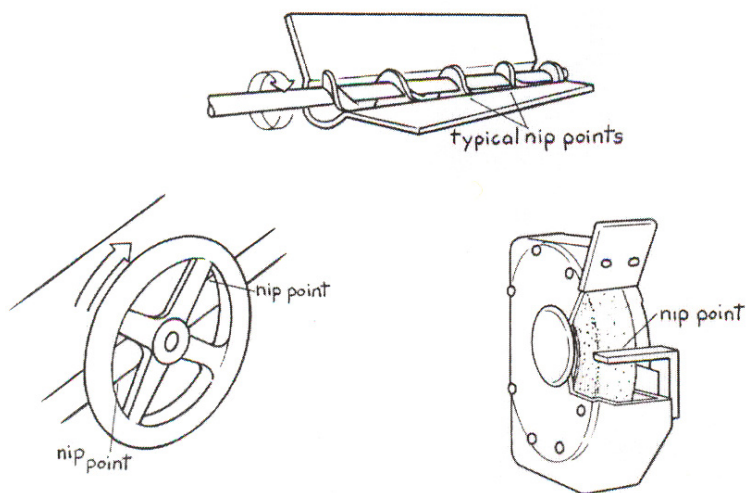
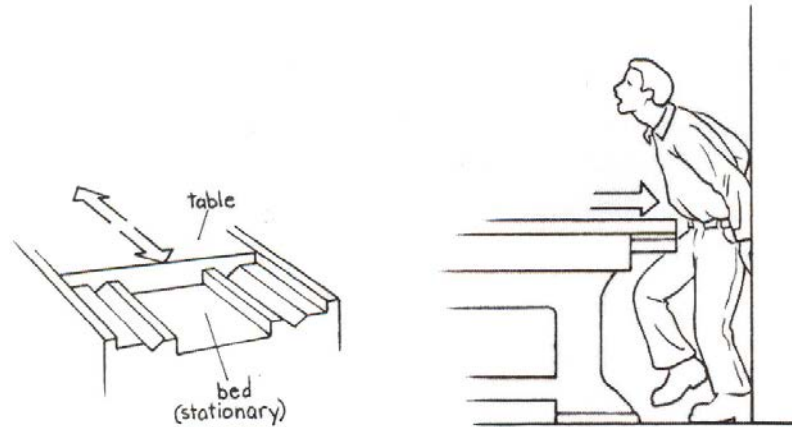


Figure 22.4 Nip points between rotating machine components



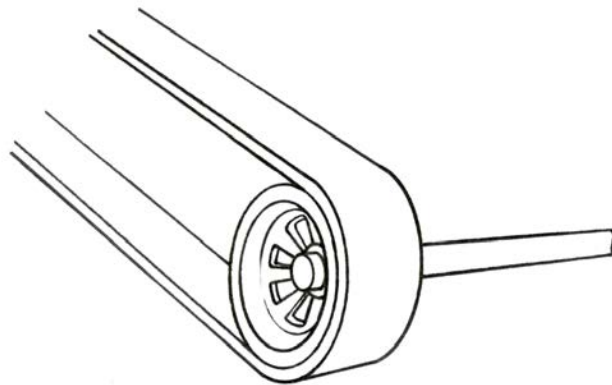
- (b) *reciprocating*—during back-and-forth or up-and-down motion, a worker may be struck or caught between moving and stationary parts (see Figure 22.5).

Figure 22.5 Hazardous reciprocating motion



- (c) *transverse*—movement in a straight, continuous line creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part (see Figure 22.6).

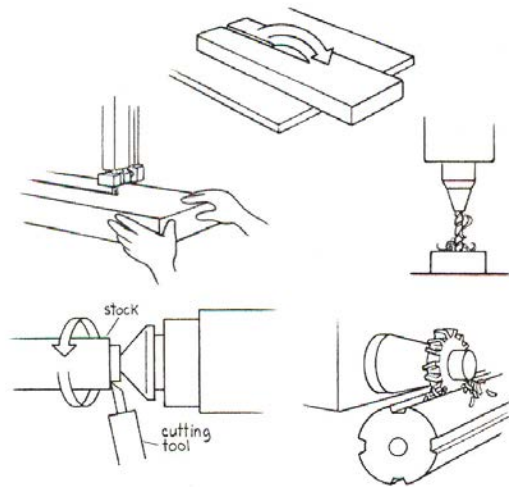
Figure 22.6 Example of transverse motion



Actions

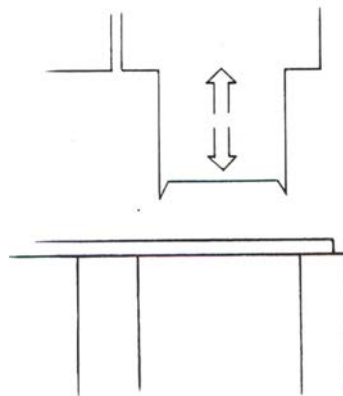
- (a) *cutting*—may involve rotating, reciprocating or transverse motion. The danger of this action is at the point of operation where finger, arm and body injuries can occur and where flying chips or scrap material can strike the head, particularly in the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials. Examples of machinery involving cutting hazards include bandsaws, circular saws, boring or drilling machines, lathes and milling machines (see Figure 22.7).

Figure 22.7 Examples of cutting hazards



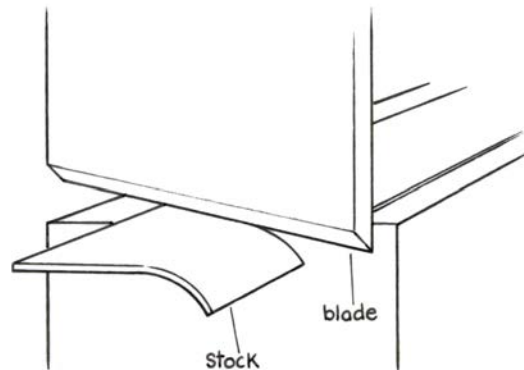
- (b) *punching*—occurs when power is applied to a ram for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where material is inserted, held, and withdrawn by hand, as may be the case with power or punch presses (see Figure 22.8).

Figure 22.8 Typical punching operation



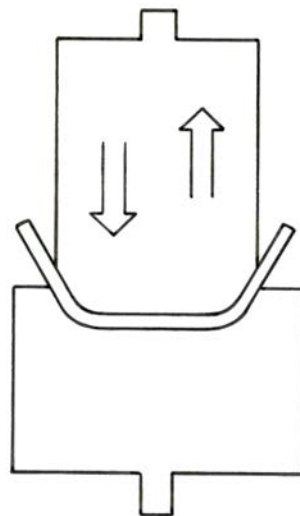
- (c) *shearing*—involves applying power to a ram or knife to trim or shear metal or other materials. A hazard is present at the point of operation where stock is inserted, held and withdrawn. Examples of machines used for shearing operations are mechanically, hydraulically or pneumatically powered shears (see Figure 22.9).

Figure 22.9 Example of shearing operation



- (d) *bending*—occurs when power is applied to a ram to draw or stamp metal or other materials. A hazard is present at the point of operation where material is inserted, held and withdrawn. Equipment that uses bending action includes power presses, press brakes and tubing benders (see Figure 22.10).

Figure 22.10 Example of bending operation



General requirements for all safeguards

All safeguards should do the following:

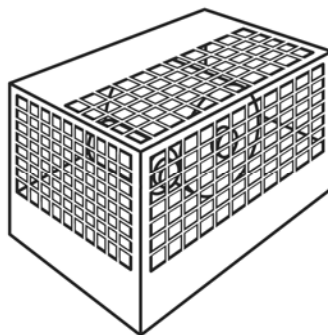
- (a) *prevent contact*—the safeguard must prevent the worker's hands, arms and any other part of the body from making contact with dangerous moving parts. A good safeguarding system eliminates the possibility of the operator or another worker placing parts of their bodies near hazardous moving parts;
- (b) *be secure*—workers should not be able to easily remove or tamper with the safeguard. Guards and safety devices must be able to withstand conditions of normal use;
- (c) *protect moving parts from the entry of falling objects*—the safeguard should ensure that objects such as tools and materials cannot fall into moving parts;
- (d) *create no new hazards*—a safeguard must not create a hazard of its own such as a shear point, a jagged edge, or an unfinished surface that can cause a cut. The edges of guards for example, should be rolled or bolted in such a way as to eliminate sharp edges;
- (e) *create no interference*—any safeguard that prevents workers from doing their work quickly and comfortably may soon be overridden, ignored or disabled; and
- (f) *permit safe lubrication*—if possible, workers should be able to lubricate the machine without having to remove safeguards. Locate oil reservoirs outside the guard, with a line leading to the lubrication point.

Methods of guarding equipment and machinery

The following are examples of six commonly used methods of guarding equipment and machinery:

- (1) Fixed or barrier guard that encloses hazardous parts
 - can be used in cases where access to the hazardous parts is not required;
 - the enclosure permanently guards the hazardous part(s).

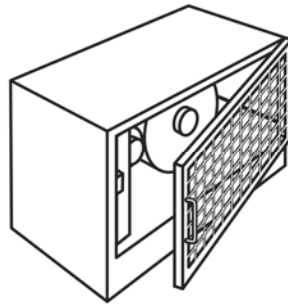
Figure 22.10.1 Fixed or barrier guard



(2) Moveable guard with interlock switch

- can be used where access to moving parts is required;
- the moveable guard is interlocked, often mechanically or electrically, to the machine's power source. When the guard door is opened, the machine loses power—hazardous parts stop moving or the entire machine stops.

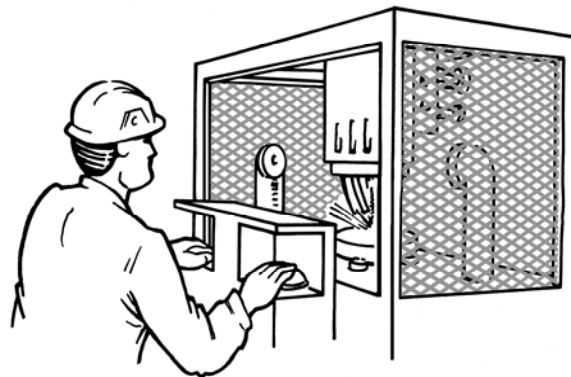
Figure 22.10.2 Moveable guard with interlock switch



(3) Two-hand control

- to prevent a hand from being caught in the machine, two start or process control buttons have to be operated at the same time to allow the machine to run;
- the operator's hands cannot be in the machine and at the control at the same time.

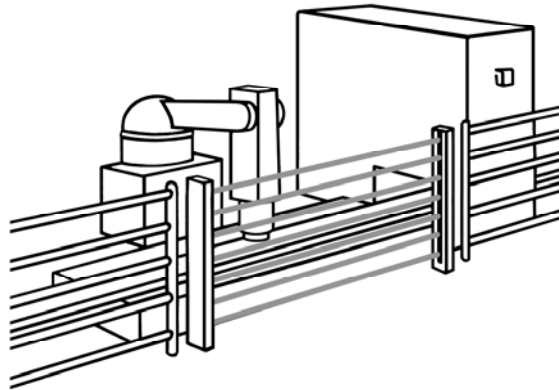
Figure 22.10.3 Two hand controls



(4) Infrared light curtains

- a “curtain” of harmless light beams run in front of the hazardous area;
- if a beam is blocked or interrupted, a control circuit senses this and shuts off power to the moving parts or the entire machine.

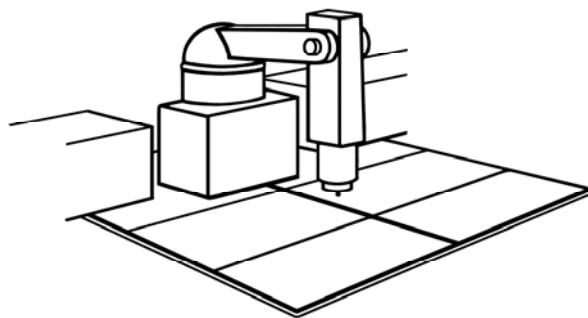
Figure 22.10.4 Infrared light curtains



(5) Pressure sensitive safety mats

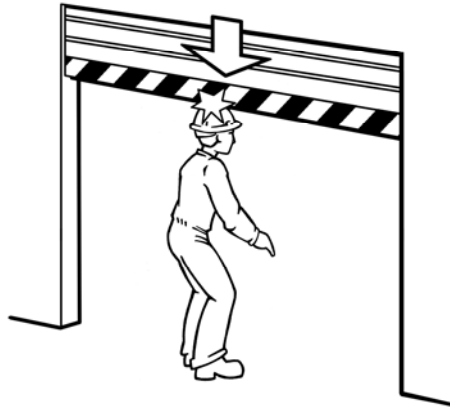
- these mats are used to guard a machine by controlling access to the machine while it is running;
- mats are placed around the hazardous area and are electrically connected to the machine's control circuits;
- an operator's footstep on a mat triggers a pressure-sensing circuit to cut power to the machine.

Figure 22.10.5 Pressure sensitive safety mats





(6) Pressure sensitive edges

- flexible edging strips, electrically connected to the guarded device's control circuits, can be added to a moving part such as a powered door or moving machine table;
- if the moving part hits the operator, or the operator hits the edge, the edging strip deforms and a stop signal is sent to the power source.



For more information

 *Best Practices on Conveyor Safety*
Government of Alberta

 *Concepts and Techniques of Machine Safeguarding*
U.S. Department of Labor, Occupational Safety and Health Administration

Subsection 310(2.1)

Repealed

Subsection 310(3)

This subsection permits the use of alternate measures where enclosing or barricading a hazard is inappropriate or undesirable. The measures listed are intended to interrupt the process when the worker approaches the hazard, or to restrain or prevent the worker from coming into contact with the hazards listed.

Subsections 310(4) and 310(5)

Situations arise in which equipment is used in a manner never envisioned at the time that it and its safeguards were originally designed. Situations also arise in which, because of the nature of the work, the work cannot be performed with the guard in place, e.g., performing particular types of cuts with a table saw, using an angle grinder in a very tight space.

Removing a guard in order to perform work is always the least desirable option. Consider the following angle grinder example. Its principle can be generalized to all situations in which an employer wishes to remove a guard.

Before removing the angle grinder's guard, the employer should first try

- (a) using a grinder with a smaller diameter grinding wheel—Are we using the correct size of tool?;
- (b) using a die or pencil grinder that fits into a tighter space—Are we using the correct tool for the task?; and
- (c) using some other type of work method—Can we alter the fabrication or finishing process so that we can still use the original tool or make its use unnecessary? Can we redesign the workpiece so that we can still use the original tool or make its use unnecessary?

If the employer determines that an effective safeguard cannot be provided, then the employer may use an alternative mechanism, system, or change in work procedure in place of the safeguard. If an employer uses this option, the alternative approach must offer workers a level of protection that is *equal to or greater than* the protection required by subsection 310(3). To use this option an employer must apply to Director of Inspection for an acceptance. An employer should be able to explain why an effective safeguard could not be provided and justify how the alternative approach provides an *"equal to or greater than"* level of worker protection. A Director reviews the application and if the alternate approach provides equal or better safety than legislated requirement, an acceptance is issued.

Alternative approaches to having a safeguard in place may involve combinations of the following:

- ensuring that a machine's dangerous moving parts are out of the reach of workers, i.e., safe by location or distance. For example, the machine can be located on the other side of a wall, or dangerous parts can be located high enough to be out of the normal reach of a worker. The main disadvantage of this approach is that if the equipment jams or becomes blocked, an operator might try to correct the problem with the machine turned on—and no safeguards in place. A worker can relatively easily gain access to the machine by using a ladder or stand on an object at hand to gain access to elevated dangerous parts. Safe by location or distance is an approach that is only suitable when policies and procedures are in place that ensure that the safety provided by this method is not compromised.
- marking danger zones that need to be kept clear of and ensuring that the zones are respected.
- restricting the number of machines that use an alternate guarding arrangement.
- "inching" or "inch-safe-service" procedures. These procedures involve limited motion of machinery where dangerous parts are exposed during cleaning, setting, adjustment or feeding material. The terms "jog," "crawl" and "pulse" may also be used depending on the machine and industry. Machinery operated in this way

normally has a “safe” or “hold-to-run” control, with the machine running at the slowest practical operating speed for the purposes of cleaning, loading and setting up. The inching control should be of a hold-to-run type so that on release of hand pressure the machine’s dangerous motion stops immediately.

- using procedures that are confirmed as offering an appropriate level of worker protection.

Subsection 310(6)

The employer is required to place signs in a clearly visible location(s) warning workers of automatically or remotely starting machinery. The signs may bear a message such as “WARNING—This Equipment May Start Without Warning.”

Section 311 Tampering with safeguards

This section places responsibilities on a worker who removes a safeguard or makes it ineffective. Safeguards can only be removed or made ineffective under the circumstances listed, and must be immediately replaced or reactivated once the purpose of the interruption is completed. After replacement, the safeguard must be tested to confirm that it is still effective.

A worker may need to remove or make a safeguard ineffective on equipment that is not under the worker’s direct control. When this is the case, the worker must control hazardous energy, e.g., lockout, as required by Part 15. This ensures that the equipment cannot be activated through the actions of another worker.

Section 312 No safeguards

Circumstances may arise during which machinery cannot accommodate or operate with its safeguards in place. Such machinery would, under normal circumstances, require the use of limited or no personal protective equipment. If the safeguards must be removed, then their absence must be compensated for by the use of personal protective equipment.

In such cases, the personal protective equipment used must offer protection that is *equal or greater* than that provided by the original safeguard. For example, if a guard must be removed to allow a dimensionally larger piece of material to be fed through the equipment, the personal protective equipment used must offer protection against whatever hazards are now exposed by removal of the safeguard. The hazards might require eye protection, hearing protection, limb and body protection, hand protection against cuts and abrasions, etc.

This personal protective equipment alternative is unacceptable if it is used to bypass the employer’s responsibility to provide safeguards as required by the *OHS Code*. The use of

personal protective equipment should always be thought of as the “last resort.” Personal protective equipment should *not* be used as a substitute for engineering controls such as safeguards.

Section 313 Building shafts

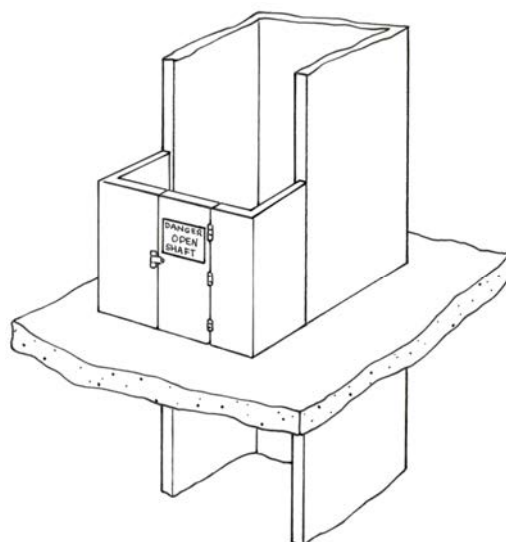
This section is intended to prevent or limit worker and equipment falls into, or in the vicinity of, openings to a building shaft. The work in building shafts referred to in this section usually involves the forming and stripping of forms during the construction of the shaft. However, the requirements apply to other types of work done in building shafts.

The platform from which work is being performed must be covered to prevent any worker, and all larger tools and equipment, from falling to a lower level. The decking itself can be solid material such as plywood, sectional material such as planking, or see-through material such as catwalk grating. Regardless of the material selected, the working platform must be strong enough to withstand the maximum load expected at any given time due to workers, tools and materials.

Because of the potential for any system to fail, and the potential for a significant fall distance, a second platform must be provided below the first. Located not more than 4 metres below the first or working platform, this second platform is intended to limit the fall of any worker, tools or materials. As a result, this second platform must be as strong as or stronger than the working platform.

Where there is no work platform at a doorway or opening to a building shaft, workers must be protected from falling into the shaft. The doorway or opening must be enclosed and signed as shown in Figure 22.11.

Figure 22.11 Enclosure of open building shaft



Section 314 Covering openings

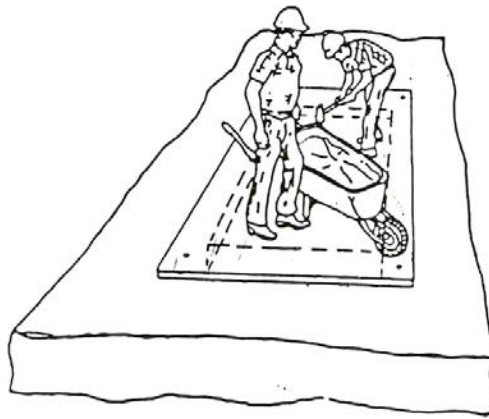
This section protects workers against the hazard of falling into openings and holes. The section does not specify a minimum or maximum dimension on the opening or hole—if a worker's foot could fall through, then the opening or hole is large enough to present a hazard requiring protection.

Also, this section does not specify a minimum height of fall. If a worker can get injured in the fall, regardless of the height, the provisions of this section apply.

The employer has two options:

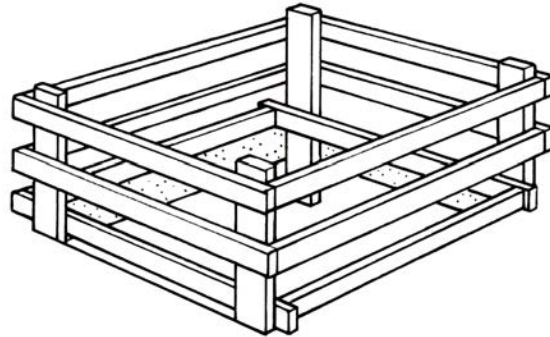
- (1) cover the opening or hole (see Figure 22.12):
 - (a) the cover must be securely attached over the opening or hole; and
 - (b) the cover must be designed to support any anticipated load—this includes workers, tools and materials; or

Figure 22.12 Securely attached covering



- (2) install a guardrail and toe boards (see Figure 22.13):
 - (a) the guardrail must comply with section 313; and
 - (b) the toe boards must comply with section 321.

Figure 22.13 Guardrails and toe boards



The removal of a covering, guardrail, toe board, or any part of one of these safeguards can expose workers to a hazard. The employer is responsible for ensuring that when such a safeguard is removed, an effective alternate means of protection is provided immediately. The removal of guardrails from around an opening may, for example, require the placement of barriers and flagging around the perimeter of the opening (but at a further distance) to prevent workers from getting near the opening.

As required by subsection 311(3), the worker who removes a safeguard or makes it ineffective also has responsibilities. The worker must ensure that alternate measures are in place to protect workers and the original safeguard(s) is replaced immediately upon the work being completed. The worker is responsible for making sure the safeguard functions properly once it is replaced.

As shown in Figure 22.14, where a temporary covering is used, a warning sign or markings clearly indicating the nature of the hazard must be provided. Workers could remove an unmarked cover, thinking it to be a piece of material left lying on a secure floor surface. Workers removing such a covering could be at risk of falling into the opening. A temporary covering must not be removed unless an effective means of protection is immediately provided.

Figure 22.14 Example of a warning sign for a temporary covering



Section 315 Guardrails

Figures 22.15 and 22.16 show guardrails that meet the requirements of this section. Wire rope or other similar material can be used for the horizontal top or intermediate member as long as it

- (a) has a nominal diameter or thickness of at least 6 millimetres (1/4 inch) to prevent cuts and lacerations; and
- (b) is under tension to minimize sag—unloaded sag should be no more than approximately the span length between tensioning devices divided by 60, and the lowest portion of the wire rope must not be less than the required minimum heights above the working or walking surface.

If wire rope or a similar material is used as the horizontal top member, it must be flagged at intervals of at least 1.8 metres (6 feet) with highly visible material so that the wire rope or similar material can be seen.

Figure 22.15 Guardrail specifications

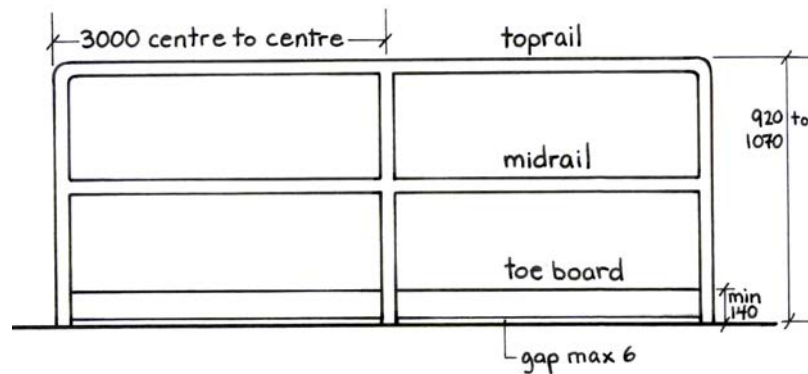
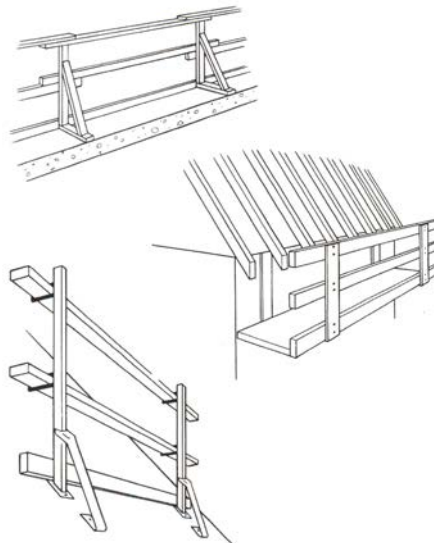
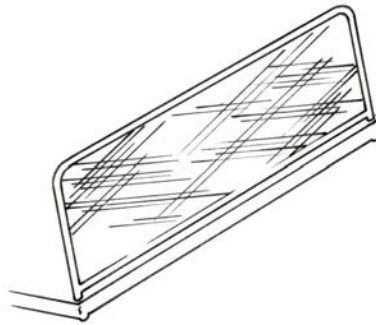


Figure 22.16 Examples of acceptable guardrails



With temporary guardrails, the intermediate horizontal member can be replaced with a substantial barrier such as a wire mesh or solid panel (see Figure 22.17). The alternative must be a substantial barrier that, when positioned and secured between the top member, toe board, and vertical members, will prevent a worker from falling through the space.

Figure 22.17 Wire mesh used as midrail



An often asked question is “How strong should a guardrail be?” As a general guide, a guardrail should be capable of withstanding a force of at least 890 newtons (200 pounds-force) applied within 5 centimetres (2 inches) of the top edge in any outward or downward direction. The guardrail can bend but must not break or separate (dislodge) from the structure to which it is attached.

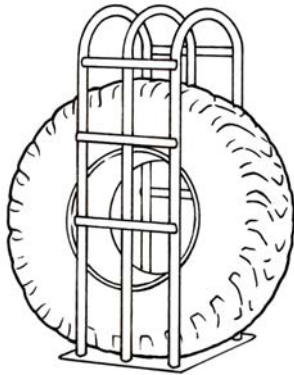
Section 316 Hoppers, bins and chutes

This section is intended to protect workers from falling into hoppers, bins or chutes used for dumping or directing the flow of materials. Alternate means that may provide equally effective protection include guardrails that enclose all open sides or safely capping or blocking off openings that will no longer be used.

Section 317 Machine failure

Where an employer has identified a hazard of machine failure that could result in the machine breaking apart and throwing out debris that might injure a worker, some form of adequate restraining or containing safeguard is required. For example, Figure 22.18 shows a cage used to restrain split rim wheel assemblies while being serviced.

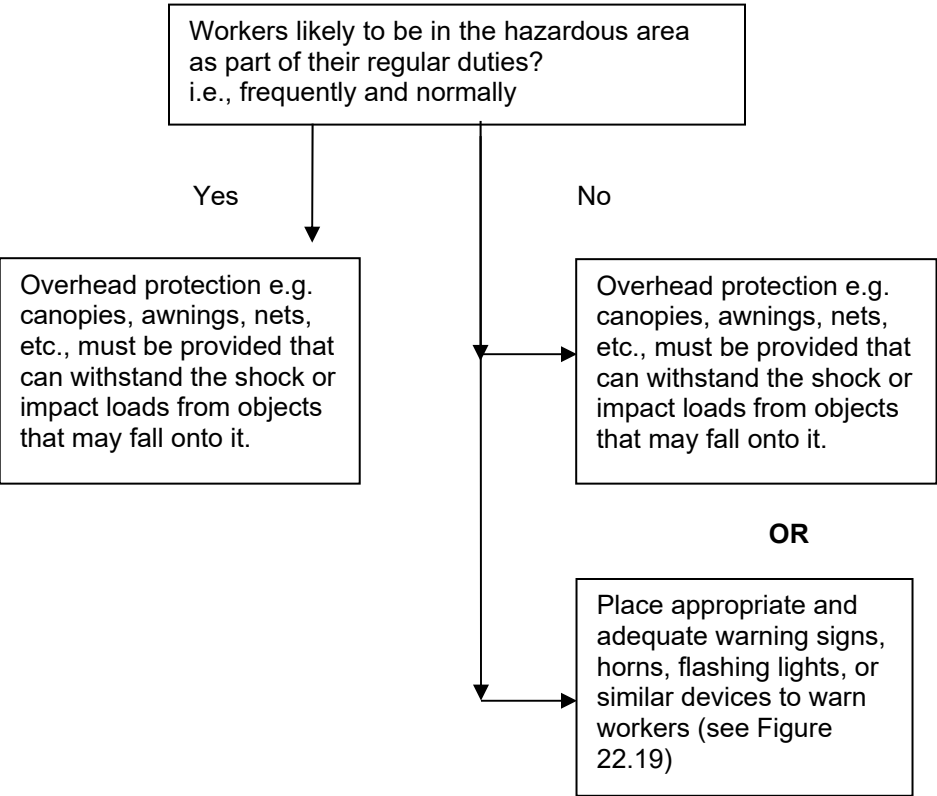
Figure 22.18 Cage to restrain split rim wheel assemblies



Section 318 Protection from falling objects

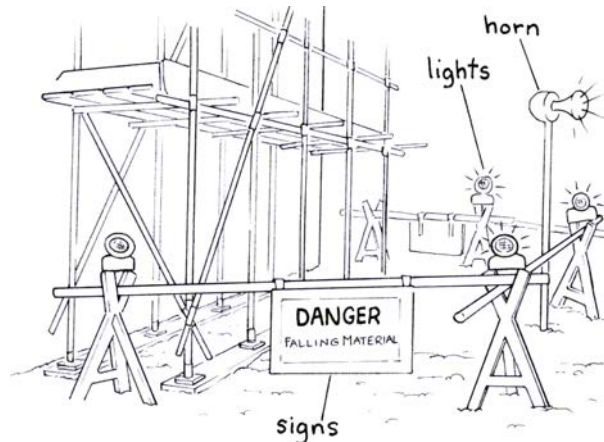
This section permits an employer to use an alternate type of falling object overhead protection based on the extent to which workers are in the hazardous area. Table 22.1 shows the options available to an employer.

Table 22.1 Options for falling object protection



When used as protection from falling objects, structures such as canopies must be strong enough to prevent collapse and to prevent penetration by any objects that may fall onto them.

Figure 22.19 Alternate approaches to providing overhead protection



Section 319 Push stick or block

This section is intended to protect workers from hazards inherent in the operation of equipment such as powered carpentry, wood milling or metal milling machinery. Push sticks and push blocks control the work piece, significantly reducing the possibility of the worker's hands contacting the cutting devices.

The push stick shown in Figure 22.20 should be used on small work pieces and when the distance between the blade and fence is narrow. A push block as shown in Figure 22.21 should be used on a jointer or planer to keep the operator's thumbs and fingers away from the cutting head.

Figure 22.20 Example of push stick

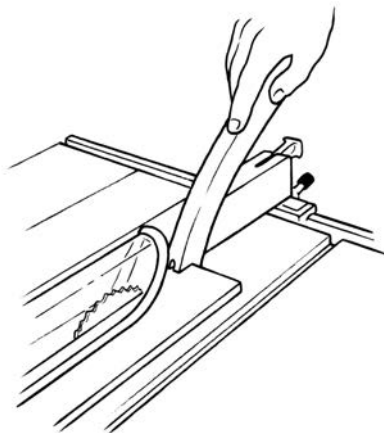
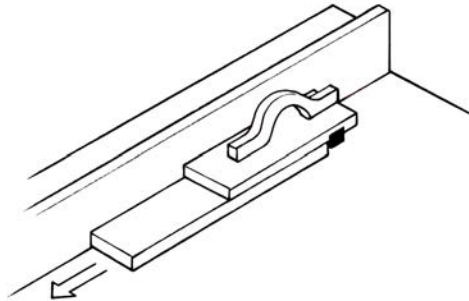


Figure 22.21 Example of push block



Section 320 Safety nets

The term “safety net” includes both personnel and debris nets. Personnel nets are designed to safely catch workers who fall from a height; debris nets are designed to catch small, lightweight debris, tools, building materials, and other materials that might be dropped, pushed, knocked off or blown from a structure.

Personnel nets are made of a variety of natural and synthetic materials. Ropes or strips are used to produce webbing that is strong enough to withstand the force of a person falling, and a mesh size small enough to minimize personal injury.

The mesh size of debris nets depends on the application. These nets are available in many sizes and strengths depending on the size and weight of the debris to be contained. Safety nets for debris can provide overhead protection in cases where workers are required to work beneath an area exposed to falling debris. In general, safety nets tend to be most commonly used by the construction industry.

ANSI Standard A10.11-1989 (R1998), *Construction and Demolition Operations—Personnel and Debris Nets*, establishes safety requirements for the selection, installation, and use of personnel and debris nets during construction, repair, and demolition operations. The standard allows nets to be made of natural, e.g., manila, sisal, hemp, etc., or synthetic fibres. Procedures to be used by manufacturers during the testing of their products for compliance with the standard are also described.

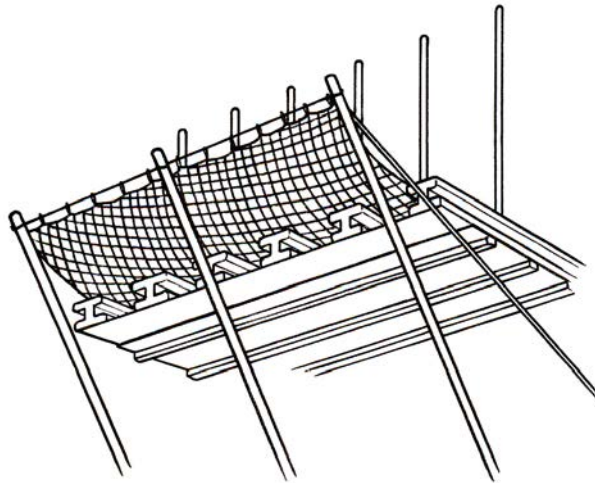
To meet the requirements of the Standard, personnel nets must be permanently labelled with the following information:

- (a) name of manufacturer;
- (b) identification of net material;
- (c) date of manufacture;
- (d) date of prototype test;
- (e) name of testing agency; and
- (f) serial number.

The Standard does not require debris nets to be labelled.

The ultimate strength of safety hooks and shackles is specified in subsection (2) to ensure that hooks and shackles are sufficiently strong. Connections or joints between safety net panels must be as strong as the net panels themselves. Safety nets should be installed as close as practicable under the walking or working surface on which workers are walking or working, and never more than 6 metres below that surface. Safety nets must be installed with sufficient clearance underneath to prevent contact with the surface or structure below (see Figure 22.22).

Figure 22.22 Example of safety net in use



Out of necessity, safety nets are often secured to some type of supporting structure. As a result, a professional engineer must certify any structure to which a personnel safety net is attached. The certification must indicate that the structure is capable of withstanding any load the net is likely to impose on it, e.g., depending on the circumstances of the work site, one or more tool-laden workers falling the maximum distance of 6 metres.

Section 321 Toe boards

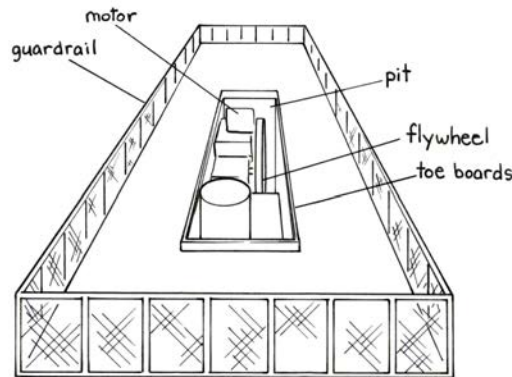
Toe boards are intended to prevent tools and materials from being dislodged from the edge of an elevated platform and falling on persons below. The maximum 6 millimetre gap allowed between the walking or working surface and the bottom of the toe board is new to the requirement for toe boards.

Without a maximum gap height, toe boards could be installed that would fail to prevent tools and materials from falling from elevated platforms. This new 6 millimetre requirement does not apply retroactively to toe boards already in place.

Toe boards must be installed around pits in which rotating machinery operates and in which workers may be working. The toe boards prevent objects from falling into

rotating machinery and becoming projectiles capable of injuring workers (see Figure 22.23).

Figure 22.23 Toe boards at perimeter of machinery pit



Section 322 Wire mesh

Wire mesh can be used to create protective enclosures. Such enclosures may for example, restrain materials, prevent worker limbs from extending beyond work platforms or into moving machinery, or prevent loose materials from falling into underground shaft openings.

The thickness of the wire determines its strength and although the term “diameter” is used, a wire that is not round may be used but must be at least 1.63 millimetres (1/16 inch) thick across its thinnest dimension. The spaces of the wire mesh must be sufficiently small to prevent a 40 millimetre (1 9/16 inches) diameter object from passing through the openings with minimal effort.

Part 23 Scaffolds and Temporary Work Platforms

Highlights

- Section 326 requires employers to visually inspect and tag all site-built scaffolds before initial use and at least every 21 calendar days while in use. Scaffold tag colours are green for “Safe for Use,” yellow for “Caution: Potential or Unusual Hazard,” and red for “Unsafe for Use.”
- Section 347 lists numerous standards applicable to elevating platforms and aerial devices. Elevating platforms and aerial devices must comply with the Canadian Standards Association (CSA) or American National Standards Institute (ANSI) standards referenced in this section.
- Section 349 presents requirements for fork-mounted work platforms intended to support a worker. The section also prohibits workers from being on these platforms while the powered mobile equipment the platform is attached to is moving along the ground.
- Section 351 requires a professional engineer to certify a boatswain’s chair if it is not commercially manufactured.

Requirements

Section 323 CSA Standard applies

CSA Standard CAN/CSA-S269.2-M87 (R2003), *Access Scaffolding for Construction Purposes*, provides rules and requirements for the design, fabrication, erection, inspection, testing, maintenance and use of scaffolding equipment, materials and equipment where scaffolds are erected to provide working platforms for workers and materials during the construction, alteration, repair or demolition of buildings and other structures. The Standard does not apply to:

- (a) suspended scaffolds or swing stages,
- (b) truck or vehicle mounted platforms;
- (c) falsework;
- (d) shoring; or
- (e) self-elevating work platforms.

The following is a *selection* of requirements within the Standard. Users of the *OHS Code* must comply with these requirements and all others in the Standard.

Used Lumber

Where lumber has been mechanically damaged (including repeated nailing of the same piece of lumber to the point that its mechanical integrity is questionable) or has deteriorated due to insects, decay, or chemical attack, the lumber must not be used unless a qualified lumber grader regrades it (Clause 4.3).

Loads on Guardrails, Midrails and Stair Handrails

Rails must be capable of resisting, without failure, a single point load of not less than 900 newtons (202 pounds-force) applied in any direction on any span (Clause 5.5.1).

Posts must be capable of supporting, without failure, a single point load of not less than 900 newtons (202 pounds-force) applied in any direction at the level of the top rail (Clause 5.5.2).

General Stability of Scaffolding

The ratio of maximum height to minimum horizontal width of an access scaffold must not exceed 3:1, unless lateral support is provided as required below (Clause 6.6.2).

External Lateral Supports

External lateral supports must be installed at vertical intervals, not exceeding 3 times the minimum width of the structure, and at every third bay of scaffolding longitudinally (Clause 6.6.3).

External lateral supports must consist of:

- (a) a rigid connection to another structure or building; or
- (b) guy wires or other supplementary devices securely fastened to adequate anchors.

External lateral supports must be installed at vertical intervals not exceeding every third tier and every third bay of scaffolding longitudinally, or 6.4 metres (21 feet), whichever is less (Clause 6.6.3.1).

Sills

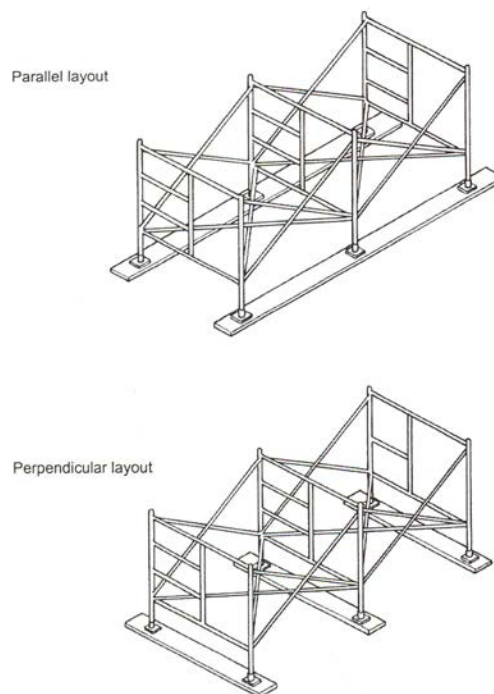
A sill is a wood, concrete or metal footing used to distribute the load from a standard or vertical post or base plate to the ground. Sills must be sound, rigid and capable of adequately supporting the maximum load to which the scaffold is likely to be subjected. Any settling or deformation of the sill should not affect the stability of the scaffold (Clause 6.6.8.2).

To ensure proper distribution, sills must be continuous at least under two consecutive vertical legs or vertical supporting members as shown in Figure 23.1 (Clause 6.6.8.3). This CSA requirement is considered to apply to scaffolds that use

rigid scaffold frames. Although Figure 23.1 shows sills made of wood, sills can also be made of materials such as concrete, e.g., base plates may rest on a concrete slab that serves as a sill, and metal. Regardless of their material of construction, sills must be sound, rigid, and capable of adequately supporting the load to which the scaffold is likely to be subjected.

Continuous sills may not be practical, safe, or appropriate in situations where the terrain is uneven and cannot be leveled. A tube and clamp or similar type of scaffold that allows the use of variable lengths legs may be required to compensate for elevation variations in the surface on which the scaffold rests. In such cases the use of a continuous sill is likely impossible.

Figure 23.1 Mudsill layout



Areas Requiring Special Attention in Foundation Design

Special consideration needs to be given to the following conditions:

- (a) In the absence of soil tests and a detailed design, topsoil or other unsuitable material must be excavated to obtain an adequate bearing capacity of not less than 75 kilonewtons per square metre (1566 pounds/square foot). Topsoil or other unsuitable material must be excavated if necessary to obtain adequate bearing capacity.
- (b) When frozen ground is used as a foundation for all or part of the sills, thawing must be prevented.
- (c) Sills in areas where variable degrees of foundation compaction and bearing capacity exists, as in previously excavated ground, trenches, and backfilled areas, must be

designed to span soft areas, or other appropriate measures must be taken to limit differential settlement to acceptable levels.

- (d) Sills in areas subject to erosion, such as the edges of slopes and terraces, must be protected.
- (e) Reduction of bearing capacity of the foundation due to changes in ground water elevation during construction or due to groundwater flows must be prevented.
- (f) Sills resting on thin concrete slabs, pan or waffle slabs, and slabs containing voids must be designed and located so as to safely distribute the concentrated loads.
- (g) Where the required foundation bearing capacity cannot be safely developed by other means, access scaffolding must be supported on piles providing the required load capacity.

(Clause 6.6.8.6)

Leg Adjustments

Adjustment devices must be provided at the base of all uprights of frames where foundation settlement is uncertain or the support surface is uneven, sloping or stepped. Travel of adjustment devices must be mechanically limited to the maximum travel specified in the manufacturer's specifications. If extension of the device reduces allowable load, such information must also be specified in the manufacturer's specifications and established by test (Clause 6.7.7).

Supervision and Erection Procedures

Only competent persons experienced in the erection of access scaffolding are allowed to supervise assembly of the scaffold. This ensures that the erection is carried out according to acceptable practices, such that

- (a) the requirements of the drawings or suppliers' literature are strictly complied with,
- (b) no unusual settlement of foundations or strains in other external supports occur, and
- (c) the correct components and materials are being used.

(Clause 7.2.1.1)

Sills and Foundations

When foundations for access scaffolding are located in areas where the soil bearing capacity is, or is likely to become, inadequate to support the loads without detrimental settlement,

- (a) the soil beneath sills must be stabilized with cement to an adequate depth;
- (b) soil beneath sills must be removed and replaced with concrete having a low cement content;
- (c) sills must be founded on a layer of compacted gravel 150 to 300 millimetres thick; or
- (d) piles must be driven into the soil beneath the scaffolding supports to provide adequate load-carrying capacity.

(Clause 7.2.4.2)

Section 324 Design

Subsections 324(1)(a) and 324(1)(b)

Tie-ins anchor a scaffold to the structure it serves, preventing the scaffold from falling into or away from the structure. Tie-ins also improve a scaffold's lateral stability by bracing the structure. Figure 23.2 shows several of the many types of tie-ins that can be used. A reveal tie is considered to be a non-positive tie-in as it depends on friction for its holding power. A box tie is a positive tie-in because it encircles an immovable portion of the structure. Anchor bolt ties are yet another alternative.

A particular scaffold or load may require additional tie-ins. The 4.6-metre vertical and 6.4-metre horizontal intervals stated in the subsection are the minimum distances at which tie-ins must be placed. Tie-ins must never be placed at intervals greater than these minimum distances.

In some situations, there may be an advantage to using tie-ins in combination with outriggers (the use of outriggers with free-standing scaffolds is discussed in section 334). When used in combination, outriggers can stabilize the scaffold up to a maximum height equal to 3 times the scaffold's smallest base dimension. Beyond that height, tie-ins must be used as described in this section.

Subsection 324(1)(c)

Hoarding refers to tarps or other materials used to cover a scaffold. When hoarding is used, the stress on the ties stabilizing the scaffold increases due to wind loading. As a result, the number of tie-ins used must also increase. Rather than the 4.6 metre vertical and 6.4 metre horizontal intervals required for scaffolds that are not hoarded, hoarded scaffolds require tie-ins at 3 metre vertical and 3 metre horizontal intervals. Tie-ins on hoarded scaffolds must never be placed at intervals greater than these minimum distances.

Subsection 324(1)(d)

As required by Clause 7.2.3.1 of CSA Standard S269.2-M87 (R1998), *Access Scaffolding for Construction Purposes*, vertical load-carrying members must be erected and maintained within the following limits:

- (a) not more than 12 millimetres (0.47 inches) out of plumb in 3 metres (9.8 feet);
- (b) not more than 19 millimetres (0.75 inches) out of plumb in 6 metres (20 feet); or
- (c) not more than 38 millimetres (1.5 inches) in the height of the structure.

Departures from plumb must be corrected by adjusting the devices provided for this purpose, e.g., wedges, jackscrews, etc.

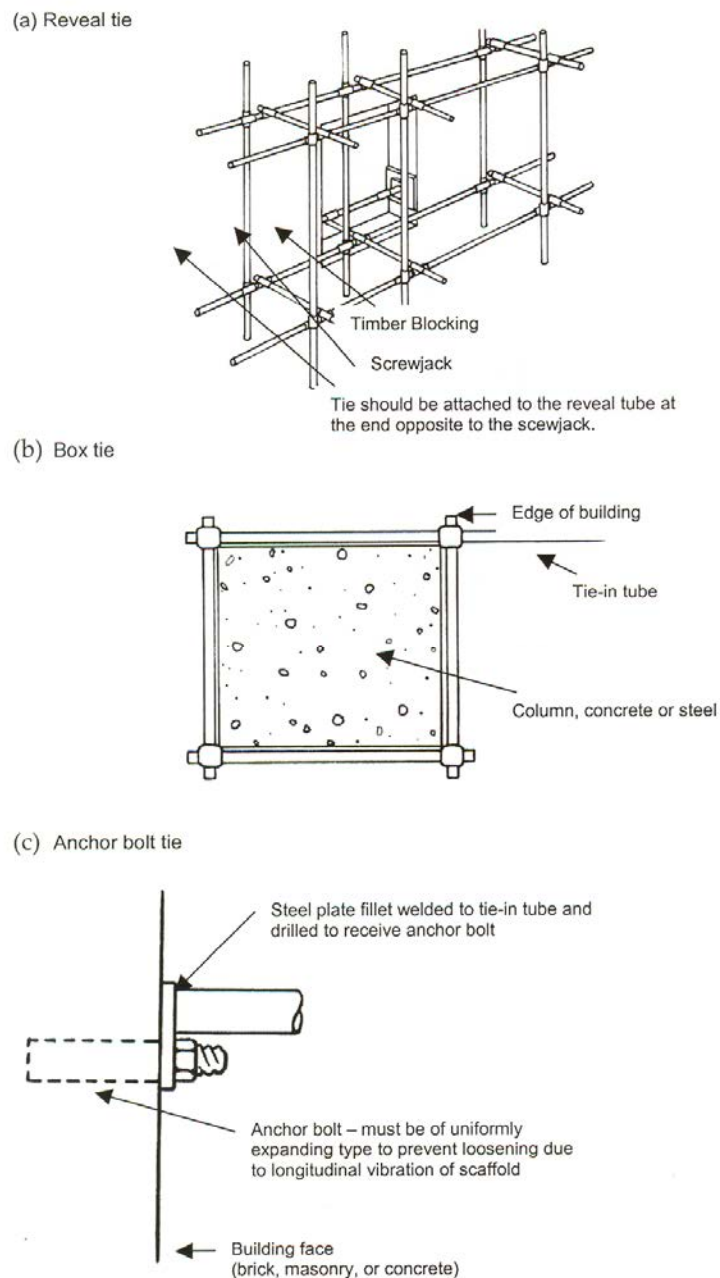
Devices such as base plates and jackscrews effectively disperse loads from scaffold vertical members to the scaffold foundation. A vertical member cannot rest directly on a mud sill, board or block of wood without an intervening load dispersing device. The

compressive forces created at the end of the vertical member can easily exceed the strength of the sill, board or block, damaging it and making the scaffold unstable.

Baseplates and mudsills

A scaffold transmits its load through its legs to its baseplates and mudsills, and then onto the foundation. By using baseplates and mudsills to control load distribution, workers erecting the scaffold can significantly decrease the likelihood of foundation failure.

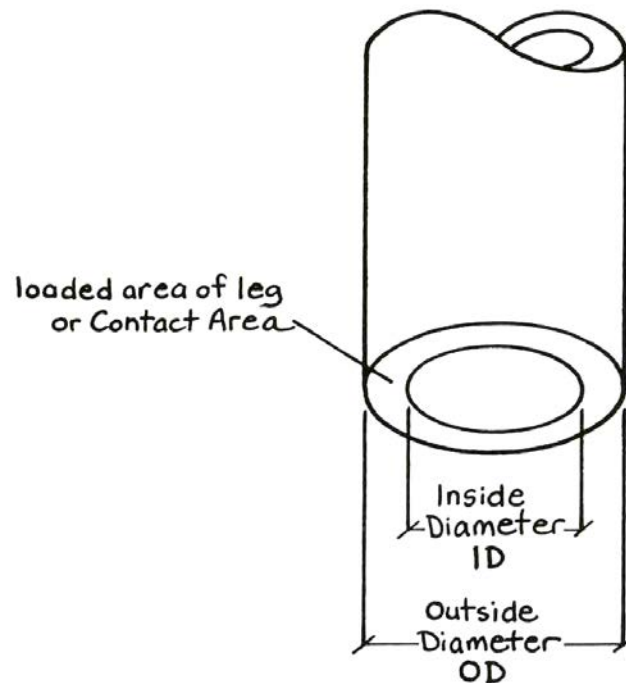
Figure 23.2 Examples of typical tie-ins



The importance of baseplates and mudsills is even more dramatic if the leg load transmitted to a foundation without them is considered. For example, consider a light duty scaffold one tier high supporting 122 kilograms/square metre (25 pounds/square foot). Assume a total surface area of 3.7 square metres (40 square feet) between its standards. This scaffold has a maximum intended load of 454 kilograms (1000 pounds) live load. Include an estimated 227 kilograms (500 pounds) for the scaffold dead load. The total leg load is therefore 681 kilograms (1500 pounds). Using the safety ratio of 4 times the intended load means that the foundation must support 2722 kilograms (6000 pounds).

If the load is level, the 2722 kilograms (6000 pounds) load is distributed evenly through the legs to the foundation. Each leg receives 681 kilograms (1500 pounds) of the load. This load is concentrated on the extremely small surface area of the scaffold leg as shown in Figure 23.3.

Figure 23.3 Loading and cross-sectional area of the leg at the scaffold baseplate

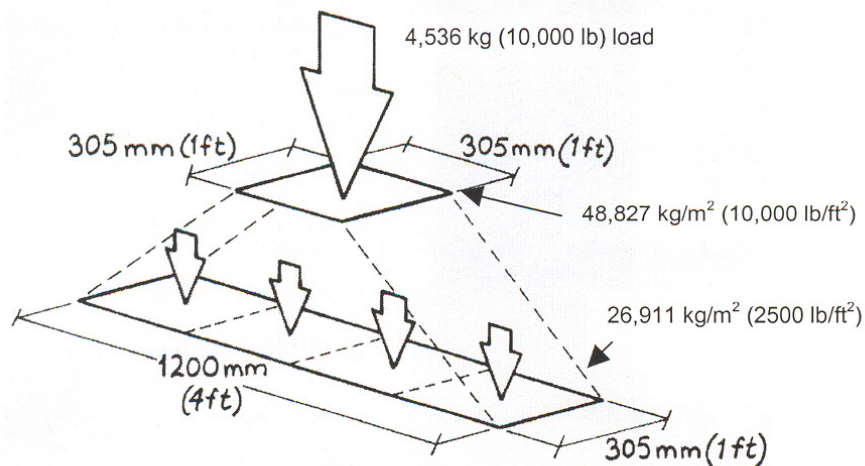


On a scaffold leg area of 25 square millimetres (1 square inch), the compressive force for a 681 kilogram (1500 pound) load is 1,054,656.5 kilograms/square metre (216000 pounds/square foot). This concentrated weight will drive the leg into any type of soil, punch it through asphalt surfaces, and even shatter wood, concrete, or stone foundations.

As weight is transferred from the small surface areas of the legs to the larger surface areas of baseplates or mudsills, the load per square unit of area decreases significantly (see Figure 23.4). For example, a 4536 kilogram (10000 pound) load on a 0.09 square

metre (1 square foot) baseplate transmits 48,827 kilograms per square metres (10000 pounds per square foot) to the foundation. A 0.09 metre x 1.2 metre (1 foot x 4 foot) mudsill under the baseplate reduces the load even further to 26,911 kilograms/square metre (2500 pounds/square foot). Many soils can support a load of that weight.

Figure 23.4 Use of baseplate and sills reduces foundation loading

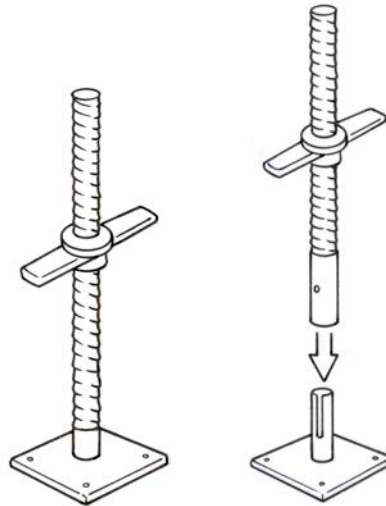


Baseplates

Baseplates help distribute concentrated leg loads over a larger area. They also connect scaffold standards and mudsills. Baseplates attach to scaffold legs with pins or locking devices. Workers erecting scaffolds often put screwjacks between the scaffold legs and baseplates to allow the scaffold to be leveled (see Figure 23.5). Baseplates usually contain predrilled nail holes for attaching the plates to a mudsill.

A baseplate measuring 150 millimetres by 150 millimetres provides approximately 0.023 square metres (36 square inches) of load distribution area. The load distribution area of a typical scaffold leg is approximately 25 square millimetres (1 square inch). Therefore the baseplate reduces leg load force on the foundation by a factor of 36 by distributing the load over a much larger area. A 0.04 square metre (64 square inch) baseplate reduces the force on the foundation by a factor of 64.

Figure 23.5 Baseplates help distribute the leg load



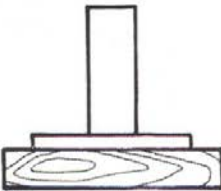
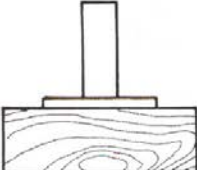
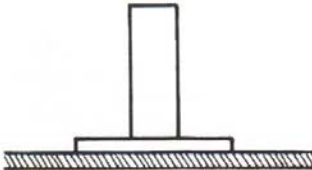
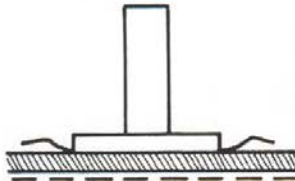
Mudsills

Normally, baseplates alone are inadequate for load distribution. Good erection practice often includes a timber mudsill under the baseplate. Mudsills serve two purposes:

- (1) *They provide a friction surface*—baseplates are smooth metal and can easily slip. A timber mudsill has more texture. It does not allow the baseplate to slip as easily. Mudsills also have more surface area than baseplates which means they have more contact with the surface they rest on.
- (2) *They distribute loads over a larger foundation area*—because mudsills have more surface area than baseplates, mudsills distribute any load placed on them over a larger area of the foundation.

Mudsills are usually made of wood and come in many sizes. Workers erecting a scaffold should choose a size according to the load and the foundation strength required. For typical scaffold work under normal conditions, a 50 millimetre x 250 millimetre (2 inch x 10 inch) wood mudsill is adequate. Table 23.1 suggests the type of mudsills that should be used under various ground conditions.

Table 23.1 Sample mudsills

Type of base	Ground conditions
 <p>51 mm x 254 mm (2 in x 10 in) Timber</p>	<ul style="list-style-type: none"> Asphalt surface Paths Grass Clay Gravel Generally good firm ground
 <p>76 mm x 305 mm (3 in x 12 in) Timber</p>	<ul style="list-style-type: none"> Soft or loose ground Made-up ground Wet sites All heavily loaded scaffolds On earth type surface
 <p>6.4 mm (1/4 in) Plywood</p>	<ul style="list-style-type: none"> Flat concrete Level stone Steel Load bearing Brick work or similar work surface
 <p>6.4 mm (1/4 in) Plywood with a suitable material to protect the surface</p>	<ul style="list-style-type: none"> Marble Mosaic Polished wood Linoleum Carpets, etc.

Subsection 324(2)

Ropes or wire ropes used in scaffolding may be exposed to potentially damaging processes such as welding operations or the cleaning of masonry surfaces with acid solutions. Where this is the case, the ropes must be made of heat or chemical resistant materials.

Subsection 324(3)

Unpainted, dressed lumber is specified so that it can be inspected visually for defects such as cracks, large knots or faults.

Subsection 324(4)

This subsection presents tie-in requirements specific to hoarded masonry walk-through scaffold frames. These scaffold frames are approximately 2.1 metres by 2.1 metres in size. For an erected masonry scaffold frame to maintain its rigidity, tie-ins should be connected to both sides of a frame as close as practicable to horizontal frame members. Restricting the tie-in points to the 3-metre spacings required by subsection 324(1)(c) places the tie-ins at less than desirable locations that can reduce the rigidity of the erected masonry scaffold and can restrict the movement of workers and materials on the scaffold.

Subsection 324(4) requires a vertical and horizontal tie-in for each 9 square metres of hoarding surface area (3 metre horizontal x 3 metre vertical interval = 9 square metres), regardless of the type of scaffold frame being used. This subsection maintains the 9 square metre surface area requirement while allowing the vertical tie-in spacing distance to vary within the range of 2 metres to 3 metres to better suit the dimensions of a masonry walk-through scaffold.

Subsection 324(4) requires that the product of the vertical tie-in spacing distance and the horizontal tie-in spacing distance equal 9 square metres. For example,

- (a) with a vertical tie-in spacing of 2 metres, the horizontal tie-in spacing must be no more than 4.5 metres ($2 \times 4.5 = 9$);
- (b) with a vertical tie-in spacing of 2.5 metres, the horizontal tie-in spacing must be no more than 3.6 metres ($2.5 \times 3.6 = 9$); or
- (c) with a vertical spacing of 3 metres, the horizontal tie-in spacing must be no more than 3 metres ($3 \times 3 = 9$).

Horizontal tie-ins will most likely be placed at every second frame [a horizontal distance of 4.2 metres (2×2.1 metres)], resulting in vertical tie-ins being spaced at 2.1-metre intervals.

Subsection 324(5)

As powered mobile equipment and vehicles move about on a work site, they can unintentionally contact unprotected scaffolding and temporary work platforms, damaging these structures and possibly injuring workers. This subsection requires that employers take reasonable measures to protect scaffolding or temporary work platforms from being contacted. This might be achieved through selective placement of the structures to eliminate the potential for contact, or erecting or placing barriers that direct equipment and vehicles away from the structures.

Section 325 Load

Subsections 325(1) and 325(2)

This subsection requires a scaffold to be capable of safely supporting four times the load that may be imposed on it—a 4:1 safety factor. The imposed or intended load consists of two components: the live load and the dead load.

The live load is the maximum combined weight of all workers, tools and materials placed on the scaffold platform at any given time. When estimating the live load, assume a weight of 91 kilograms (200 pounds) for each worker and 22.7 kilograms (50 pounds) for the worker's tools and accessories, resulting in a combined weight of 113.7 kilograms (250 pounds) per worker on the scaffold. Multiply the number of workers on the platform by this value, adding to the result the estimated weight of any material placed on the scaffold.

The dead load is the weight of the scaffold itself and includes the weight of all bases, frames, posts, tubes, clamps, guardrails, toe boards, ladders or stairs, platforms or planks, and any accessories. The dead load is estimated by multiplying the total number of scaffold parts by the weight of each part and taking the sum of the resulting values.

Subsections 325(3) and 325(4)

Situations may arise in which a scaffold must support an evenly distributed load exceeding 367 kilograms/square metre or is of a type not described in this Part. To ensure worker safety when this is the case, the employer is required to have the scaffold designed and certified by a professional engineer and constructed, maintained and used in accordance with the engineer's certified specifications.

Subsection 325(5)

Workers must be aware of the maximum load the scaffold from which they are working is permitted to carry. Doing so ensures that workers use the scaffold as intended and do not exceed its load limit. The method by which workers are made aware of this information rests with the employer and may involve signage, verbal instructions or a posted notice.

Section 326 Tagging requirements

Subsections 326(1) through 326(5)

The tagging of scaffolds following visual inspection is a requirement new to Alberta. The requirement applies to the following types of scaffolds:

- (a) bracket scaffold;
- (b) double-pole scaffold;
- (c) needle-beam scaffold;

- (d) outrigger scaffold;
- (e) single-pole scaffold;
- (f) suspended scaffold;
- (g) swingstage scaffold; and
- (h) any similar site-assembled scaffold.

The meaning and colour coding of scaffold tags is summarized in Table 23.2. Tags need not be solidly coloured—coloured stripes and broken lines are acceptable. When a person looks at the tag, its colour coding must clearly be green, yellow or red.

Table 23.2 Summary of scaffold inspection tag requirements

Colour of inspection tag	Wording to appear on tag
Green	“Safe for Use” or similar wording
Yellow	“Caution: Potential or Unusual Hazard” or similar wording
Red	“Unsafe for Use” or similar wording

The tags let workers know that a particular scaffold is safe for use, that a potential or unusual hazard is present, or the scaffold is unsafe for use. The yellow tag is required to describe any precautions to be taken while working on the scaffold. A scaffold being modified on a particular level requires a yellow tag. The tag alerts workers climbing onto the scaffold of the modification work and any special precautions that might affect them.

Tags must be placed at each point of entry to the scaffold. This includes access points from ground level and any access points from the structure with which the scaffold is being used. Doing so ensures that workers are aware of the status and condition of the scaffold, regardless of where they access it. Whatever their colour, tags must include

- (a) the duty rating of the scaffold;
- (b) the date on which the scaffold was last inspected;
- (c) the name of the competent worker who inspected the scaffold;
- (d) any precautions to be taken while working on the scaffold; and
- (e) the expiry date of the tag.

Scaffolds to which this section applies must be inspected prior to initial use and at least every 21 calendar days thereafter while workers work from the scaffold or materials are stored on it. A scaffold that is erected but not immediately put into service, or not used for more than 21 consecutive calendar days, must be tagged with a red tag until inspected by a competent worker. A scaffold sitting idle may be exposed to weather or

other circumstances that could make it unsafe for use. Inspection, just prior to the scaffold being put into service, confirms that it is safe for workers to use.

Subsections 326(6) and 326(7)

No worker can use a scaffold under the listed conditions unless the worker is involved in the erection, inspection or dismantling of a scaffold, and is competent to do so. Workers performing these duties are specially trained to perform this work safely.

Subsection 326(8)

For farming and ranching operations, an employer may perform a hazard assessment related to the erection and continued use of their scaffolding, as an alternative to complying with the tagging requirements established by subsections (1) through (7).

Section 327 Vertical ladder on scaffold

Subsections 327(1) and 327(2)

Workers must safely move up and down ladders by maintaining three-point contact with the ladder at all times, and keeping their centre of gravity over the ladder rungs. Ladders are intended for workers to move up or down the scaffold—workers must not perform work from a ladder. These requirements apply to the frame of a scaffold that is designed to look like a ladder and is used as a ladder by workers.

Subsection 327(3)

A ladder attached to a scaffold and that provides access to a working level of a scaffold must meet the listed conditions. Ladders must extend at least 1 metre above the uppermost working level of the scaffold to provide workers with handholds when getting on to or off of the ladder.

The maximum unbroken length of the ladder is restricted to 9.1 metres unless a fall protection system complying with Part 9 is used (see subsection 327(5)). The 9.1-metre distance was chosen to make this maximum unbroken length consistent with the maximum unbroken length for fixed ladders described in section 130. The 9.1-metre distance is measured from the ground or between working levels.

If the ladder attached to the scaffold is more than 6.1 metres in height, it must be equipped with a ladder cage. For the purpose of the *OHS Code*, a ladder cage is *not* considered to be a type of fall protection. A ladder cage provides a structure against which workers can lean and rest, and for some workers it reduces their anxiety or sense of “exposure” by enclosing them. Should a worker in a ladder cage lose his or her footing and handgrip, the worker will most likely plummet to the base of the ladder unless their body becomes entangled in a ladder hoop. A properly functioning fall protection system will catch the worker in mid-air within the ladder cage, preventing

them from falling to the base of the ladder. The ladder cage must begin within 2.4 metres of the ground or working level from which the unbroken length of ladder begins.

Subsection 327(4)

This subsection recognizes two ladder cage shapes and places limits on their dimensions. Circular ladder cages must have an inside diameter that measures no more than 760 millimetres. Square ladder cages must have inside dimensions that measure no more than 760 millimetres by 760 millimetres. These dimensions are large enough to allow workers to easily move up and down within the cage. Yet the dimensions are small enough to ensure that workers can comfortably lean back into the cage with their feet positioned on the rungs and rest without losing their balance.

Subsection 327(5)

As described in subsection 327(3), the maximum unbroken length of the ladder is restricted to 9.1 metres unless a fall protection system complying with Part 9 is used. The 9.1-metre distance was chosen to make this maximum unbroken length consistent with the maximum unbroken length for fixed ladders described in section 130. The 9.1-metre distance is measured from the ground or between working levels.

If a fall protection system complying with Part 9 is used, the maximum unbroken length of the ladder can exceed 9.1 metres and the ladder cage required by subsection 327(3)(f) is unnecessary.

Section 328 Working from a ladder

These requirements apply to the frame of a scaffold that is designed to look like a ladder and is used as a ladder by workers. Such access ladders are intended for workers to move up and down the scaffold. Workers must not perform work from such a ladder.

Section 329 Scaffold planks

Subsection 329(1)

Manufactured scaffold planks are often made of wood laminates or combinations of wood and metal. Because the planks may have properties that differ from those of conventional solid sawn lumber, manufactured planks must be used, stored, inspected and maintained according to the manufacturer's specifications.

Readers are referred to section 349 of this Explanation Guide for a discussion of the term "commercially manufactured."

Subsections 329(2) and 329(3)

Solid sawn lumber scaffold planks must be graded as scaffold grade or better. Scaffold grade planks are assessed against numerous criteria that include density, knots, splits, warps, twists, decay and dimensions. These planks are also subjected to deflection tests and are capable of supporting loads expected during scaffold work. Planks that meet the inspection criteria are stamped as “scaffold grade” and bear a grade stamp.

Subsection 329(4)(a)

Before installing a scaffold plank on a scaffold, the plank must be visually inspected to ensure it is safe for use. Normal wear and tear and storage can damage a plank to the point that it is unsafe for continued use. Reasons for removing a plank from service include decay, conditions that reduce the thickness or width of the plank, damaged welds in the case of metal planks, and cracks in metal or composite planks.

Subsection 329(4)(b)

If visual inspection reveals damage that could affect the strength of the plank, the acceptability of the plank for continued use must be confirmed by load testing or the plank must be removed from service. Using the deflection test procedures and test criteria of ANSI Standard A10.8-1988, *Construction and Demolition Operations — Scaffolding — Safety Requirements*, the deflection of a scaffold plank under its design load must not exceed the span length divided by 60.

To test a plank, the plank is placed on stable supports set at the plank’s intended use span. The plank is then weighted with the intended load at the center of the span and the plank’s deflection measured.

If a plank is intended to support one worker over a 2.4 metre (8 feet) span, a 113 kilogram (250 pound) load must be placed at the plank’s centre and the resulting plank deflection measured. The deflection must not exceed 1/60th of 2.4 metres—a distance of 40 millimetres (1.6 inches). If the plank is to support two workers, the ANSI Standard recommends placing two 113 kilograms (250 pounds) weights on the plank, one 460 millimetres (18 inches) to the right of centre and one 460 millimetres (18 inches) to the left of centre. If the plank is to support three workers, ANSI recommends placing three 113 kilograms (250 pounds) weights on the plank, one at the centre, one 460 millimetres (18 inches) to the left of centre and one 460 millimetres (18 inches) to the right of centre.

Subsection 329(4)(c)

The minimum 150 millimetre (6 inch) distance reduces the likelihood of a plank slipping off its supporting ledger. Limiting the distance that a plank can extend beyond its supporting ledger to 300 millimetres (12 inches) discourages workers from using the extended area as part of their working platform. This reduces the chance of a worker causing the plank to flip up and out of position.

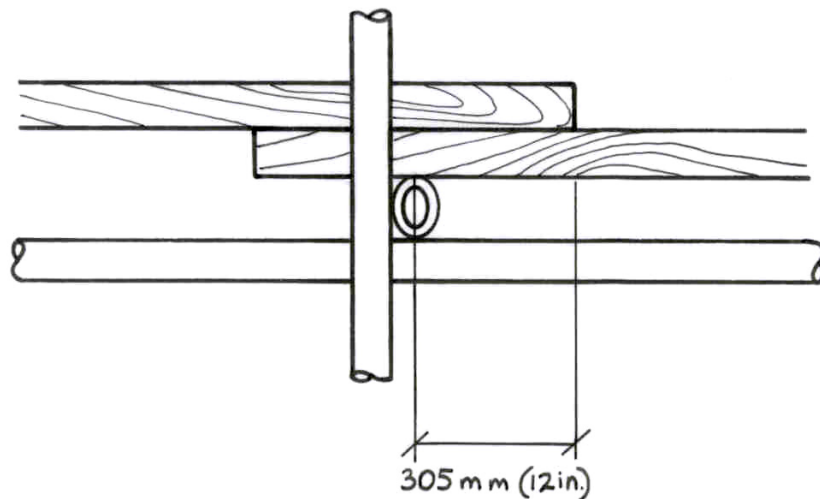
Subsection 329(4)(d)

Planks may be secured in many different ways. Some wooden planks use cleats, some steel or aluminum planks use hooks or recesses into which ledgers are positioned. The securement method must prevent movement of the plank in any direction that may create a danger to a worker.

Subsection 329(5)

Scaffold planks are overlapped when scaffolds have multiple bays and a continuous work platform is required. The overlap in such cases must be at least 300 millimetres (12 inches) and occur only over supports as shown in Figure 23.6.

Figure 23.6 Plank overlap



Section 330 Scaffold platform

A scaffold platform is a raised, typically flat, horizontal floor or surface that supports workers, material and equipment. This section establishes the minimum width for the platform of most scaffolds at 500 millimetres in order to provide an adequate working space. Exceptions include ladderjacks, pump jacks and similar systems where the width of the platform can be no less than 300 millimetres.

This section also requires that there be no space greater than 250 millimetres in width between any part of the platform and a structure adjacent to the platform. This is typically the wall of a building or similar structure and this space is needed for the passage of materials or equipment from one level to another. The 250 millimetre distance is measured at the point of widest separation.

Scaffold platforms should, ideally, be level in order to provide safe footing for workers. Where, for the purposes of accomplishing the work, there is a need to elevate one end of the platform, the surface of the platform must be such that workers do not slip or slide.

Scaffolds are used for a wide range of purposes and are often assembled around pipes or columns or other structures, resulting in an obstruction that workers must work around. In such cases, the platform must be constructed to prevent the creation of openings into or through which a worker might step or fall through.

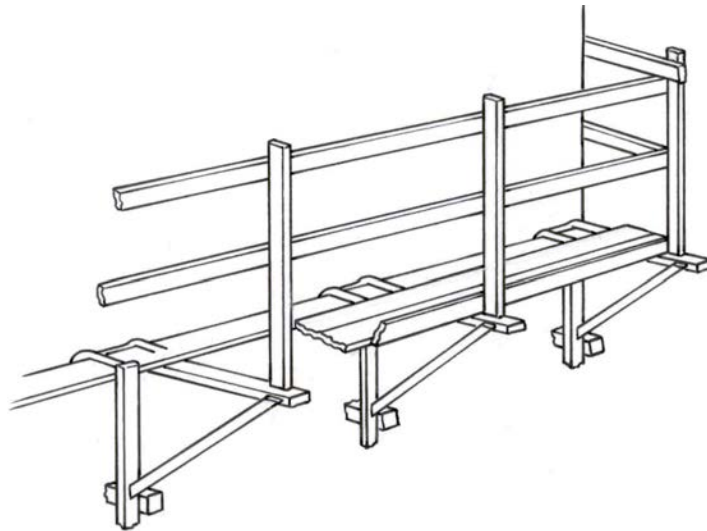
Section 331 Metal scaffolding

The requirements that apply to scaffold planks may not always apply to metal scaffolding. Such scaffolding must therefore be erected, used, inspected, maintained and dismantled according to the manufacturer's specifications.

Section 332 Bracket scaffolds

Bracket scaffolds have their brackets "hung" off of supporting structures such as the top of a structure such as a vessel wall—the scaffold supports do not rest on the ground. Planking then spans the brackets and a safe working platform is created. The scaffold must meet the requirements of this section. Figure 23.7 shows an example of a typical bracket scaffold.

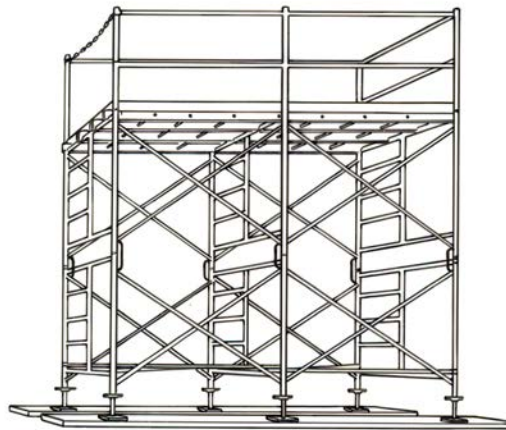
Figure 23.7 Typical bracket scaffold



Section 333 Double-pole scaffolds

This type of scaffold is supported from the base by a double row of uprights, independent of support from the walls and constructed of uprights, ledgers, horizontal platform bearers and diagonal bracing. Figure 23.8 shows a typical double-pole scaffold. Readers should compare this design of scaffold to the single-pole scaffold shown in the Figure 23.15.

Figure 23.8 Typical double-pole scaffold

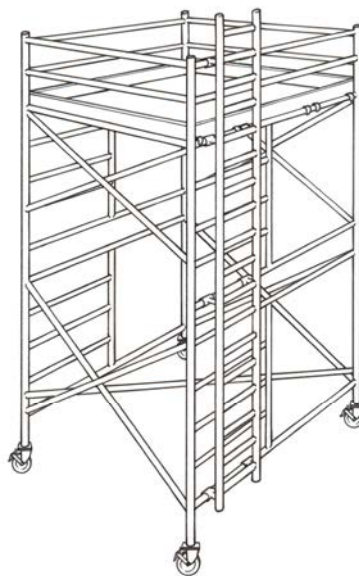


Section 334 Free-standing or rolling scaffolds

Subsection 334(1)

Figure 23.9 shows a typical manually propelled rolling scaffold. To optimize the stability of the scaffold, its maximum height is based on a height to base dimension ratio of 3:1. The height of the scaffold is limited to three times the *smallest* base dimension. Properly installed outriggers permit the height of the scaffold to be increased by increasing the smallest base dimension.

Figure 23.9 Typical manually propelled rolling scaffold



In some cases, rolling scaffolds are installed on a vehicle. When this is the case, component parts of the scaffold may loosen over time due to vibration. As a result, the scaffold should be checked regularly to make sure that all parts are securely fastened together and the scaffold is securely attached to the vehicle. When outriggers are used on such vehicle-mounted scaffolds, the outriggers must be securely attached to the frame of the vehicle.

To prevent the scaffold from rolling while workers work from the scaffold, locking wheels must be locked and non-locking wheels must be blocked.

Subsection 334(2)

This subsection permits a worker to remain on a rolling scaffold when it is in motion but attaches conditions to the height of the scaffold and the surfaces over which the scaffold travels. A “level” surface is considered “level” if it varies no more than 3 degrees from horizontal. Hazards that may cause a scaffold to tip include pits, holes, depressions or obstructions.

Subsection 334(3)

This subsection makes the worker responsible for locking or blocking the wheels of a rolling scaffold under specified conditions.

Section 335 Half-horse scaffolds

A half-horse or lean-to scaffold is a supported scaffold that is kept upright by tilting it toward and resting it against a building or structure. Lumber sizes for half-horse scaffolds are specified in Tables 5 and 6 of Schedule 7 of the *OHS Code*.

Section 336 Ladderjack scaffolds

Figure 23.10 shows a typical ladderjack scaffold. The ladderjack scaffold brackets must be supported by the side rails of the ladder to which they are attached or have at least 90 millimetres (3 ½ inches) of width resting on the ladder rung. Doing so ensures that the weight of the scaffold is safely transferred onto the ladders.

Figure 23.10 Typical ladderjack scaffold. Since the working platform is more than 3 metres above the ground the workers are using personal fall arrest systems

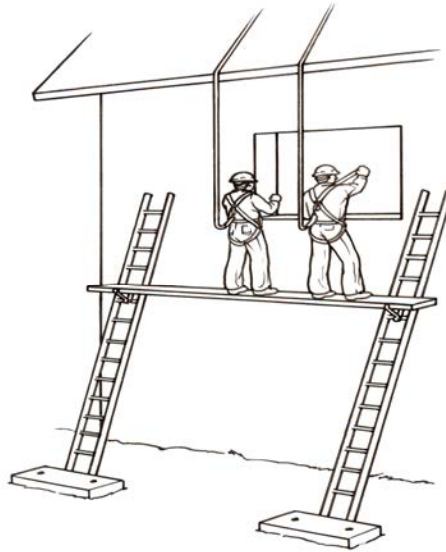
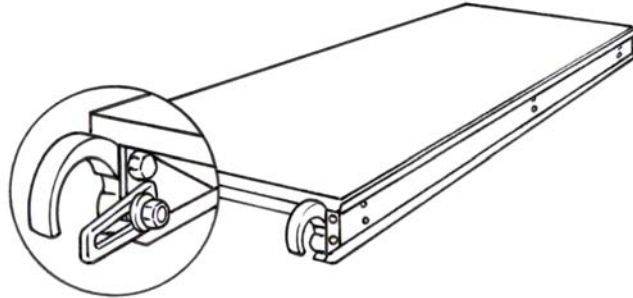


Figure 23.11 shows a commercially manufactured aluminum plank that could be used on a ladderjack scaffold.

Figure 23.11 Commercially manufactured aluminum plank

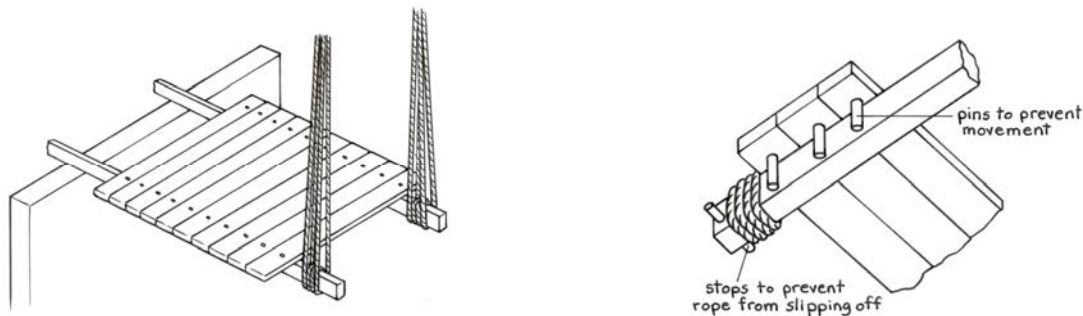


Readers are referred to section 349 of this Explanation Guide for a discussion of the term “commercially manufactured.”

Section 337 Needle-beam scaffolds

Figure 23.12 shows a typical needle-beam scaffold, highlighting several of the design details that make the scaffold safe for use.

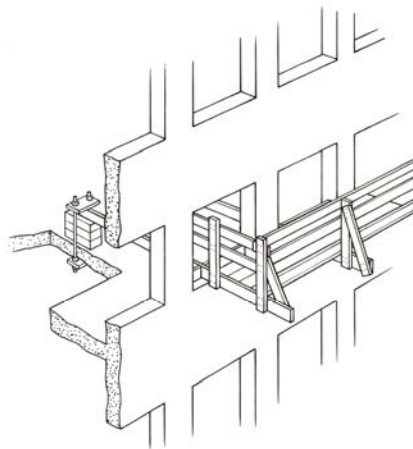
Figure 23.12 Needle beam scaffold and design details



Section 338 Outrigger scaffolds

Figure 23.13 shows a typical outrigger scaffold. An outrigger scaffold is a scaffold that consists of a platform resting on outrigger beams or thrustouts. The beams project beyond the wall or face of the building or structure, with inboard ends secured inside the building or structure.

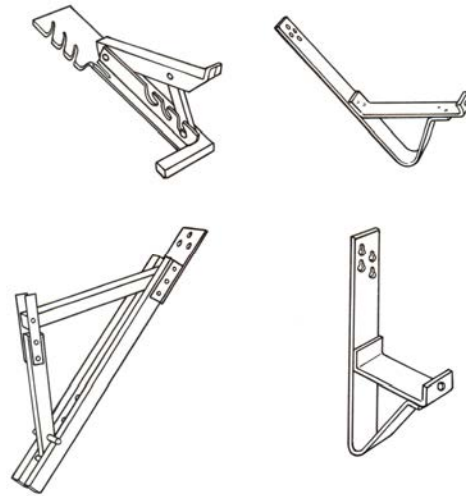
Figure 23.13 Typical outrigger scaffold



Section 339 Roofing brackets

Figure 23.14 shows examples of typical roofing brackets.

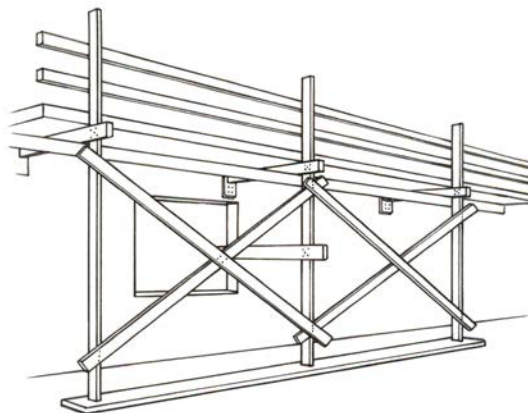
Figure 23.14 Examples of typical roofing brackets



Section 340 Single-pole scaffolds

This section only applies to wooden single-pole scaffolds (see Figure 23.15). This type of scaffold has platforms resting on putlogs or cross beams, the outside ends of which are supported on ledgers secured to a single row of posts or uprights, the inner ends of which are supported on or in a wall. Readers should compare this to the double-pole scaffold shown in Figure 23.8.

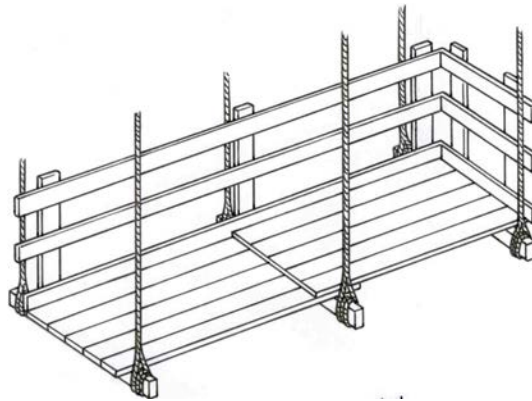
Figure 23.15 Example of a typical wooden single-pole scaffold intended for light duty service



Section 341 Suspended scaffolds

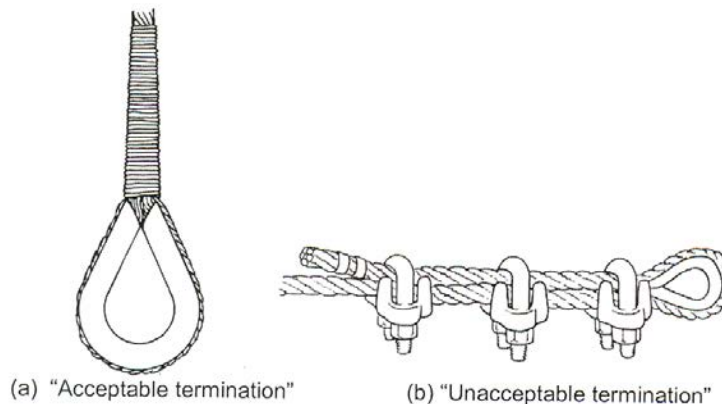
A suspended scaffold is a scaffold supported from above by wires or ropes. This type of scaffold is used for work on, or providing access to, vertical sides of structures on a temporary basis. Figure 23.16 shows an example of an interior hung suspended scaffold.

Figure 23.16 Example of an interior hung suspended scaffold



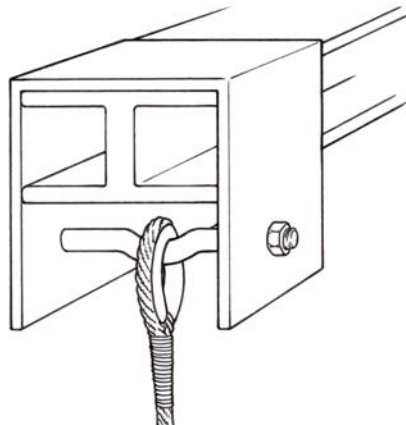
The upper end of the suspended scaffold's suspension rope must be terminated in a spliced loop as shown in Figure 23.17(a). The clamped wire rope arrangement shown in Figure 23.17(b) is unacceptable because the connection may loosen and slip if not properly maintained.

Figure 23.17 Suspension rope terminations



Suspension ropes must be prevented from separating from the shackles to which they are attached. A securing nut must be used as shown in Figure 23.18.

Figure 23.18 Suspension rope securement to thrustout shackle



Because the safety and stability of the working platform relies on the thrustouts from which it is suspended, the thrustouts must be securely anchored to the building or structure from which the platform is suspended. Counterweights cannot be used as the method of anchoring or stabilizing a thrustout. Figure 23.19 shows two types of properly secured thrustouts.

Figure 23.19(a) Examples of thrustout correctly tied back to wall

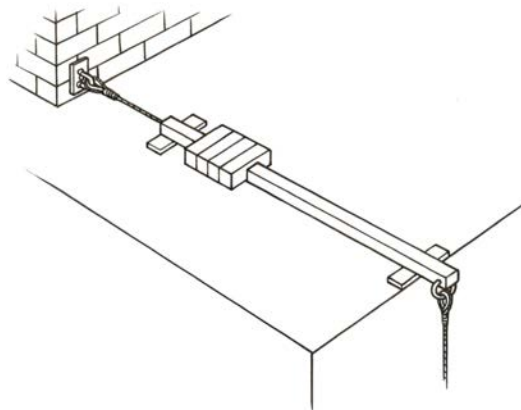
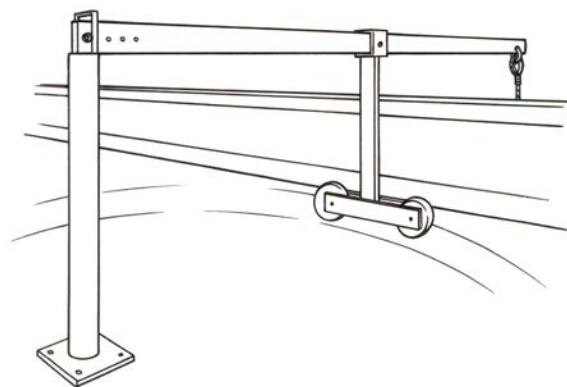
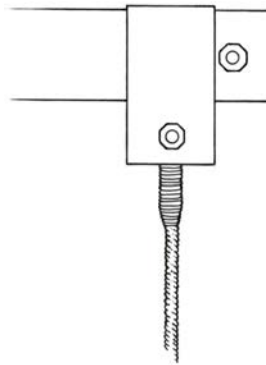


Figure 23.19(b) Example of thrustout on rotating centre



As shown in Figure 23.20, stop bolts must be installed at the outer ends of thrustouts to prevent shackles from slipping off the thrustouts.

Figure 23.20 Stop bolts at end of thrustout



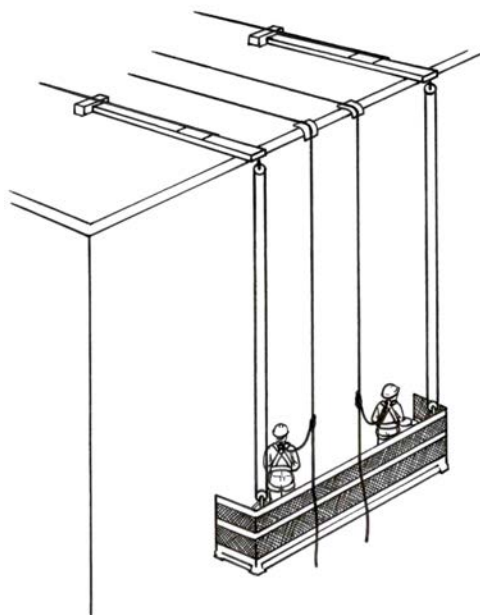
Readers are referred to section 349 of this Explanation Guide for a discussion of the term “commercially manufactured”.

Section 342 Swingstage scaffolds

Figure 23.21 shows a swingstage scaffold in use. If a swingstage scaffold has been designed by a professional engineer rather than manufactured commercially, operating procedures certified by a professional engineer must be developed.

Readers are referred to section 349 of this Explanation Guide for a discussion of the term “commercially manufactured.”

Figure 23.21 Example of a swingstage scaffold

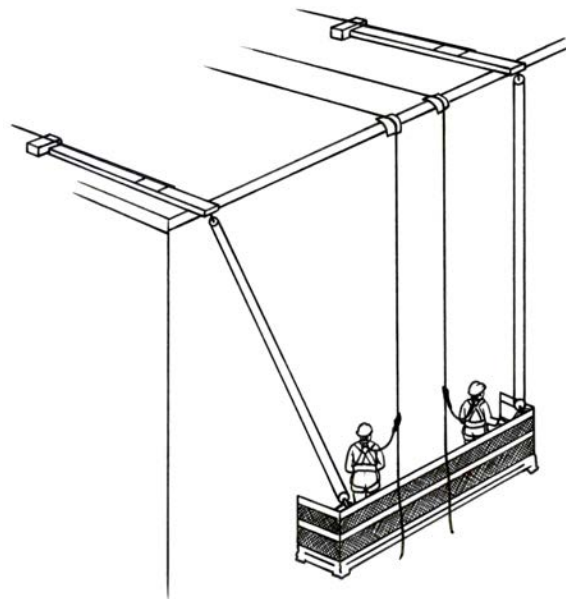


Section 343 Requirements for swingstage scaffold

A light duty scaffold is intended for workers only. Materials other than tools should not be stored on this type of scaffold. Such a scaffold is designed to support the equivalent of an evenly distributed load of no more than 122 kilograms/square metre (25 pounds/square foot).

Figure 23.21 shows the proper parallel positioning of suspension ropes. This positioning eliminates the creation of lateral forces on those structures supporting the ropes. Lateral forces could cause thrustouts and thrustout blocking to suddenly shift, damage parapets, and cause the swingstage to become unstable. Figure 23.22 shows suspension ropes that have been positioned improperly.

Figure 23.22 Improper suspension rope positioning

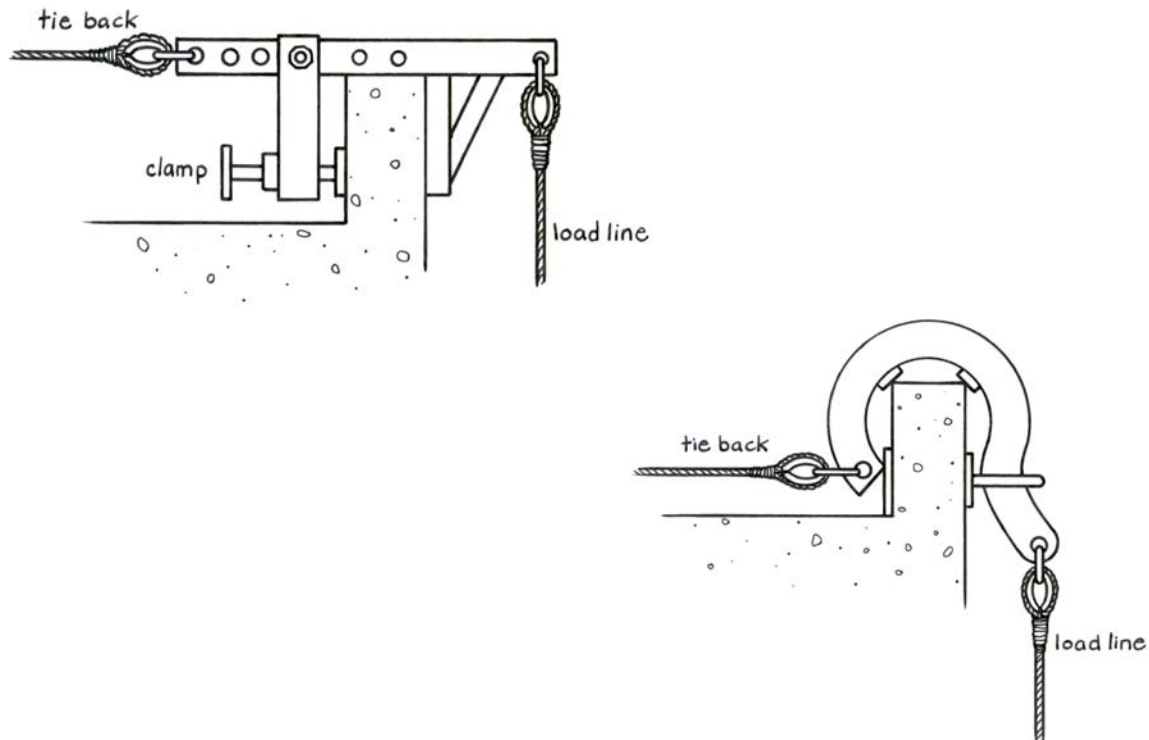


A parapet or cornice hook is a device that functions as a portable or temporary anchor for a suspension line. A parapet clamp functions as a portable or temporary anchor for a suspension line, lifeline or tieback line (Figure 23.23 shows both devices in use). As such, each hook or clamp should be designed with a minimum breaking strength of 22.2 kilonewtons (5000 pounds-force). If a parapet clamp is used to anchor a lifeline, i.e., life safety rope (vertical lifeline), it must have a minimum breaking strength of 16 kilonewtons (3600 pounds-force) or two times the maximum arresting force per worker attached as required by subsection 152.1(2).

The tieback of a thrustout, parapet hook or parapet clamp can only function as an effective anchor if it is positioned on a part of the building or structure that is structurally sound and able to support the loads that the tieback will apply. These tiebacks should, as much as possible, be rigged at right angles to the building face from

which the scaffold is suspended. Selection of proper tieback points is extremely important.

Figure 23.23 Parapet clamp and parapet or cornice hook



A “constant pressure control” is one that requires a deliberate, sustained application of force by a human body part for the machine to operate. Removal of this force immediately stops the machine from operating. A control equipped with a locking mechanism that keeps the control active without contact by a human body part is unacceptable.

“Positive drive,” in relation to a swingstage scaffold power unit, means that the power unit actively drives the stage in both the up and down directions. A “non-positive” or “free-wheeling” power unit drives the stage up but permits it to descend freely.

Section 344 Safety on swingstage scaffolds

Failure of the hoisting mechanism of a manually operated swingstage scaffold could cause the scaffold to drop uncontrollably. To prevent this, all manually operated swingstage scaffolds must be equipped with a secondary anti-fall device that connects the scaffold to the suspension rope at a point above the hoisting mechanism.

In case of a mechanical or power failure, workers must be able to safely leave a powered swingstage scaffold. In the case of a building with windows designed to open, or on

buildings under construction with access to completed floors, workers may be able to safely leave the stage without the need for any additional or specialized equipment.

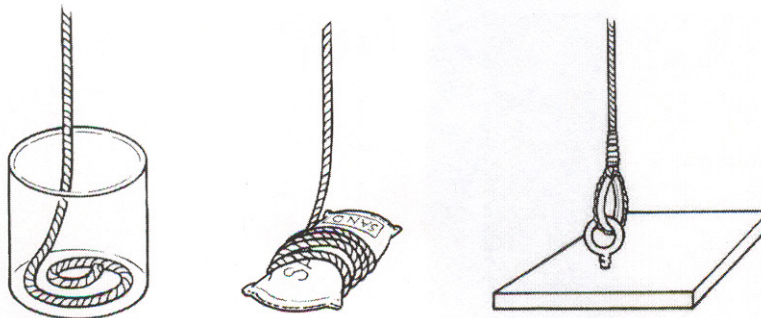
However, where workers cannot safely leave the stage as described above, the scaffold must be equipped with a manually operated secondary mechanism—perhaps the power units are capable of being converted to manual operation—or an escape device. The purpose of the secondary mechanism is to permit the stage to be positioned so that workers can safely leave it. The purpose of the escape device is to permit workers to reach a point of safe exit. The escape device cannot be a vertical lifeline used by a worker for fall protection.

Section 345 Workers on swingstage scaffolds

Subsections 345(1) to 345(3)

Ropes, i.e., life safety ropes (vertical lifelines) that extend to the ground or a landing must be secured to prevent them from getting entangled in equipment or vehicular and pedestrian traffic. Figure 23.24 shows examples of how this might be done.

Figure 23.24 Examples of how to secure ropes



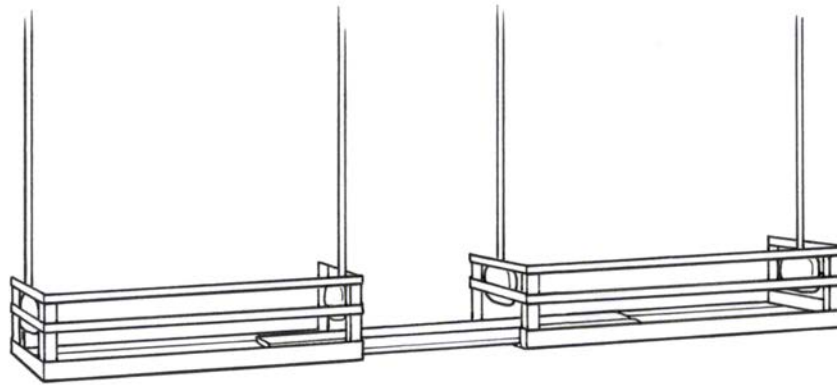
Maintaining the stage level within the specified 10 percent limit helps to prevent workers from falling, materials from upsetting, and rigging from being subjected to excessive wear.

Workers must remain between the swingstage's stirrups for their personal safety and to prevent the possibility of the stage becoming unstable. Stirrups are the main support brackets located at each end of the stage and onto which the hoisting devices are normally attached. They are also commonly known as suspension brackets.

Workers must not bridge the distance between two or more scaffolds with planks or similar connecting materials. This prohibition is consistent with subsection 344(7).

Figure 23.25 shows what bridging scaffolds means.

Figure 23.25 Bridging between two or more scaffolds is not permitted



Subsections 345(4) and 345(5)

Workers working from a suspended scaffold must be protected from falling. Two cables suspend most swingstage scaffolds, one at either end of the scaffold. However, other swingstage scaffolds are available with two suspension cables at each end, a primary and a secondary suspension cable.

The Canadian Standards Association (CSA), in clause 5.3.4 of CSA standard Z91-02, *Health and Safety Code for Suspended Equipment Operations* and clause 7.2.3.2 of CSA standard Z271-98, *Safety Code for Suspended Elevating Platforms*, recognizes the use of swingstages in which the failure of one suspension rope will not substantially alter the position of the suspended swingstage. This type of swingstage has primary and secondary suspension lines at each end of the swingstage.

With this type of swingstage, CSA states that a worker's personal fall arrest system can be attached to a horizontal lifeline or anchorage on the swingstage itself, rather than the traditional approach in which workers are attached to a vertical lifeline, i.e., life safety rope, secured to an anchorage integral to the structure from which the swingstage is suspended.

Subsection 345(5) now recognizes this situation.

Section 346 Worker safety

This section prohibits a worker from remaining in or on a moving basket, bucket or other elevating platform in situations where doing so creates a danger to the worker. Examples of such situations include road traffic conditions in which there is reduced or restricted visibility, or road surfaces are too slippery for safe travel. Overhead wires and cables may be an electrical contact hazard if they are energized, or present an entanglement hazard.

Where the worker is not in any danger, the worker may remain in or on a moving basket, bucket or other elevating platform. This often involves moving a short distance, as might occur between street lamps during bulb replacement or lamp cleaning. In spite of this subsection, the employer must comply with the manufacturer's specifications for movement with a worker onboard.

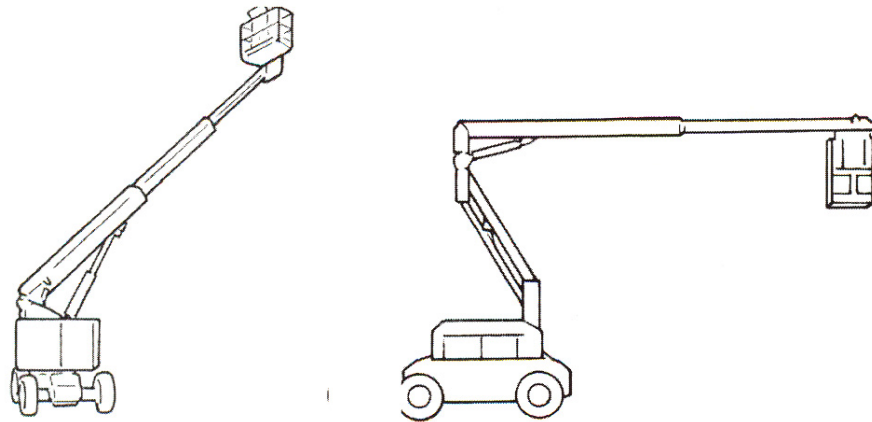
Section 347 Standards

Subsection 347(1)

CSA Standard

CSA Standard B354.4-02 applies to all integral frame, boom-supported elevating work platforms used to position personnel, along with their tools and necessary materials, at overhead work locations. The boom may telescope, articulate, or rotate, and extend the platform beyond the base dimensions. The platform is power operated with primary functions controlled from the platform. The equipment may be manually or self-propelled. Figure 23.26 shows examples of typical boom-type elevating work platforms.

Figure 23.26 Articulated boom and aerial device



An articulated boom is a boom made of two or more hinged sections that support the work platform. A telescoping boom is one in which motion created between two or more boom sections is in a longitudinal direction that lengthens or shortens the boom.

Clause 8.1 of the CSA Standard requires the platform to be equipped with a guardrail or other equivalent structure. Chain, or its equivalent, may be substituted as the toprail or midrail across an access opening. Clause 8.3 of the Standard requires fall protection anchorage point(s) to be installed on the work platform.

The Standard does not require the platform to be marked as complying with the Standard. However, a permanent plate must be located on the platform that lists

- (a) the make, model, serial number and the manufacturer's name and address;
- (b) the rated working load;
- (c) the maximum platform height;
- (d) the maximum horizontal reach;
- (e) special warnings, cautions, or restrictions necessary for safe operation, including the use of outriders or stabilizers; and
- (f) the operating instructions and a notice indicating the need to read the operating manual before use.

The product manufacturer can provide confirmation of compliance with the Standard.

ANSI Standard

ANSI Standard A92.5-2006, *Boom-Supported Elevating Work Platforms*, applies to self-propelled integral chassis aerial platforms having a platform that can be positioned completely beyond the base and used to position workers, along with their necessary tools and materials, at work locations. Aerial platforms are power operated with primary functions, including drive, controlled from the platform. Such aerial platforms are intended to be occupied when driven. Figure 23.26 shows examples of typical boom-supported elevating work platforms.

The Standard sets criteria for the design, manufacture, performance, inspection, training, maintenance, testing and operation of the platforms. Clause 4.12.5 of the Standard requires boom-supported elevating work platforms to be equipped with anchorage(s) for personal fall protection for fall protection devices for workers occupying the platform. Clause 4.12.2 requires such platforms to have a guardrail system. Flexible materials such as cables, chains or ropes cannot be used in the guardrail system.

A boom-supported elevating work platform complying with the ANSI Standard will have a manufacturer-installed nameplate indicating that the equipment complies with the Standard.

Subsection 347(3)

CSA Standard

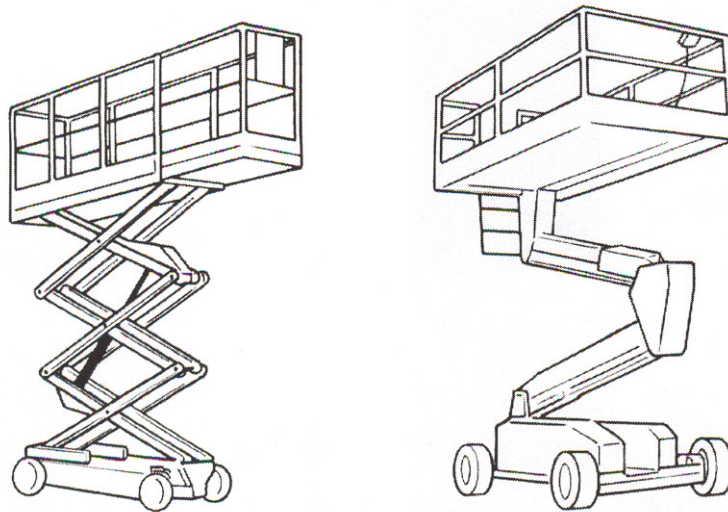
CSA Standard CAN/CSA-B354.2.-01, *Self-Propelled Elevating Work Platforms*, applies to self-propelled integral chassis elevated work platforms that have a platform that cannot be positioned completely beyond the base and that are used to position personnel, along with their necessary tools and materials, at work locations. Self-propelled elevating work platforms (aerial platforms) are power operated with primary functions, including drive, controlled from the platform. The Standard applies to aerial platforms designed for use in both on-slab and off-slab applications.

An on-slab surface means any asphalt, concrete, or equivalent surface. An off-slab surface is an uneven surface made of materials other than asphalt, concrete, or their equivalent. Compacted soil is an example of an off-slab surface. Work platforms intended for off-slab work are more stable than those intended for use on paved/slab surfaces.

The Standard specifies the minimum requirements for the establishment of criteria for the design, manufacture, remanufacture, rebuild/recondition, testing, performance, inspection, training, maintenance, and safe operation of self-propelled elevating work platforms.

Self-propelled elevating work platforms are generally intended for use over level surfaces. Normally they are not insulated for use near electrically energized circuits nor are they intended to be used in hazardous locations. The term self-propelled means that the machine can be power driven using a primary set of operator controls located on the elevated work platform. Figure 23.27 shows examples of typical self-propelled elevating work platforms.

Figure 23.27 Examples of powered (self-propelled) elevating platforms



Clause 4.13.2 of the Standard requires the platform to be equipped with a guardrail. Clause 4.13.5 requires fall protection anchorage point(s) to be installed on the work platform. The platform must be equipped with one anchorage point for each occupant.

The Standard does not require the platform to be marked as complying with the Standard. However, the platform must be durably marked with various warnings and instructions. The following is a partial list of what is required by clause 4.19.1 of the Standard:

- (a) the make, model, serial number and the manufacturer's name and address;
- (b) the rated working load;

- (c) the maximum platform height;
- (d) special warnings, cautions, or restrictions necessary for safe operation, including the use of outriders or stabilizers; and
- (e) the operating instructions and a notice indicating the need to read the operating manual before use.

The product manufacturer can provide confirmation of compliance with the Standard.

ANSI Standard

ANSI Standard ANSI/SIA A92.6-2006, *Self-Propelled Elevating Work Platforms*, applies to self-propelled integral chassis aerial platforms having a platform that cannot be positioned completely beyond the base and that are used to position personnel, along with their tools and materials, at work locations. Aerial platforms are power operated with primary functions, including drive, controlled from the platform. Figure 23.27 shows examples of the equipment covered by the Standard.

The Standard sets criteria for the design, manufacture, remanufacture, rebuild/recondition, testing, performance, inspection, training, maintenance and operation of the platforms.

The ANSI Standard allows manufacturers to voluntarily include fall protection anchorages on their equipment. When provided, Clause 4.13.5 of the Standard requires the anchorage(s) for personal fall protection to be capable of withstanding a load of 16 kilonewtons (3,600 pounds-force). Special requirements apply if more than one worker uses a single anchorage at one time.

Clause 4.13.2 requires all work platforms to be equipped with a guardrail system. Flexible materials such as cables, chains and ropes cannot be used in the guardrail system except as a midrail at access openings 760 millimetres (30 inches) wide, or less.

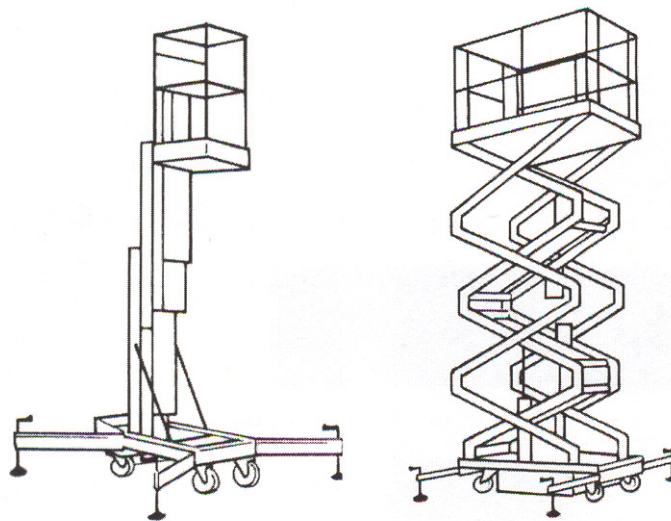
A self-propelled elevating work platform complying with the ANSI Standard will have a manufactured-installed nameplate indicating that the equipment complies with the Standard.

Subsection 347(4)

CSA Standard

CSA Standard CAN3-B354.1-2004, *Elevating Rolling Work Platforms*, applies to elevating rolling work platforms used on a level surface and that are incapable of being self-propelled from an operating station on the work platform. The work platforms are used to position workers, along with their tools and necessary materials, at overhead work locations. The Standard describes requirements and recommended practices for product design and manufacture, lists performance criteria, and sets standards for testing and inspection. Figure 23.28 shows the type of equipment to which this Standard applies.

Figure 23.28 Examples of manual elevating platforms



The Standard does not require the platform to be marked as complying with the Standard. However, a permanent plate must be located on the platform that lists

- (a) the make, model, serial number and the manufacturer's name and address;
- (b) the rated working load;
- (c) the maximum platform height;
- (d) the maximum horizontal reach;
- (e) special warnings, cautions, or restrictions necessary for safe operation, including the use of outriders or stabilizers; and
- (f) the operating instructions and a notice indicating the need to read the operating manual before use.

The product manufacturer can provide confirmation of compliance with the Standard.

ANSI Standard

ANSI Standard ANSI/SIA A92.3-2006, *Manually Propelled Elevating Aerial Platforms*, applies to manually propelled, integral chassis aerial platforms having a platform that cannot be positioned completely beyond the base and that are used to position workers, together with their tools and materials, at work locations. Platforms are adjusted by manual or powered means and cannot be occupied when moved horizontally. This Standard sets criteria for the design, manufacture, testing, performance, inspection, training, maintenance and operation of the platforms. Figure 23.28 shows typical examples of the equipment to which the Standard applies.

Clause 4.12.5 of the Standard requires the aerial platform to be equipped with a fall protection anchor point(s) if the platform's guardrail system, or parts of the guardrail system, can be removed. Clause 4.12.2 requires all work platforms to be equipped with a

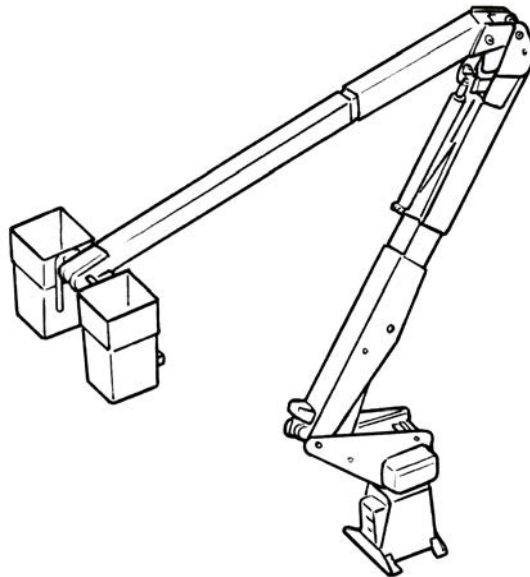
guardrail system. Flexible materials such as cables, chains and ropes cannot be used in the guardrail system.

A manually propelled elevating aerial platform complying with the ANSI Standard will have a manufacturer-installed nameplate indicating that the equipment complies with the Standard.

Subsection 347(5)

CSA Standard CAN/CSA-C225-00 (R2005), *Vehicle-Mounted Aerial Devices*, sets criteria for the design, manufacture, testing, inspection, installation, maintenance, use and operation of vehicle-mounted aerial devices. These devices are installed on a chassis, are primarily used to position workers for work purposes, and are used for operator training. The vehicle may be a truck, trailer or all-terrain vehicle. The design and manufacturing requirements of the Standard apply to those devices manufactured after the date of publication of the Standard. Figure 23.29 shows a typical aerial device.

Figure 23.29 Example of a typical aerial device



The Standard recognizes both insulated and non-insulated aerial devices. Insulated aerial devices are classified into three categories based on the degree of electrical protection they provide and the type of work being performed.

Clause 4.9.4 of the Standard requires the work platform to be equipped with a fall arrest anchor(s) capable of withstanding a load of 22.2 kilonewtons (5000 pounds-force). Clause 4.5.4 of the previous 1988 edition of the Standard required anchors to have a strength of 18 kilonewtons (4000 pounds-force). Special requirements apply if more than one worker uses a single anchor at one time. Clause 8 of the Standard, "Responsibilities

of Owners,” describes what is required of equipment owners in terms of equipment inspections and tests.

Although an attached nameplate may show compliance information, an aerial device is not required by the Standard to bear a marking indicating compliance with the requirements of the Standard. Where compliance is in question, the manufacturer’s specifications should be consulted.

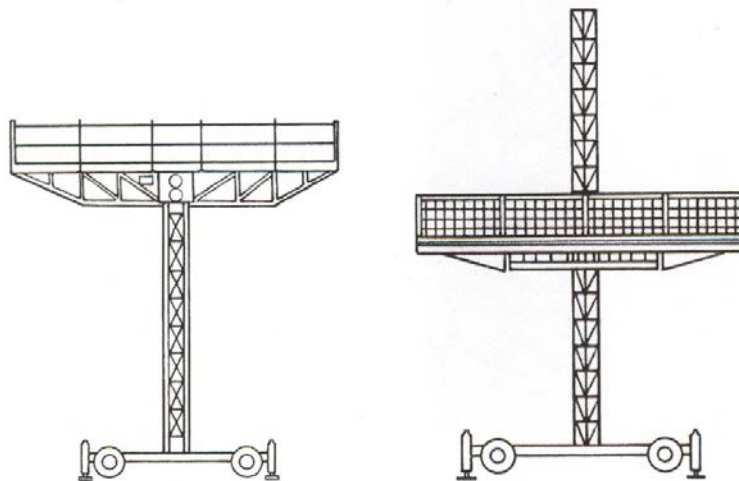
Subsection 347(6)

ANSI Standard

ANSI Standard ANS/SIA A92.9-1993, *Mast-Climbing Work Platforms*, applies to mast-climbing platforms primarily used to position workers, including their tools and materials, so that work can be performed. Platforms can be adjusted by manual or powered means. The Standard sets criteria for the design, manufacture, performance, inspection, training, maintenance, testing and operation of these work platforms. Figure 23.30 shows examples of typical platforms covered by the Standard.

A mast-climbing work platform complying with this Standard will have a manufacturer-installed nameplate indicating that the equipment complies with the Standard.

Figure 23.30 Examples of typical mast-climbing work platforms



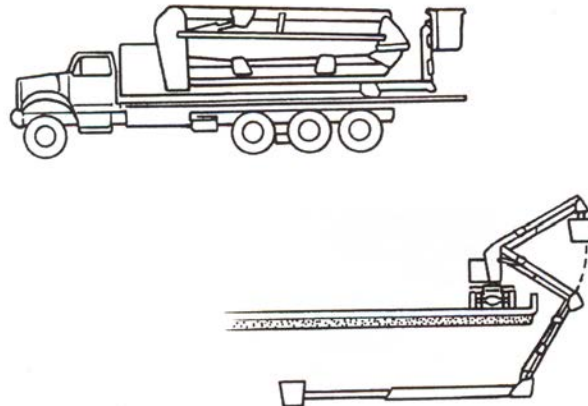
Subsection 347(7)

ANSI Standard ANSI/SIA A92.8-1993 (R1998), *Vehicle-Mounted Bridge Inspection and Maintenance Devices*, applies to mobile units generally designed to be supported on bridge surfaces of varying degrees of grade and super-elevation and have the capability of providing personnel quick and easy access to the underside of such structures. The Standard describes requirements for the design, manufacture, testing, inspection, installation, maintenance, use, training and operation of such devices.

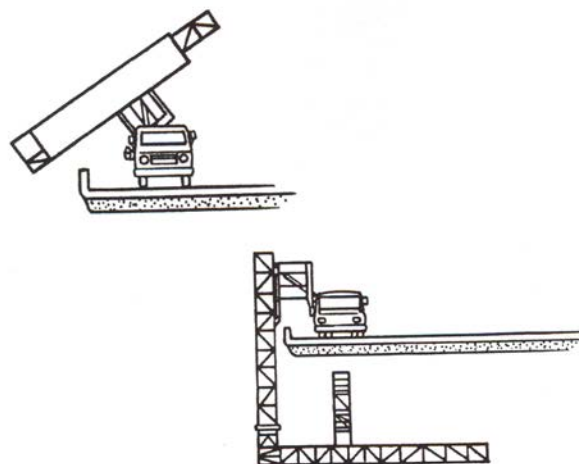
Figure 23.31 shows typical examples of vehicle-mounted bridge inspection and maintenance devices. The device manufacturer can provide confirmation of compliance with the Standard.

Figure 23.31 Typical examples of vehicle-mounted bridge inspection and maintenance devices

(a) Typical example of articulated boom equipment



(b) Typical example of tower type equipment



Subsection 347(8)

ASME Standard B56.1-2000, *Safety Standard for Low Lift and High Lift Trucks*, defines safety requirements relating to the elements of design, operation and maintenance of low lift and high lift powered industrial trucks controlled by a riding or walking operator, and intended for use on compacted, improved surfaces.

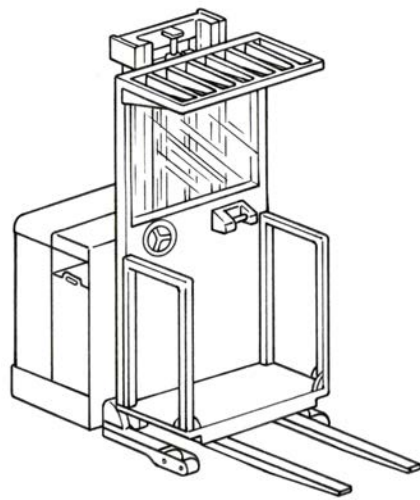
An order picker lift truck complying with the Standard will have a manufacturer-installed nameplate indicating that the lift truck complies with those mandatory requirements of the Standard applicable to the manufacturer. The lift truck may also

bear other markings, authorized by an appropriate nationally recognized testing laboratory, indicating compliance with the Standard.

This subsection applies to both high lift and low lift order pickers. The ASME Standard defines this equipment as follows:

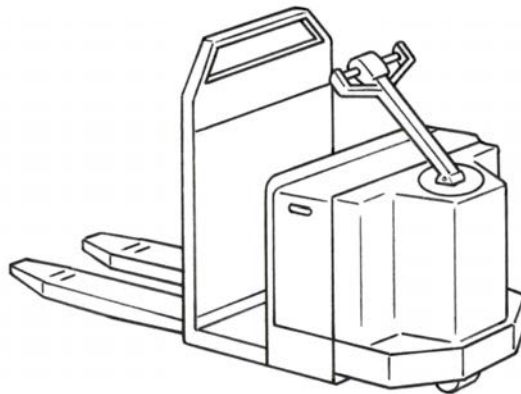
“high lift order picker truck” means a high lift truck controllable by the operator stationed on a platform movable with the load-engaging means and intended for (manual) stock selection. The truck may be capable of self-loading and/or tiering. Figure 23.32 shows an example of such a truck.

Figure 23.32 High lift order picker rider truck



“low lift order picker truck” means a low lift truck controllable by an operator when stationed on, or walking adjacent to, the truck, and intended for (manual) stock selection. The truck may be capable of self-loading. Figure 23.33 shows an example of such a truck.

Figure 23.33 Low lift order picker truck



Section 348 Permanent suspension powered work platforms

This section applies to equipment that is permanently installed on a structure and includes a suspended working platform, a roof car, or other suspension means, track or guidance systems, and the required operating and control devices. This is in contrast to portable powered platforms such as swingstages which are removed from their points of suspension after each use and are normally handled on the ground.

CSA Standard CAN/CSA-Z271-98 (R2004), *Safety Code for Suspended Elevating Platforms*, applies to the design, construction, installation, operation, inspection, test, maintenance, alteration, and repair of suspended elevating platforms designed to carry personnel for the purpose of gaining access to exterior and interior building surfaces and other structures. The Standard also applies to manually operated platforms and boatswain's chairs.

Section 349 Fork-mounted work platforms

Subsection 349(1)

This section applies to a cage or work platform mounted on the forks of powered mobile equipment and intended to only support material. The cage or work platform must be securely attached to the lifting carriage or forks of the powered mobile equipment. Doing so prevents the cage or platform from accidentally moving laterally or vertically and prevents the powered mobile equipment from tipping.


Subsection 349(2)

Because the work platform is intended to support a worker, it must meet a higher standard of design and construction than is required by subsection 349(1) for a platform intended to only support material. This means that the work platform must be commercially manufactured or designed and certified by a professional engineer if not commercially manufactured. This is the same standard of safety that applies to suspended man baskets (see subsection 350(1)), a type of work platform that similarly supports workers at a height above ground level.

The work platform must be equipped with guardrails and toe boards. Guardrails act as a type of fall protection and the toe boards prevent small objects from falling off the platform.

The platform must be equipped with a screen or similar barrier that guards any drive mechanism accessible to a worker while on the work platform. This screen or barrier is intended to protect a worker on the platform from contact with moving parts associated with the lifting or lowering mechanism.

For more information

 ASME Standard B56.1-2000, *Safety Standard for Low Lift and High Lift Trucks*. Clause 7.36 presents design specifications for elevating work platforms.

The fall protection approach to be followed when using a fork-mounted work platform depends on the type of forklift being used. The two situations normally encountered are summarized as follows.

Forklift truck with vertical mast

When a work platform is attached to a forklift truck having a vertical mast and the platform only moves up and down, then the platform's guardrail system provides worker protection against falls. However, if a portion of the guardrail system is absent or has to be removed while in an elevated position and its absence exposes the worker to an edge from which the worker could fall, then additional safety measures must be taken. Specifically, the worker must use either a travel restraint or personal fall arrest system. Because of the (usually) limited clearance distance below the work platform, a travel restraint system consisting of a self-retracting lanyard and full body harness is preferred.

Forklift truck with telescopic mast

In a study of deaths involving aerial work platforms used in the U.S. construction industry between 1992 and 1999, it was determined that boom-supported work platforms accounted for almost 70 percent of deaths involving aerial work platforms.

The study reported that

- (a) half of all falls from boom-supported work platforms involved being ejected from the bucket or platform after being struck by vehicles, cranes, or crane loads, or by falling objects, or when the work platform suddenly jerked;
- (b) two-thirds of the deaths from collapses/tipovers of boom supported work platforms occurred when the bucket cable or boom broke or the bucket fell; and
- (c) almost one-third of the deaths were due to tipovers.

Experience in Alberta about ejections has resulted in subsection 141(1) explicitly requiring that workers use a personal fall arrest system when working from a telescopic forklift truck work platform. The worker's lanyard must be connected to an engineered anchor point. The worker's lanyard must, if reasonably practicable, be short enough to prevent the worker from being ejected from the work platform yet be long enough to allow the worker to perform his or her work. Readers are referred to the explanation to section 141 of the *OHS Code* for additional information.

Subsection 349(3)

A worker working from an elevated fork-mounted work platform relies on the equipment operator to position the worker up and down. The operator must not leave the controls while a worker is on the elevated work platform.

Subsection 349(4)

No one is permitted to remain on a fork-mounted work platform while the powered mobile equipment to which it is attached is being driven. The platform is not designed to protect a worker from injury if the powered mobile equipment stops or starts suddenly, or in the event of a collision or upset.

Commentary about “commercially manufactured”

In general, a commercially manufactured product has the following qualities:

- (a) it is designed and built to some standard or generally accepted engineering principles that make it safe for use;
- (b) it is designed and built by person(s) with the skill or competence to be able to make the product safe;
- (c) it is produced with the intention of being generally available to anyone who wants to buy it—normally there is an exchange of money;
- (d) it is normally supported by the manufacturer with a warranty, guarantee, and product support; and
- (e) liability and safety issues related to its use have been addressed by the manufacturer.

It is implied by the *OHS Code*, that a product that is “commercially manufactured” is “safe” because it has been produced by a “manufacturer” that has the skills and competencies to do so.

Criterion (a) refers to the product being designed and built to some “generally accepted engineering principles.” It is expected that a “manufacturer” is able to provide drawings or sketches of the product that include an assessment of the product’s strength, load-bearing capacity, etc. Further, criterion (d) mentions “product support.” This may include, among other elements, the availability of written manufacturer specifications.

Section 350 Suspended man baskets

Moved to section 75.1

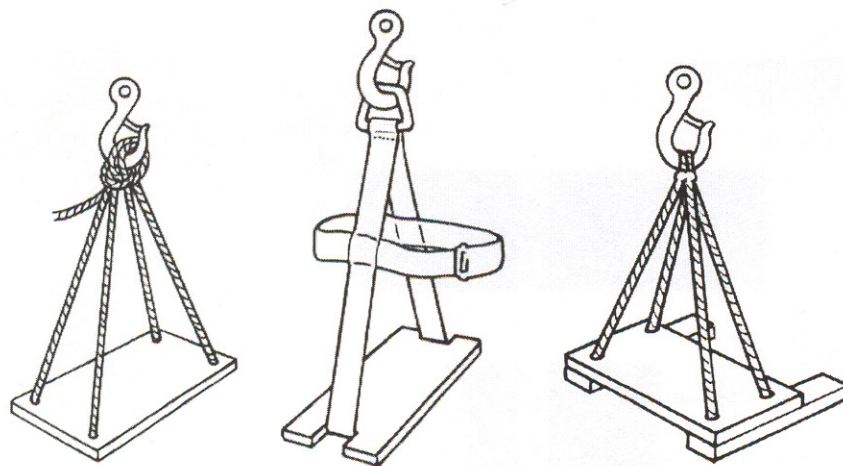
Section 351 Boatswain's chairs

Subsections 351(1) and 351(2)

A boatswain's chair raised and lowered by manually powered hoisting equipment, or used with a "descent only" rigging arrangement, should be designed to support a minimum load of 113.7 kilograms (250 pounds). Generally, the chair will have a minimum 19 millimetre (3/4 inch) thick plywood seat, attached at four corners by minimum 13 millimetre (1/2 inch) diameter nylon rope to a master link, or be constructed to provide an equivalent strength, and have a lap belt to secure the chair to the worker. Various designs of boatswain's chairs are shown in Figure 23.34.

Readers are referred to section 349 of this Explanation Guide for a discussion of the term "commercially manufactured".

Figure 23.34 Various designs of boatswain's chairs



A powered (motorized) boatswain's chair is a powered platform and must meet the requirements of CSA Standard CAN3-Z271-M98 (R2004), *Safety Code for Suspended Powered Platforms* (see section 348).

Subsection 351(3)

While the anchor to which the rope is attached must have a strength of 22 kilonewtons (5000 pounds-force), the rope must have a strength of 27 kilonewtons (6000 pounds-force). The "breaking strength" of rope means the manufacturer's specified minimum (or nominal) strength of new rope under a straight pull test condition. The 5 kilonewton difference between rope strength and anchor strength is to allow for losses in rope strength due to factors such as the rope termination (such as knots or splices), the rope running over pulleys or other small radius surfaces, wear within generally accepted

limits, and deterioration in the rope from regular use up to the time when rejection criteria require the rope to be removed from service.

Subsection 351(4)

No explanation required.

Section 352 Temporary supporting structures

CSA Standard S269.1-1975 (R2003), *Falsework for Construction Purposes*, provides rules and requirements for the design, fabrication, erection, inspection, testing, maintenance and use of falsework materials and components where they are erected to provide temporary vertical support for buildings and other structures during their construction, alteration or repair.

Falsework is the term used to describe structural supports and the bracing required to support temporary loads during construction. A fly form deck panel is a complete, unitized falsework structure intended to be moved as a unit. A form or formwork is the mould into which concrete is placed.

If any of the conditions listed in subsection (3) are present, or may be present, the employer must have the resulting temporary supporting structure certified by a professional engineer. The engineer's certified specifications must contain the information listed in subsection (4).

Section 353 Fly form deck panels

No one is allowed to be on a fly form deck panel while it is being flown. In addition to the hazard of falling, the presence of a person on the panel may make the panel unstable.

Part 24 Toilets and Washing Facilities

Highlights

- Section 356 clarifies employer's responsibilities regarding toilet facilities at mobile or temporary work sites.
- Section 359 requires employers always to provide workers with access to at least one wash basin or hand cleaning facility.

Requirements

Section 354 Restrictions by employer

The employer must not place unreasonable restrictions on a worker's use of drinking fluids, toilets, washing and hand cleaning facilities. Workers must be permitted access to these fluids and facilities when required.

Section 355 Drinking fluids

This section makes the employer responsible for making drinking fluids, potable water and single-use drinking cups (if applicable) available at a work site. Where outlets exist for both potable and non-potable water, the employer must clearly label the potable water outlet(s).

Section 356 Exception

This section specifies the type of work sites to which sections 357 to 361 do not apply. For periods of up to and including five working days at a mobile or temporary work site, an employer is not required to provide toilets, washing and hand cleaning facilities, or supplies and waste receptacles if the employer has made arrangements for workers to use local toilet facilities at a nearby public building, or getting permission from a local business or restaurant owner to use their facilities during the work period. This is intended to be a temporary measure to provide workers with access to toilet facilities.

If workers working for periods of up to and including five working days at a mobile or temporary work site do not have access to toilet facilities in such local public buildings or businesses, then the employer must meet the requirements of sections 357 to 361.

If workers work at a mobile or temporary work site for more than five working days, the employer must meet the requirements of sections 357 to 361, regardless of what other toilet facilities may be available locally.

Section 357 Toilet facilities

Subsections 357(1) through 357(5)

This section specifies the minimum number of toilets to be provided at a work site for members of each sex, based on the number of workers of that sex at the work site (see Table 24.1). Rules by which toilets are substituted with urinals are also described.

Table 24.1 Number of toilets required at a work site (appears in the *OHS Code* as Schedule 7)

Number of workers of the sex	Minimum number of toilets for that sex
1 - 10	1
11 - 25	2
26 - 50	3
51 - 75	4
76 - 100	5
> 100	6 plus 1 for each additional 30 workers of the sex in excess of 100

Subsection 357(6)

Farming and ranching operations are often carried out in areas that are remote. Since it may not be practical for an employer to install or provide toilets at these locations, they are exempt from the requirements listed in subsections 357(1) through 357(5).

Subsection 357(7)

Despite subsection (6), employers of farming and ranching operations must provide workers with sanitary and hygiene supplies (e.g., sanitary napkins, hand sanitizer, clean water, paper towel, waste disposal bin).

Employers of farming and ranching operations must provide workers access to a toilet, if one is available at the work site. The employer must not restrict their workers from accessing the toilet facilities.

Section 358 Water and drainage

This section deals with the connection of toilets to sanitary drainage systems and, in the case of self-contained toilets, requires that they be emptied and serviced to prevent overflow.

Section 359 Hand cleaning facilities

The requirements of this section apply regardless of whether or not the work site is connected to a public or municipal water main and sanitary drainage system. A “hand cleaning” facility might be as simple and effective as providing the work site with waterless hand cleanser and paper towels, or several containers of wet wipes and a means of disposing of used wipes. Workers must always be provided the opportunity to wash their hands and face, particularly prior to eating.

Section 360 Supplies and waste receptacle

Employers must ensure that toilet compartments contain toilet paper, that cleaning agents and hand drying supplies or equipment are provided at each wash basin or hand cleaning facility, and that covered waste receptacles are provided.

Section 361 Condition of facilities

Employers must ensure that lunch rooms, change rooms, and sanitary and hand washing facilities are kept in a clean and sanitary condition and maintained so that the facilities are operational when required for use.

Changing rooms, lunch rooms, toilet facilities and rooms in which a wash basin or shower are located are not to be used for the storage of materials unless these spaces are built with proper storage facilities. Materials improperly stored in these high traffic and high use areas can create a slipping or tripping hazard, reduce the amount of intended space available to workers and the materials themselves may become a fire hazard or contain substances hazardous to workers.

Part 25 Tools, Equipment and Machinery

Highlights

- Section 364 requires employers to ensure that machinery or equipment used to move, raise or lower workers is designed by the manufacturer or certified by a professional engineer as being appropriate for that purpose.
- Section 367 requires that machinery not be started or operated if doing so endangers the operator or another worker.
- Sections 372 and 373 present requirements applicable to elevated conveyor belts, including restrictions on the movement of workers above and below them.
- Section 375 requires the guards of hand-held grinders to cover 120 degrees of the grinding accessory, as opposed to the previous requirement of 180-degree coverage. Less coverage exposes more of the grinding accessory, improving access into tight grinding locations and reducing kickback.
- Sections 377 through 383 specify requirements specific to saw blades, saw wheels and saws.
- Section 384 presents requirements applicable to industrial robots.

Requirements

Section 362 Contact by clothing, etc.

Any type of clothing, jewellery or hair that hangs down near the moving parts of machinery, equipment or tools creates a potential hazard. Serious injuries including amputation have occurred when a worker's clothing, jewellery or hair has been caught in moving equipment or machinery.

Subsections 362(1) and 362(2)

These subsections describe both employer and worker responsibilities. A hazard assessment helps determine the risk of a worker's clothing, jewellery or hair being caught. Practices to decrease the risk of workers being caught in machinery may include such things as:

- (a) wearing clothing that fits close to the body and cannot get caught on moving parts;
- (b) avoiding loose cuffs, belts, ties or protruding buckles that are easily caught on equipment;
- (c) where long sleeves or pant legs are worn, elasticized or closely buttoned cuffs, velcro closures or ties should be used;

- (d) wearing coveralls to contain or control clothing;
- (e) wearing close fitting leather or insulated work gloves that are less likely to become caught than loose fitting handwear. In some circumstances it may not be appropriate to wear gloves at all if there is a risk of them getting caught in moving parts;
- (f) ensuring boots are laced using all eyelets and tucking in bootlaces;
- (g) tying back long hair and covering it with a hairnet that is snug to the head;
- (h) covering a long beard with a net to contain it;
- (i) not wearing jewellery and accessories such as chains or scarves with loose ends;
- (j) removing a fall protection lanyard rather than wearing it draped over a shoulder; and
- (k) rings can increase the damage to a finger or result in amputation when a hand is crushed. Rings should be removed if a hazard is present.

Subsection 362(3)

It is important that workers with certain medical conditions wear medical alert bracelets to obtain prompt treatment if required. Medical alert bracelets with a breakaway or tear away band allow workers to do this while maintaining safety.

Breakaway bands should be tested to ensure that there is no danger of the worker getting caught. If breakaway medical alert bracelets are not available, consider attaching the medical alert tag to some other breakaway band or lanyard or linking it through bootlaces.

Section 363 Machines close together

This section outlines the employer's responsibility to ensure that workers are not in danger because of machines being too close together. It is important to identify the boundaries that separate restricted areas from areas where workers can move safely. The layout of machinery and equipment must allow workers to move without risk of being struck by or caught on moving or protruding parts of the equipment.

To ensure worker safety, a machine or its dangerous parts should be positioned so that hazardous areas are not accessible or do not present a hazard to a worker during the normal hours of operation. The assessment should start with identifying the specific clearances required by each machine or component in the automated system. Issues to consider when positioning machinery include:

- (a) the operation of the machine;
- (b) operator/worker interaction with the machine;
- (c) other tasks performed in the area;
- (d) visibility when moving around the machinery; and
- (e) the need to move supplies in the area.

Section 364 Moving workers

Machinery or equipment used to move, raise or lower workers must be specifically designed for that purpose. Machinery or equipment intended to move, raise or lower materials may not have the safety features or factor of safety designed into it to allow it to be safely used with workers.

Examples of machinery or equipment for which the design is critical and to which specific requirements of the *OHS Code* apply include:

- (a) rigging [see subsection 292(1)];
- (b) fork-mounted work platforms intended to support a worker [see subsection 349(2)];
- (c) suspended man baskets [see section 350]; and
- (d) the travelling block or tugger of an oil derrick [see section 770].

Subsection 364(1.1) Moving workers on a farm or ranch

Employers of farming and ranching operations may use a tractor's front-end loader bucket to raise and lower workers to their working area, only if it is not reasonably practicable to use another piece of equipment designed for this purpose.

When using the bucket to raise or lower workers, the employer must ensure that:

- (a) a hazard assessment has been completed;
- (b) fall protection is used when the worker is raised to a height of 3 metres or more;
- (c) the bucket is secured against unintended movement; and
- (d) the machinery or equipment to which the bucket is attached remains stationary on the ground.

A worker must not remain in the bucket of a tractor while the machinery or equipment is travelling.

Section 365 Starting machinery

Subsection 365(1)

This subsection addresses the use of alarm systems when starting machinery. The start-up of machinery can cause injury to workers near the machine if they are not aware that the machine is being started and the machine is not appropriately guarded. If a machine operator cannot see the machine or parts of the machine being operated from the control panel or operator's station, *and moving machine parts may endanger workers*, an alarm system must be installed. The alarm system may include sirens, buzzers, horns, flashing lights or a combination of these alarms. A combination of both visual (flashing lights) and audible (siren, buzzer or horn) alarm systems provides the best protection.

Alarm systems should be automatic. They should be constructed and located so that they provide a recognizable audible or visual signal to workers. Audible devices should

have a distinctive sound and be able to be heard above the surrounding noise, including the noise of the machine being operated.

An alarm system is not required if moving machine parts that could endanger workers are guarded.

Subsection 365(2)

The alarm system must be effective at warning workers that a machine is about to start. It must be loud enough or bright enough to attract workers' attention while allowing them sufficient time to reach a safe location. Time delays should be in place so that the warning provides workers with enough time to move to a safe position.

Section 366 Preventing machine activation

The employer must install positive means to prevent equipment from starting up when a worker is feeding material into the equipment or a part of the worker's body is within the machine's danger zone.

Methods of accomplishing this include:

- (1) presence-sensing devices such as
 - (a) photoelectric devices that use a system of light sources and controls that can interrupt the machine's operating cycle. If the light field is broken, the machine stops and will not cycle or will not start. This device is to be used only on machines that can be stopped before the worker reaches the danger area;
 - (b) radiofrequency (capacitance) presence-sensing devices that use a radiofrequency beam that is part of the machine control circuit. When the capacitance field is broken, the machine stops or will not activate. This device is only to be used on machines that can be stopped before the worker reaches the danger area. This requires the machine to have a friction clutch or other reliable means of stopping;
 - (c) electromechanical sensing device that has a probe or contact bar that moves to a predetermined position when the operator initiates the machine cycle. If there is an obstruction preventing it from moving to its safety position, the control circuit does not allow the machine to cycle;
- (2) two-hand controls require the use of both hands at the same time to activate the machine. The operator's hands are out of the danger area. The controls must be designed so that they cannot be operated with one hand and another part of the body; and
- (3) two-hand trips require the operator to press two buttons at the same time to start the machine. Once the machine is started the operator's hands are free to perform other tasks. The controls must be designed so that the operator cannot use one hand and another body part to activate the machine.

Section 367 Operator responsibilities

The machine operator is responsible for checking the machine and the surrounding area to ensure that both the operator and other workers are not at risk of being caught or struck by moving equipment. This may include such things as checking visually and verbally to make sure workers are not in the immediate vicinity of the machinery, and activating warning alarms. Having a second worker check the area may be necessary in some situations. Convex mirrors may be used to allow the operator to see obstructed areas.

Section 368 Controls

The employer is responsible for ensuring that operational controls on equipment are designed, located, or protected to prevent unintentional activation. If appropriate, the controls must be suitably identified to indicate their nature or function.

A control is anything—a switch, lever, pedal button, knob, dial or keyboard—used by an operator to affect a system’s operation. Preventing unintentional activation is often done by recessing start buttons so they cannot be accidentally activated or covering buttons with a guard.

People expect things to behave in certain ways when they are operating controls, and safety may be jeopardized if controls are operated in the wrong way. The position and design of machine controls is important. Speed and ON-OFF controls are particularly important and should be readily accessible. Controls should be standardized on similar machinery so that operators can shift from one machine to another without having to use different controls. The function of the control must be suitably identified.

Controls can be identified based on their:

- (a) shape and texture—useful where illumination is low or where a control needs to be identified and operated through touch only;
- (b) location—grouping controls for the same operations together in one area or always having a particular function in the same location on different control panels; or
- (c) colour—useful for quick visual identification of various controls and for grouping controls for a particular operation. Common examples are green for start and red for stop.

Controls can also be labelled with words or symbols.

Section 369 Immobilizing machinery

The worker is responsible for making sure that a machine, or part of or extension to a machine, is not left unattended or in a suspended position unless the machine is immobilized and secured against accidental movement.

For powered mobile equipment this means setting parking brakes and transmission locks and lowering any blades, buckets or forks to the ground. The wheels may sometimes need to be blocked.

Section 370 Drive belts

Drive belts include power transmission belts such as flat belts, round belts, V-belts, etc. Conditions such as misalignment at loading points, sidewinds, rain, snow and build-up of product can interfere with the alignment or “train” of belts.

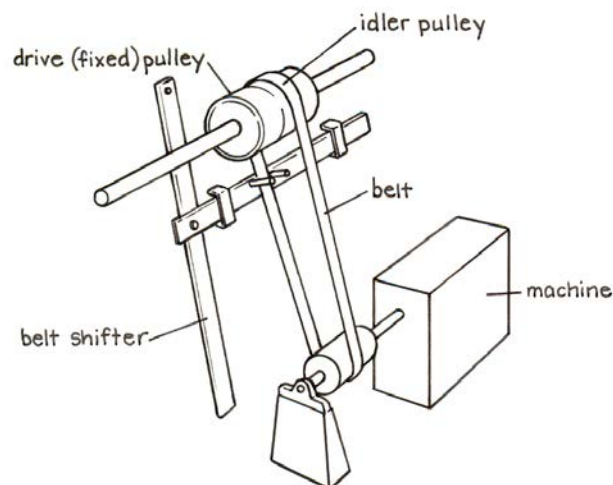
Subsection 370(1)

Realigning belts is one of the highest risk activities. When realignment is attempted on a moving belt, workers can get hands, tools or clothing caught in machinery, be struck by components, or be pulled into pinch points where they may lose a limb or be crushed. Under no circumstances is a worker allowed to manually shift a belt while it is in motion or while the machine or motor is energized.

Subsection 370(2)

A belt shifter is a device for mechanically shifting belts from tight to loose pulleys or vice versa, or for shifting belts on cones of speed pulleys (see Figure 25.1). Permanent drive belts must be provided for all loose pulleys on a machine and must be constructed so that the drive belt cannot creep back onto the driving pulley.

Figure 25.1 Example of mechanical pulley shifting device



Section 371 Continuous-feed machinery

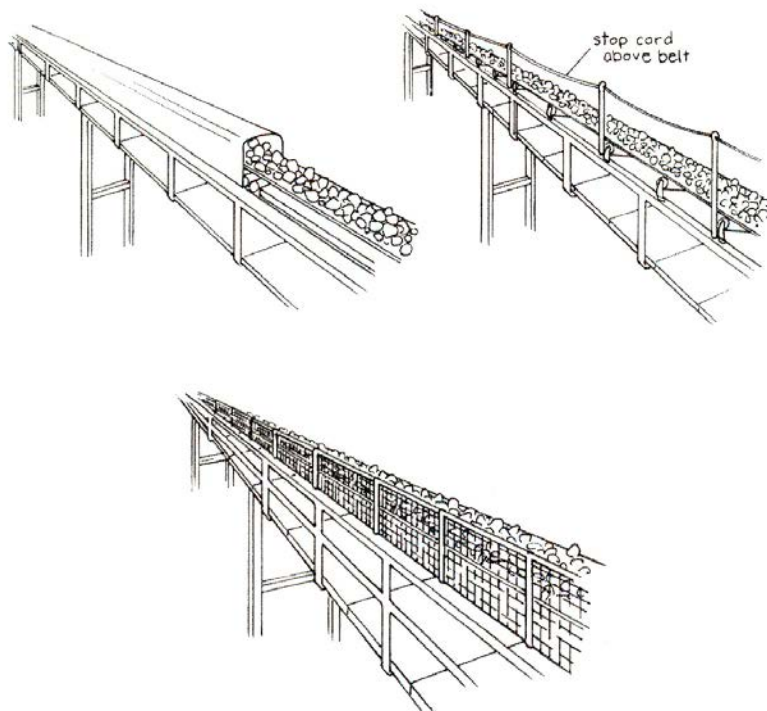
This section requires the machine's feeder device to be able to be stopped independently of the machine's processing mechanism. This usually allows the feeder device to come to a full stop fairly quickly if, for safety reasons, the feeder must be stopped.

Section 372 Elevated conveyors

Elevated conveyors may present a hazard to workers from falling objects. Suggested safeguarding of elevated conveyors (see Figure 25.2) includes:

- (a) covering the entire length of the conveyor;
- (b) installing expanded metal along the length of the conveyor;
- (c) installing guardrails; and
- (d) emergency stop cords along the entire length of the conveyor.

Figure 25.2 Examples of conveyor safeguarding



For more information



Best Practices on Conveyor Safety, Government of Alberta



MSHA's Guide to Equipment Guarding, U.S. Department of Labour, Mine Safety and Health Administration (2004)

Conveyor side walls must be high enough to prevent materials from falling out of the conveyor. The trough the conveyor is running in must be of sufficient strength to prevent a worker who is using a designated walkway beneath the conveyor from being injured by falling materials or objects. A wide variety of materials are available for guard construction such as wire mesh panels, expanded metal, or solid sheet metal. The choice of material is generally dependant upon the size and weight of the material being handled.

A worker must use a walkway to cross a conveyor belt if the conveyor belt is moving or the conveyor belt is motionless but has not been locked out. A moving conveyor, or a motionless conveyor that suddenly and unexpectedly begins moving, could cause a worker to fall. If the worker falls onto the moving surface, the worker could be drawn into dangerous process equipment.

Similarly, crossing under a moving conveyor belt at a location other than a walkway may be dangerous. Such walkways are specially designed to offer protection from overhead falling objects and exposure to operating mechanisms.

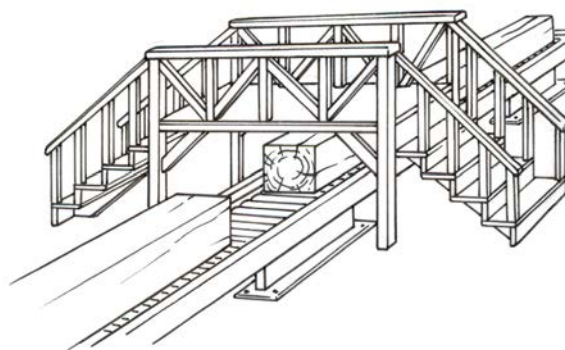
Section 373 Crossing conveyor belts

Common types of incidents with conveyor belts involve workers being struck by objects or getting caught in the moving equipment.

Subsection 373(1)

Workers crossing over a conveyor belt are at a risk of falling onto the conveyor belt or getting caught in moving parts. To prevent this, a bridge that is at least 1 metre wide with adequate guardrails must be in place (see Figure 25.3).

Figure 25.3 Example of bridge over conveyor belt



Good practices include solid construction of crossover bridges, including steps and guardrails on both sides. The steps and floor of the walkway should be surfaced with non-slip material.

If the conveyor belt is locked out, workers may cross over the conveyor belt at locations other than where a bridge is located.

Workers crossing under a conveyor may be at risk of injury due to objects falling from the conveyor belt or getting caught in the moving parts of the conveyor belt. Workers must only cross under conveyor belts where they are protected from falling materials and moving parts.

Section 374 Actuated fastening tools

An actuated fastening tool is a tool that uses a pneumatic, hydraulic, explosive or electric source of energy to bring about its action. Improper use of an actuated fastening tool can cause serious injury or death. The trigger of an actuated fastening tool should not operate unless the worker is in control of the tool and is holding the trigger in the ON position. The trigger should not be mechanically held in the ON position unless the manufacture's specifications permits it to be operated in this way. Workers must be trained to properly use such tools.

For more information



Powered Hand Tools—Powder-Actuated Tools, Government of Canada—CCOHS



Powered Hand Tools—Pneumatic Tools—Basic Safety, Government of Canada—CCOHS

Section 375 Grinders

Subsection 375(1)

Grinding machines shape materials by bringing them into contact with a rotating abrasive wheel or disk. Hazards associated with grinders include:

- (a) eye injuries, if appropriate eye protection is not worn;
- (b) contact with moving parts;
- (c) using broken or cracked grinding wheels;
- (d) reaching across or near rotating grinding wheels;
- (e) grinding on the side of a wheel not designed for this type of use;
- (f) vibrations and excessive speed that cause a wheel or disk to shatter;
- (g) using the wrong type, a poorly maintained, or unbalanced wheel or disk;
- (h) incorrectly holding the work; and
- (i) incorrectly adjusted tool rest or a grinder that does not have a tool rest but should.

Workers operating grinders must be trained to safely and correctly operate the equipment. Appropriate personal protective equipment must be worn.

Grinders must be operated in accordance with the manufacturer's specifications and where required, be equipped with a grinder guard. Guards protect the operator and should not be removed as serious injuries can occur. Guards should enclose the wheel as completely as the nature of the work permits.

In using the various types of abrasive wheels and disks, the manufacturer's stated running speeds in revolutions per minute (RPM) and operational procedures must be followed. Before a grinding wheel is installed, its size and maximum rated speed must be checked against the manufacturer's specifications. The maximum rated speed must be equal to or greater than the maximum speed of the grinder shaft. The hazard associated with grinding wheels is that they tend to shatter into pieces (due to centrifugal force) with the potential of injuring both operators and bystanders.

If a hand held grinder is being used, the object being ground must be secured and unable to move.

Subsection 375(2)

Almost all guards on hand held grinders cover one-half or 180 degrees of a grinding disk's circumference. This subsection allows guards to be cut back to cover 120 degrees of the grinding disk's circumference. Doing so exposes more of the grinding disk, allowing the disk to be used in tighter, difficult-to-get-at grinding locations, and may reduce the danger of grinder kickback with some work pieces.

Subsection 375(3)

If a tool rest is installed on a fixed grinder, the employer must ensure that the manufacturer's specifications are followed if they exist or the tool rest is:

- (a) installed in a manner compatible with the work process;
- (b) securely attached to the grinder;
- (c) set at or within 3 millimetres of the face of the wheel; and
- (d) set at or above the centre line of the wheel.

Many wheels have broken and caused injury to operators because work has become wedged between the tool rest and the wheel. The tool rest should be substantially constructed and securely clamped not more than 3 millimetres from the face of the wheel. The position of the tool rest should be checked frequently. The tool rest height must be set at or above the centre line of the wheel.

Subsection 375(4)

An abrasive wheel is made of bonded abrasive and only the periphery or circumference of an abrasive wheel is usually designed for grinding. If grinding on the side is required, then wheels designed for this purpose that are either cemented or bolted to a steel or flexible backing plate can be used.

Workers are responsible for making sure that they do not grind material using the side of an abrasive wheel unless the wheel has been designed for that purpose.

The tool rest of a fixed grinder must never be adjusted while the wheel is in motion. The tool rest may slip, strike the wheel and break it, or the operator may catch a finger between the wheel and the rest.

For more information



Use of Portable Grinders, Government of Canada—CCOHS



Surface Grinders, Government of Canada—CCOHS



Wheel Mounting on Portable Grinders, Government of Canada—CCOHS

Section 376 Chain saws

A chain saw is a powered saw that uses an articulated chain with integral cutting teeth running around a bar of flat steel. Serious injuries can result from the unsafe use of chain saws including kickback, falling while carrying a saw or when sawing, strains and sprains from carrying and working with a heavy saw, hand-arm vibration syndrome, being cut by contact with the chain while it is in motion, being cut by the chain when it is not in motion, eye injuries from debris or fragments, hearing damage and many others.

Subsection 376(1)

There are many different brands, models and sizes of chain saws. A chain saw must be operated, adjusted, and maintained according to the manufacturer's specifications. Kickback is the main cause of chain saw injuries. A kickback is the sudden and potentially violent rearward and/or upward movement of the chain saw. It is often caused by the chain striking wood or other objects, or can be caused by binding or pinching in the cut. All chain saws used at the work site must be designed or equipped with a mechanism that minimizes the risk of injury from kickback when the saw is in use.

Anti-kickback devices found on chain saws include

- (a) safety nose or guard—prevents contact with the chain at the end of the chain (see Figure 25.4);
- (b) safety chains—designed to reduce the tendency of catching or “hanging-up” in the wood; and
- (c) chain brakes—stops the chain as the chain bar rises upwards and the hand pivots against the brake switch (see Figure 25.5).

Figure 25.4 Example of chain saw nose guard

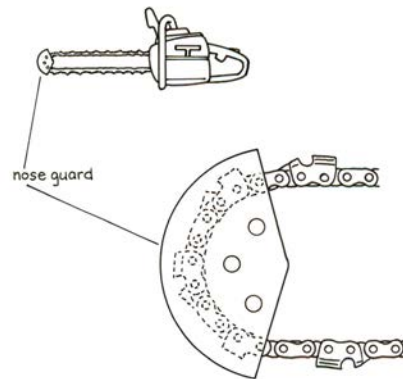
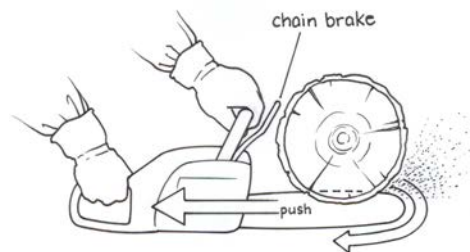



Figure 25.5 Example of chain brake that helps prevent chain saw kickback




Subsection 376(2)

Workers must ensure that the chain saw's motor is off and movement has completely stopped before attempting to adjust, clean, maintain or repair the chain or chain saw.

For more information

 *Chain Saw Information and Online Tutorial*, U.S. Department of Labor, Occupational Safety and Health Administration

 *Industry Prevention Resources for Forestry—Falling and Bucking*, Government of British Columbia—WorkSafeBC

Section 377 Circular saw blades

The characteristics and conditions of circular saw blades are important safety factors for the operators who use them. Workers must follow the manufacturer's specifications and instructions for care and use of saw blades.

It is good practice to inspect the saw blade for cracks every time the teeth are filed or set. As soon as a crack is detected, the blade should be removed from service. If cracked blades are left in service, the crack may grow larger and cause partial fragmentation.

Circular saw blades with cracks of any size that are adjacent to the collar line of the saw, or with a crack anywhere else on the saw that exceeds the limits specified in Table 1 of Schedule 8 of the *OHS Code* (shown as Table 25.1), must be removed from service and either replaced or repaired before it is used again.

Table 25.1 Circular saw blade crack limits (appears as Table 1 of Schedule 8 in the *OHS Code*)

Saw blade diameter (millimetres)	Maximum length of crack (millimetres)
up to 300	13
301 to 610	25
611 to 915	38
916 to 1220	50
1221 to 1525	64
> 1525	76

A circular saw blade with a crack of any length that is located near the periphery (edge) must be removed from service and replaced or repaired. The blade may be returned to service if it is repaired or if the crack is prevented from getting longer by slotting, centre punching, drilling or another effective means.

Circular saws must be properly tensioned before being used. Saw blades that have not been tensioned properly may wobble which can cause a saw blade to fracture. After repairs are made to a circular saw blade, it must be retensioned by a person who has been specifically trained to do this.

Section 378 Band saw blades and wheels

The most common cause of band saw injuries is an operator's hands coming into contact with the blade, such as when hand-feeding stock.

Band saw blades (other than a shake band saw blade) with a crack that exceeds the limits specified in Table 2 of Schedule 8 of the *OHS Code* (shown as Table 25.2) must be removed from service and either replaced or repaired.

Table 25.2 Band saw blade crack limits (appears as Table 2 of Schedule 8 of the *OHS Code*)

Width of band saw blade (millimetres)	Maximum length of crack (millimetres)
up to 125	1/10 of saw width
126 to 300	13
> 300	19

To reduce the risk of injury it is good practice to inspect the band saw prior to each use. Cracked or broken blades should be removed immediately.

Any band saw blade (other than a shake band saw blade) with a crack not exceeding the limits outlined above must be removed from service until the crack is repaired or the crack is prevented from getting longer by centre punching or some other means. After repairs are made to a band saw blade, it must be retensioned by a person who has been specifically trained to do this.

Shake band saws are generally smaller than other band saws. Shake band saw blades with any size crack must not be used.

Section 379 Band saw wheels

This section outlines the specific requirements for rim thickness of band saw wheels. Unless otherwise specified by the manufacturer or certified by a professional engineer, a cast steel band saw wheel that is 25 millimetres inboard from the rim edge must have a minimum rim thickness of:

Table 25.3 Rim thickness of band saw wheels

Wheel diameter	Minimum rim thickness
up to and including 1.8 metres	14 millimetres
greater than 1.8 metres to 2.75 metres	16 millimetres
more than 2.75 metres	17.5 millimetres

Band saw wheels that are more than 1.2 metres in diameter must be tested for cracks at least once every 12 calendar months by a competent worker.

A band saw wheel that has been exposed to excessive heat must be removed from service until the wheel manufacturer or a professional engineer certifies that it is safe for continued use.

For more information

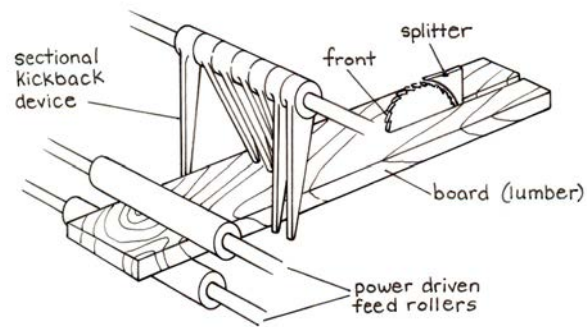


Sawmills eTool—Band Saws, U.S. Department of Labor, Occupational Safety and Health Administration

Section 380 Power-fed circular saws

A kickback occurs during a ripping operation when part or all of the work piece is violently thrown back to the operator. This section outlines the employer's responsibility to ensure that power-fed circular rip saws with horizontal power-driven infeed rolls are equipped with a sectional non-kickback device located in front of the saw blade across the full width of the feed rolls. Non-kickback devices may include the use of anti-kickback fingers (see Figure 25.6).

Figure 25.6 Example of anti-kickback fingers



When a resaw is being used, it must be equipped with a splitter and a cover. The splitter reduces the hazard of the board being thrown back against the worker because it does not allow the lumber to touch the rear of the blade. The function of the cover is to prevent dust and chips from being thrown back at the worker.

Section 381 Cut off saws

Workers may sustain hand injuries when using cut off saws in a variety of ways including:

- (a) when the blade coasts or idles;
- (b) when a worker tries to remove a sawed section of board or a piece of scrap; or
- (c) when a worker measures boards or places them in a position for the cut.

A worker may also be struck by the saw if it bounces forward or the return device falls.

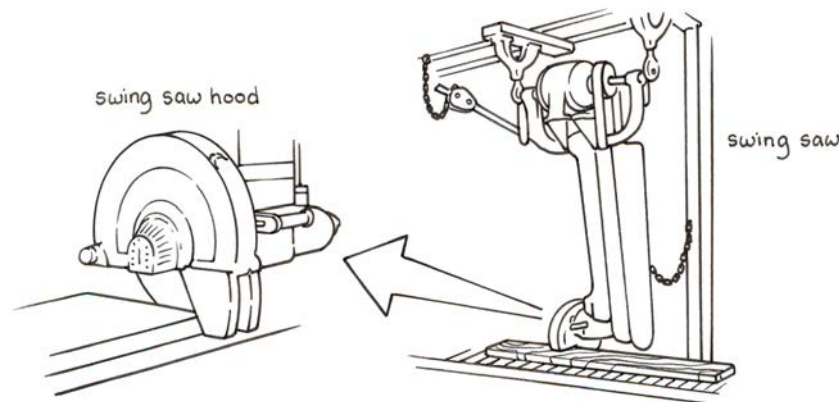
Hand operated cut-off saws (other than radial arm saws) must be equipped with a device that returns the saw automatically to the back of the table when the saw is released at any point in its travel. This prevents the saw from being left in a hazardous position.

Radial arm saws are exempt from this requirement because of the occasional need to lock these saws into a particular position for ripping and mitering.

A limit device must be in place to prevent a swing or sliding cut-off saw from travelling past the outside edge of the cutting table. This may be done by using a limit chain or other device that prevents the saw from swinging beyond the back or front edges of the table. Another device should keep the saw from rebounding from its idling position.

The limit device prevents the worker from operating the saw in an unsafe position (see Figure 25.7).

Figure 25.7 Example of automatic return and blade guard on a swing cut-off saw



Section 382 Sawmill head rig

This section outlines the employer's responsibilities for circular head saws in sawmill head rigs. The term "head rig" means a combination of head saw and log carriage used for the initial breakdown of logs into timbers, cants, and boards. A sawyer is a worker in a sawmill who operates the head rig or main saw.

The employer must make sure that circular head saws have adjustable guides and splitters that are located not more than 75 millimetres from the back of the head saw, and that extend not less than 250 millimetres above the carriage bench. Adjustable guides maintain true tracking of saw circumference and control flexing of the saw.

The employer must also ensure that the upper half of a top saw on a circular head rig is covered. The employer must also ensure that circular head saw guide adjustment controls are operated remotely from the guides.

Section 383 Sawmill log carriage

A log carriage is a framework, mounted on wheels, that runs on tracks or in grooves parallel to the face of the saw. Carriages also contain an apparatus that holds a log securely while advancing towards the saw.

A sawmill log carriage must have a substantial buffer stop at each end to limit travel. The carriage must have a safety device that keeps blocks not less than 30 millimetres from the saw. Each head block must be equipped with a dog and there must be sweepers at the front and back of the carriage to clear obstructions from the track.

The sawyer's lever, operating the drive of the carriage, must be designed and constructed to operate in the opposite direction from the direction the carriage travels if the operator's position with respect to the carriage could put the operator in danger.

This is applicable in cases where a sawyer is positioned parallel to the carriage track so that if he or she is struck by a broken limb or loses his or her footing, his or her forward motion will send the carriage away from the saw. If the mill is equipped with controls located at right angles to the carriage track, this provision is not required.

A security device holds the carriage tight to the track when the log turning device is in operation. Devices that turn logs on the carriage tend to exert a great deal of pressure.

Maintaining the carriage drive control mechanism and the log-turning control in neutral if the operator is not at the control may be done by using a specialized mechanical lockout device on the carriage and log turning controls.

For more information



Log Carriages/Carriages Runways, U.S. Department of Labor, Occupational Safety and Health Administration

Section 384 Robots

Subsection 384(1)

Robots are machines specifically designed and programmed to perform certain operations. They are part of today's workplace and are used in a variety of applications such as spray painting, arc and spot-welding, materials handling, assembly, and machine loading and unloading.

CSA Standard Z434-03 (R2008), *Industrial Robots and Robot Systems—General Safety Requirements*, applies to the manufacture, remanufacture, rebuild, installation, safeguarding, maintenance and repair, testing and start-up of industrial robots and robot systems. The Standard also includes requirements for worker training.

Robot safety can be divided into three major areas:

- (1) safety in the process of manufacturing, remanufacturing, and rebuilding of robots;
- (2) robot installation; and
- (3) safeguarding workers exposed to hazards associated with the use of robots.

A hazard assessment as required by section 7 of the *OHS Code* must be conducted to identify potential hazards and appropriate controls when working with robots. A sample risk assessment process is included in the CSA standard. A risk assessment for robot safety may consider:

- (a) size, capability, and speed of the robot;
- (b) applications and process;
- (c) anticipated tasks that will be required for continued education;
- (d) hazards associated with each task;
- (e) anticipated failure modes;

- (f) probability of occurrence and probable severity of injury; and
- (g) level of expertise of exposed workers and the frequency of exposure.

The robot and robot system must be equipped with adequate safeguarding devices to protect workers against hazards. Safeguarding should eliminate or control the hazard. A hierarchy of safeguarding controls is recommended in the CSA standard and summarized in Table 25.4.

Table 25.4 Hierarchy of safeguarding controls

Most effective	(1) Elimination or substitution	<ul style="list-style-type: none">▪ eliminate human interaction in the process▪ eliminate pinch points (increase clearance)▪ automated material handling
	(2) Engineering controls (safeguarding technology)	<ul style="list-style-type: none">▪ mechanical hard stops▪ barriers▪ interlocks▪ presence-sensing devices▪ two hand controls
	(3) Enhancing worker awareness of hazards	<ul style="list-style-type: none">▪ lights, beacons, and strobes▪ computer warnings▪ signs▪ restricted space painted on floors▪ beepers▪ horns▪ labels
	(4) Training and procedures (administrative controls)	<ul style="list-style-type: none">▪ safe job procedures▪ safety equipment inspections▪ training▪ lockout
Least effective	(5) Personal protective equipment	<ul style="list-style-type: none">▪ safety glasses▪ ear plugs▪ faceshields▪ gloves

Source: CSA Standard Z434-03 (R2008), Table A.1

Types of safeguards

Safeguards that prevent workers from entering a restricted work area include:

- (1) *barriers*—a physical means of separating the worker from the hazards;
- (2) *interlocking safeguarding devices*—the operation of one control or mechanism allows or prevents the operation of another. These devices may be mechanical or electrical and must
 - (a) have a key, plug or actuating device that is not easily duplicated;
 - (b) be tamper-resistant and not be defeated intentionally without tools;

- (c) provide a means for secure attachment; and
 - (d) be provided with documents stating the standards the product meets, the standard the product is independently certified to meet, and their safety circuit performance;
- (3) *safeguarding devices that signal a stop*—examples include
- (a) safety light curtains, screens;
 - (b) area scanning safeguarding devices;
 - (c) radiofrequency (RF) capacitance safeguarding devices;
 - (d) safety mat systems;
 - (e) single and multiple bean safety systems; and
 - (f) two-hand control systems;
- (4) *safeguards that limit robot motion*—a restricted space must be established by installing a limiting device that minimizes the total distance a robot can travel. Limiting robot motion may be accomplished by means integral to the robot or by external limiting devices. Limiting devices redefine the space for a robot to perform its task. The restricted area is made smaller than the maximum space. The robot's movement zone should be restricted to the range of motion a particular operation or installation requires; and
- (5) *presence sensing safeguarding devices*—are used to detect intrusion into an area where a hazard may exist and include
- (a) photoelectric cells;
 - (b) pressure-sensitive mats; and
 - (c) light or sound curtains.

Subsections 384(2) through 384(8)

Repealed

Section 385 Teaching a robot

Often a robot is programmed by being physically guided by an operator through a desired sequence of tasks. Teaching may be done by:

- (a) use of a TEACH pendant—a control box that resembles a TV remote control. The operator uses it to walk the robot through the program steps slowly and recording each step; or
- (b) the operator taking the end of the robot arm and leading it through a pattern of motions.

In either case, the worker doing the teaching will be within the restricted work envelope of the robot.

For more information



Robotics—Overview, U.S. Department of Labor, Occupational Safety and Health Administration



CSA Standard Z434-03 (R2008), *Industrial Robots and Robot Systems—General Safety Requirements*, Canadian Standards Association, 2003

Part 26 Ventilation Systems

Highlights

- Section 386 lists the circumstances under which a mechanical ventilation system is typically used to control worker exposure to hazardous substances or atmospheres.
- Section 387 requires employers to have ventilation systems designed, installed and maintained in accordance with established engineering principles.

Requirements

Section 386 Application

If a mechanical ventilation system is chosen as a method of controlling worker exposure to a contaminant, dust or hazardous atmosphere, the system must meet certain minimum requirements for design, maintenance and operation. While this Part specifies minimum requirements, employers are free to exceed them.

Section 387 Design

Subsection 387(1) Design

The design of a mechanical ventilation system depends on workplace conditions. These conditions include the types of substances and processes used and design of the building. The requirement to design, install and maintain the mechanical ventilation system using established engineering principles allows the employer the flexibility to use equipment that best suits the workplace conditions.

Guides that are commonly used and represent established engineering principles associated with ventilation system design include, but are not limited to:



Industrial Ventilation—A Manual of Recommended Practices, published by the American Conference of Government Industrial Hygienists (ACGIH);



Standard 62-2001, *Ventilation for Acceptable Indoor Air Quality*, published by the American Society of Heating, Refrigeration and Air Conditioning Engineers Inc. (ASHRAE).

Factors that need to be considered in the design, maintenance and installation of a ventilation system include the following:

- (a) type of contaminant(s);
- (b) concentration of contaminant(s);

- (c) nature of tasks being performed at the workplace;
- (d) location of equipment and workers at the workplace;
- (e) building ventilation systems already in place;
- (f) layout of the building and specifics of the work area such as layout, equipment, furnishings, etc.;
- (g) location of ventilation exhausts and intakes;
- (h) physical parameters such as temperature, pressure and humidity at the workplace, volume of make-up air required, etc.; and
- (i) types and configurations of equipment, ducting and other components of the ventilation equipment, including fans.

Mechanical ventilation systems must be maintained and operated according to the manufacturer's specifications. This ensures that the systems provide a safe and healthy breathing environment for workers.

Subsection 387(2)(a) Exhausted air re-entering the workplace

One of the most important considerations in the design and operation of a ventilation system is to ensure that exhausted air does not re-enter the workplace, particularly if the purpose of the system is to remove contaminants. Issues to consider include the location of exhausts relative to air intakes and existing and foreseeable air circulation patterns outside the building.

Subsection 387(2)(b) Make-up air

An adequate volume of make up air must be provided to ensure that the effectiveness of the ventilation system, or other ventilation systems in the building, is not compromised.

The design of a ventilation system must consider both the supply and exhaust systems. If the quantity of air exhausted from the work area is greater than the quantity of air supplied, the interior of the building will be at negative pressure. This will cause the uncontrolled entry of air into the building through cracks, walls, windows and doorways. This can reduce system performance, possibly leading to loss of contaminant control and a potential health hazard. If make up air is not provided, ventilation system fans may be running without moving any air or removing contaminants.

Subsection 387(2)(c) Recirculating systems

If it is not practicable to exhaust a ventilation system to the outdoors, a recirculating air system may be needed. Examples of recirculating air systems include portable fume hoods used for welding, electrostatic precipitators, and dust filters. If the air passing through the system must be recirculated back into the building, care must be taken to ensure that this does not result in an increased concentration of contaminants in other parts of the building.

For this reason, the concentration of a contaminant exhausted from the recirculating system must not exceed, where reasonably practicable, 10 per cent of its occupational exposure limit. If the system cannot be designed to reduce the exhausted contaminant's concentration to less than 10 per cent of its occupational exposure limit, the employer must be able to provide a reasonable justification.

Section 388 Safety

Subsection 388(1) Warning workers

If a mechanical ventilation system fails, a method of immediately warning and protecting workers must be in place. The warning system can be as simple as streamers of tissue paper attached to a fume hood or as sophisticated as audible alarms and warning lights. Any effective system may be used as long as workers understand the warning.

Subsection 388(2) Training

Section 21 requires that if a worker may be exposed to a harmful substance at the work site, the employer must establish work procedures that minimize exposure and ensure that each worker affected is trained in the procedures, uses the training and is instructed regarding the health hazards associated with exposure to the substance.

As required by section 13 of the *OHS Regulation*, if an employer develops work procedures, the employer must ensure that all workers affected are made familiar with the procedures before they start work. If workers are required to use safety equipment or personal protective equipment, the employer must ensure they are trained in the application, care, use, maintenance and limitations of that equipment.

Workers who use or depend on a ventilation system for their health and safety must be trained to operate it properly and the procedures to follow if the system malfunctions. Workers responsible for system maintenance need to be trained in its proper operation and the manufacturer-recommended maintenance procedures.

Part 27 Violence and Harassment

Highlights

For the purposes of the *OHS Code* (as defined in the *OHS Act*):

- Violence, whether at a work site or work-related, means the threatened, attempted or actual conduct of a person that causes or is likely to cause physical or psychological injury or harm, and includes domestic or sexual violence.
- Harassment means any single incident or repeated incidents of objectionable or unwelcome conduct, comment, bullying or action by a person that the person knows, or ought reasonably to know, will or would cause offence or humiliation to a worker, or adversely affects the worker's health and safety, and includes
 - conduct, comment, bullying or action because of race, religious beliefs, colour, physical disability, mental disability, age, ancestry, place of origin, marital status, source of income, family status, gender, gender identity, gender expression and sexual orientation, and
 - a sexual solicitation or advance,but excludes any reasonable conduct of an employer or supervisor in respect of the management of workers or the work site.
- Section 389 specifies that work site violence and work site harassment are hazards for the purposes of hazard assessment under Part 2.
- Sections 390 to 390.7 require employers to develop a violence prevention plan which includes violence prevention policy and procedures and a harassment prevention plan which includes a harassment prevention policy and procedures.
- Section 391 requires employers to train workers on various aspects of addressing and preventing violence and harassment.
- Section 391.1 requires investigation of incidents of harassment and violence.
- Sections 391.2 and 392 require employers to ensure workers affected by workplace violence or harassment are advised to consult a health professional of their choice and, if treatment takes place during regular work hours, not to deduct any pay or benefits from the worker for the time spent attending treatment.
- Sections 392.1 to 392.6 address retail fuel and convenience store worker safety requirements.

Requirements

Section 389 Hazard assessment

Like all workplace hazards, the presence of violence and harassment at a work site puts the workers at risk of harm. In the cases of violence and harassment this harm can be of a physical and/or psychological nature. In occupational health and safety prevention is preferable to intervention. Completion of a hazard assessment is a logical and organized method of identifying existing and potential workplace hazards, allowing the employer to better manage these hazards. The hazard assessment required by Part 2 of the *OHS Code* must include the possibility of injury to workers from violence and harassment at the workplace.

Before they can manage workplace violence and harassment, an employer must first determine and understand the nature and extent of the problem. Employers need to consider such factors as the workers they hire, potential sources of violence and harassment, work processes and the physical environment, and the level of organizational commitment towards the prevention of workplace violence and harassment. Considering each of these factors allows an employer to identify:

- aspects of the workplace that may increase the likelihood of violence and harassment;
- those individuals at highest risk; and
- the need for controls.

The content of the prevention plans will be different from one work site to the next, as employers vary in size, the type of work they do, corporate culture, and resources.

Information specific to performing hazard assessments involving violence and harassment can be found in the OHS Bulletin *Preventing Violence and Harassment at the Workplace*. This Bulletin also provides some practical suggestions regarding prevention policies and procedures, and identifies resources that may help.

For more information



Preventing Violence and Harassment at the Workplace

<http://work.alberta.ca/documents/WHS-PUB-VAH001.pdf>



Harassment and violence in the workplace—OHS requirements for workers and employers, 2018

<https://www.alberta.ca/assets/documents/OHS-workplace-violence-harassment.pdf>



Violence in the Workplace—Canadian Centre for Occupational Health and Safety, 2017

<http://www.ccohs.ca/oshanswers/psychosocial/violence.html>

Section 390 Violence prevention plan

Employers must develop and implement a violence prevention plan in cooperation with the health and safety committee (HSC) or the health and safety representative (HS representative), if they are required to have one. If the employer does not have a HSC or HS representative, the employer must consult with affected workers when developing the plan.

Having a clear prevention plan creates a supportive work environment where violence is not tolerated. The violence prevention plan must include a violence prevention policy and violence prevention procedures.

Section 390.1 Violence prevention policy

The purpose of the policy is to ensure that:

- workers are aware of and understand that acts of violence are considered serious and corrective action will be taken;
- those exposed to incidents of violence know that their privacy will be protected; and
- workers are aware that the policy does not restrict their access to recourse under other laws.

An employer's written violence prevention policy must, at a minimum, contain the following statements.

(a) **A statement of commitment**

This statement affirms the employer's commitment to eliminating the hazard of violence, or controlling it if elimination is not reasonably practicable. The policy expresses the employer's values and beliefs with respect to workplace violence. It should include ongoing support for a workplace that is free of violence and state that any act of violence is unacceptable.

(b) **A statement pledging to investigate and take corrective action**

In this statement the employer commits to investigating any incidents of violence and to take corrective action to address the incidents. An example of corrective actions could be the implementation of prevention measures based on lessons learned from the incident investigation.

(c) **A statement protecting privacy**

The employer will state that the circumstances related to an incident of violence and the names of the complainant, the alleged perpetrator and any witnesses will not be disclosed except:

- where necessary to investigate the incident or take corrective action;
- to inform the parties involved in the incident of the investigation results and any corrective actions to be taken;

- where necessary to inform workers of a specific or general threat of violence or potential violence; or
- as required by law.

(d) A statement promising disclosure of only the minimum amount of personal information required

This statement declares that when disclosure of personal information is required to inform workers of a specific or general threat of violence or potential violence, the employer will only disclose the minimum amount of personal information necessary.

(e) A statement regarding rights

This states the violence prevention policy is not intended to discourage a worker from exercising their rights to pursue action under any other law. Although the policy guarantees an investigation by the employer, taking part in this investigation will not stop the worker from also exercising their rights in other forums, such as collective agreements or any other provincial or federal law.

An example of a violence prevention policy:

(This organization) believes in the prevention of violence and promotes a violence-free workplace in which all people respect one another and work together to achieve common goals. Any act of violence committed by or against any worker or member of the public is unacceptable conduct and will not be tolerated.

We are committed to

- (a) investigating reported incidents of violence in an objective and timely manner;*
- (b) taking necessary corrective action;*
- (c) not disclose the names of the complainant, the alleged perpetrator, or any witnesses, except*
 - (i) where necessary to investigate the incident and take corrective action, or to inform involved parties of investigation results and actions taken,*
 - (ii) if necessary to inform workers of a threat of violence or potential violence, or*
 - (iii) as required by law; and*
- (d) disclose the minimum amount of personal information required to inform workers of a threat of violence or potential violence.*

This violence prevention policy is not intended to discourage a worker from exercising their rights pursuant to any other law (e.g., contacting police, union grievance, human rights complaint, etc.).

No worker or any other individual affiliated with this organization shall subject any other person to violence.

Section 390.2 Violence prevention procedures

The “procedures,” as distinguished from the policy, outline the methods or processes required to make the policy operate on a day-to-day basis. The procedures may vary considerably from employer to employer depending upon size, role and local conditions.

The written violence prevention procedures must, at a minimum, contain the following.

(a) **Eliminating and controlling the hazard of violence**

States the measures the employer will take to eliminate the hazard of violence, or to control it if elimination of the hazard is not reasonably practicable.

(b) **Information on threats of violence or potential violence**

Provides information about the nature and extent of the hazard of violence at the work site, including information related to specific or general threats of violence or potential violence.

(c) **Procedures for employer disclosure of information**

The procedure the employer will follow if required to disclose information related to an incident of violence, or a threat of violence or potential violence. This procedure must comply with subsections 390.1(c) and (d) (ensuring privacy and restricting personal information disclosure to a minimum).

(d) **Obtaining assistance when violence occurs**

This is the practice for workers to follow to obtain immediate assistance when an incident of violence occurs. These practices could include emergency contact information and procedures.

(e) **Reporting violent incidents**

This is the process for workers to follow when reporting incidents of violence in the workplace.

The procedure should encourage immediate reporting and should clearly indicate who is to receive the report. Each employer needs to determine the appropriate individual(s) depending on the employer’s administrative structure. In cases where conflict of interest may exist, the procedure should identify an alternate recipient in order to ensure impartial consideration. Workers have the right to independently report violence to the police, union, OHS, and or other regulatory body that has jurisdiction to address the matter (e.g., Human Rights Commission where violence is associated with a protected human right). Employers may also include provisions for investigations to be completed by external investigators who are not connected to the employer.

Note: Employer investigation requirements are addressed under Section 391.1.

(f) Documenting and investigating incidents, and preventing violence

The procedure for the employer to document and investigate incidents of violence and for implementing any measures to prevent violence identified by the investigation.

After providing assistance during or immediately after an incident, filing a report should be the next step in the process. This requires the complainant and witnesses to carefully record details of the incident including the date and time, nature of the violence and names of those who may have witnessed the violence. A specific form may be developed for reporting purposes.

Before an incident occurs, the parties who will conduct investigations must be trained. The investigation should take place as soon as possible after an incident. The investigation procedure could specify methods for gathering evidence such as inspection of the scene and interviews with those involved. In the investigation consider safety of workers and how confidentiality will be maintained. Processes to implement any measures to eliminate or control the hazard of violence identified during the investigation should also be included in the violence prevention procedures.

(g) Informing parties involved in an incident

This procedure provides detail on how the employer will inform the parties involved in an incident of violence of the results of the incident investigation and any corrective action to be taken to address the incident.

The procedure should outline how and when the information will be shared; and identifying the involved parties to be informed. The procedure must also provide guidance on confidentiality and disclosure of information as required in section 390.2(c).

Section 390.3 Domestic violence

An employer must take reasonable precautions to protect a worker, and any other people at the work site who may be affected, when they become aware that the worker may be exposed to domestic violence at the work site.

Domestic violence can be a single incident or a pattern of behaviour where one person attempts to gain power and control over another with whom they have or had a personal relationship. This can range from subtle, coercive forms of control to violent acts that result in physical harm or death. Examples may include physical violence, sexual abuse, financial control, emotional and psychological intimidation, verbal abuse, stalking and using electronic devices to harass and control.

Domestic violence becomes a workplace hazard, and is no longer limited to a personal issue, when it occurs or spills over into the workplace, or there is reason to believe that it

could occur at the workplace. It may put the targeted worker at risk, and may pose a threat to co-workers.

Example: If a worker informs their employer that an ex-spouse has made threats towards them or has displayed violent behavior and the worker believes that this person poses a risk to the health and safety of themselves and their co-workers, the employer must put precautions in place to prevent the ex-spouse from accessing the work site. The employer must inform workers on site of the threat of potential violence while preserving privacy as much as possible. Precautions could include removing the worker involved from public view and enhancing security measures.

Section 390.4 Harassment prevention plan

A harassment prevention plan must be developed and implemented by the employer in cooperation with the HSC or the HS representative, if the employer is required to have one. If the employer is not required to have a HSC or HS representative, then the employer must consult with affected workers.

A harassment prevention plan supports a positive work environment where harassment is not tolerated. The plan must include a harassment prevention policy and harassment prevention procedures.

Section 390.5 Harassment prevention policy

Workers are more likely to report incidents where there is a clear and well-understood policy.

The policy makes sure worksite parties are aware harassment is a serious issue which will result in corrective actions, ensures information about incidents of harassment are kept private and maintains worker rights under other legislation.

An employer's written harassment prevention policy must, at a minimum, contain the following statements.

(a) **A statement of commitment**

This statement declares the employer's commitment to eliminating the hazard of harassment, or controlling it if elimination is not reasonably practicable. The employer can use the policy to communicate their values and beliefs with respect to harassment in the workplace. The policy should declare the employer's support for a harassment-free workplace and state that acts of harassment are unacceptable.

(b) **A statement pledging to investigate and take corrective action**

The employer must commit to investigate any incidents of harassment and to take corrective action to address the incidents. Corrective actions could include education

for the perpetrator, providing additional training for staff or providing access to a counselling service.

(c) A statement protecting privacy

In the policy the employer must state that they will not disclose the circumstances related to an incident of harassment, the names of the complainant, the alleged perpetrator or any witnesses except:

- where necessary to investigate the incident or take corrective action;
- to inform the parties involved in the incident of the investigation results and any corrective actions to be taken; or
- as required by law.

(d) A statement regarding rights

In the policy the employer must state that the harassment prevention policy is not intended to discourage a worker from exercising their rights to pursue action under any other law, including the *Alberta Human Rights Act*. Individuals have the right to pursue their concerns through alternate forums which may be through a collective agreement, or any provincial or federal law (e.g., criminal complaint when the actions constitute criminal harassment).

An example of a harassment prevention policy:

(This organization) believes that harassment is a serious issue which has a negative effect on workplace culture. We are dedicated to promoting a harassment-free workplace based on mutual respect and cooperation, and to the prevention of harassment. Any act of harassment committed by or against any worker or member of the public is unacceptable conduct and will not be tolerated.

We are committed to

- (a) investigating reported incidents of harassment in an objective and timely manner;*
- (b) taking necessary corrective action;*
- (c) not disclosing the names of the complainant, the alleged perpetrator, or any witnesses, except*
 - (i) where necessary to investigate the incident and take corrective action, or to inform involved parties of investigation results and actions to be taken, or*
 - (ii) as required by law.*

This violence prevention policy is not intended to discourage a worker from exercising their rights pursuant to any other law (e.g., contacting police, union grievance, etc.), including the Alberta Human Rights Act.

Section 390.6 Harassment prevention procedures

Prevention procedures encourage those experiencing harassment to report incidents and ask for support.

The procedures should clearly indicate who is to receive the written complaint. Each employer needs to determine their reporting processes based upon the employer's administrative structure. In cases where a conflict of interest may exist, such as when a worker is filing a complaint against their direct supervisor, the procedure should identify an alternate recipient to intake the complaint to ensure that the complaint is treated impartially. Employers may also bring in external investigators to complete harassment investigations.

A work site's harassment prevention procedures must include, at a minimum, the following.

(a) **Reporting incidents of harassment**

This is the process for workers to follow when reporting harassment.

Procedures should encourage workers to report harassment immediately. The report should include details of the alleged harassment, the names of any alleged perpetrators or witnesses, and any actions taken so far to alleviate the harassment.

The procedure should clearly designate the individual(s) who will receive reports of harassment. Employers will determine the appropriate individual and should identify an alternate, in cases where a conflict of interest may arise, to ensure impartiality.

Note: Employer investigation requirements are addressed under Section 391.1.

(b) **Documenting and investigating incidents, and preventing harassment**

The procedure for the employer to document and investigate incidents of harassment and for implementing any measures to prevent harassment identified by the investigation.

The employer must establish a process to document any incidents of harassment. The complainant(s), alleged perpetrator(s) and any witnesses should carefully record the details, including the date and time, what happened and names of any witnesses. A specific form may be developed for a statement.

When establishing investigation procedures, consider:

- who will conduct investigations and what training will they receive;
- what investigation steps will take place once the employer becomes aware of a harassment issue; and
- how confidentiality will be maintained.

There must also be a procedure to implement any measures to eliminate or control the hazard of harassment which were identified during an investigation.

(c) Informing parties involved in an incident

The employer is required to establish procedures on how they will inform the parties involved in an alleged incident of harassment of the results of the investigation and any corrective action to be taken in addressing the incident.

The procedure must outline how and when the information will be shared, who it will be shared with, and how confidentiality will be maintained.

Section 390.7 Review of plans

An employer is required to review both the violence and harassment prevention plans in cooperation with their HSC or the HS representative. If the employer is not required to have an HSC or HS representative, they must review the plans with affected workers.

The violence prevention plan must be reviewed when:

- an incident of violence occurs;
- whenever the HSC or HS representative recommends a review; or
- at a minimum, every 3 years.

The harassment prevention plan must be reviewed when:

- an incident of harassment occurs;
- whenever the HSC or HS representative recommends a review; or
- at a minimum, every 3 years.

The review will evaluate the effectiveness of the policies and procedures, and identify any areas needing improvement.

Section 391 Training of workers

Employers must ensure workers receive training in:

- recognition of workplace violence and harassment;
- the policies, procedures and arrangements developed and implemented by the employer to eliminate or control the hazards of violence and harassment;
- the appropriate response to violence and harassment, including procedures for obtaining assistance; and
- the procedures for reporting, investigating and documenting incidents of violence and harassment.

This training must explain (or review) the employer's violence and harassment policies and procedures, and describe the employer's expectations of workers and their behaviour at the workplace.

Section 391.1 Investigation and reporting of incidents

Sections 40(5)(b) to (d), (7) and (8) of the *OHS Act* regarding the investigation of incidents, apply to incidents of violence and harassment.

Accordingly, if an incident of violence or harassment occurs, an employer or prime contractor must:

- investigate the circumstances surrounding the incident;
- prepare a report outlining the circumstances and the corrective action taken, if any, undertaken to prevent a recurrence;
- have a copy of the report available to provide to an officer on demand; and
- retain the report for at least two years after the incident.

Despite s.391.1, an incident of violence or harassment may need to be reported to Alberta Labour, if it meets any of the criteria established under section 40(2) (results in a fatality or an injury requiring hospitalization) or 40(5) (results in an injury requiring more than first aid intervention or the incident had the potential of resulting in a serious injury) of the *OHS Act*.

The report completed by the employer is not admissible as evidence in a trial arising out of the incident (s.40(8) *OHS Act*), or any other action defined in the *Alberta Evidence Act*, except in matters where perjury has occurred or a party involved in the incident provides contradictory evidence.

Incidents need to be documented, promptly investigated and remedied in a timely and effective manner. Intervention needs to address the rights and responsibilities of the victim and alleged abuser. Possible consequences of substantiated violence and harassment should be included in an organization's policy and procedures. Details concerning investigation are outlined in the OHS Bulletin *Preventing Violence and Harassment at the Workplace*, in the section titled "Intervention and follow-up" and linked at the bottom of this page.

Section 53 of the *OHS Act* also applies to violence and harassment, enabling an officer to investigate such incidents.

Section 391.2 Treatment or referral


When a worker reports an injury or adverse symptom resulting from an incident of violence or harassment, the employer must ensure that the worker is advised to consult a health professional of their choice.

Victims of incidents of workplace violence or harassment and other workers who may have been exposed to an incident may require emotional support and reassurance. This subsection requires the employer to ensure that victims and other exposed workers are advised to consult a health professional of the worker's choice for treatment or referral.

Section 392 Entitlement to pay

If an injured employee attends treatment sessions during regular working hours, the employer at the work site where the triggering incident of violence or harassment occurred may not make any deductions from that worker's pay or benefits for the time they were at the appointment.

For more information

 *Harassment and violence in the workplace—OHS requirements for workers and employers*
<https://www.alberta.ca/assets/documents/OHS-workplace-violence-harassment.pdf>

 *Preventing Violence and Harassment at the Workplace*
<http://work.alberta.ca/documents/WHs-PUB-VAH001.pdf>

 *Manitoba Workplace Safety and Health-Guideline for Preventing Harassment and Violence in the Workplace*
<https://digitalcollection.gov.mb.ca/awweb/pdfopener?smd=1&did=18258&md=1>

 *Workplace Violence and Workplace Harassment—Ontario*
<https://www.labour.gov.on.ca/english/hs/topics/workplaceviolence.php>

 *Bullying & Harassment—BC*
<http://worksafebc.com/bullying>

Retail fuel and convenience store worker safety

Section 392.1 Retail fuel and convenience store worker safety application

The requirements of Sections 392.2 through 392.6 apply to gas stations, other retail fueling outlets and convenience stores. Other retail fuel outlets could include car washes or automotive shops that dispense fuel, convenience stores that dispense fuel, and gas bars. Fuel includes gasoline, diesel fuel, natural gas and propane.

Please note that the other more general sections of Part 27 apply to all workers regardless of the industry within which they work.

Gas Stations and Other Retail Fueling Outlets

Sections 392.2 through 392.6 apply to gas stations and other retail fueling outlets, where *workers are ordinarily present during business hours*.

Convenience Stores

The requirements of Sections 392.2 through 392.5 also apply to convenience stores, whether or not they dispense fuel.

A convenience store is a small retail business that stocks a limited selection of everyday items such as groceries, snack foods, confectionery, soft drinks, tobacco products, over-the-counter drugs, toiletries, newspapers and magazines. Larger convenience stores may sell quite a broad range of items including perishables such as bread, milk or limited amounts of produce. The selection, however, is still limited compared to a supermarket or grocery store. In many convenience stores, only one or two choices of a specific product type are available.

Stand-alone cigarette stores (as are sometimes associated with a grocery store) are considered to be a type of convenience store. A tobacconist, like other retailers selling a limited range of specialty items, is considered to be a specialty store, not a convenience store.

The requirements do not apply to grocery stores. Grocery and convenience stores sell many of the same products and offer similar services. Table 27.1 summarizes characteristics that can be used to tell the differences between the two.

Table 27.1 Comparing grocery and convenience stores

Grocery store	Convenience store
Offers a wide variety of products, including perishable items such as meat, produce and dairy, along with general merchandise such as cleaning supplies, paper products and health/beauty care products. Often many different name brand products are sold.	Offers a more limited selection of products, typically high-convenience items and basic food products that can include limited perishables such as bread, milk and some produce.
Tend to be larger in size.	Tend to be smaller in size.
Generally have shorter hours of operation and are closed on some holidays.	Offer longer hours of operation, typically 24 hours, seven days a week and are open on most holidays.
Few grocery stores sell gasoline. If they do, gasoline sales tend to be at a gas bar located some distance away from the grocery store but still on the same property.	Up to 80 per cent of convenience stores sell gasoline.

Section 392.2 Additional requirements for violence prevention plan

Sections 392.2 through 392.5 present detailed requirements for gas stations, retail fueling outlets, and convenience stores that add to the more general requirements of Section 390. Employers must still comply with all the other violence requirements of this Part. This includes considering workplace violence as a hazard (Section 389), developing policies and procedures (Section 390), instructing workers, responding to incidents (Section 391),

and ensuring no deductions are made to workers' pay and benefits during treatment (Section 392).

According to Section 392.2 *OHS Code*, applicable employers must have additional components in their violence prevention plan. These requirements apply regardless of time of day and the number of workers present. Alberta's violence prevention plan for retail fuel and convenience stores is based on similar programs used in British Columbia, Saskatchewan, Northwest Territories and Nunavut.

Violence prevention plans have been shown to be the most effective way of reducing crime at fuel and convenience stores.^{1,2,3} Research into the effectiveness of barriers between workers and customers shows mixed results.^{1,4,5} Research into the use of multiple workers has not shown a reduced risk of robbery.^{4,6,7,8,9}

The National Association of Convenience Stores in the United States provides guidance on the general components of a violence prevention plan.

- **Territoriality**—use physical features to show ownership over the property. Define the territory with landscaping, fencing, and signage. Remove graffiti promptly. Keep the store and parking area clean and litter-free.
- **Access control**—make access to and from the site inconvenient for criminals. Reduce the number of entrances and exits to the store and parking lot. Close off some

¹ Loomis, D.; Marshall, S.W.; Wolf, S.H.; Runyan, C.W.; Butts, J.D. Effectiveness of Safety Measures Recommended for Prevention of Workplace Homicide, *Journal of the American Medical Association*, 287(8):1011-1017 (2002)

² Casteel, C.; Peek-Asa, C.; Greenland, S.; Chu, L.D.; Kraus, J.F. A Study of the Effectiveness of a Workplace Violence Intervention for Small Retail and Service Establishments, *Journal of Occupational and Environmental Medicine*, 50(12):1365-1370 (2008)

³ Erickson, R.J. and Stenseth, A., Retail Security: Lessons Learned from Convenience Store Research, Chapter 19, *Handbook of Loss Prevention and Crime Prevention*, Fennelly, Lawrence J. editor, Butterworth-Heinemann (2004)

⁴ Hendricks, S.A.; Landsittel, D.P.; Amandus, H.E.; Malcan, J.; Bell, J. A Matched Case-Control Study of Convenience Store Robbery Risk Factors, *Journal of Occupational and Environmental Medicine*, 41(11): 995-1004 (1999)

⁵ Deloitte, Assessment of Physical Barriers in Support of Working Alone or in Isolation Regulation, Barrier Implementation Pilot Project: Findings and Recommendations, June 2010

⁶ Wellford, C.F.; MacDonald, J.; Weiss, J.C.; Bynum T.; Friedmann, R.; McManus, R.; Petrosino, A. A Multistate Study of convenience Store Robberies, report submitted to the U.S. Department of Justice, 173772 (1999), <https://www.ncjrs.gov/pdffiles1/nij/grants/173772.pdf>, accessed April 11, 2016

⁷ National Association of Convenience Stores, Convenience Store Security Report, accessed April 28, 2016 at <http://www.nacsonline.com/Research/Pages/ConvenienceStoreSecurity.aspx>

⁸ Amandus, H.E.; Hendricks, S.A.; Zahm, D.; Friedman, R.; Block, C.; Wellford, C.; Brensilber, D.; Bynum, T., McManus, R. Convenience Store Robberies in Selected Metropolitan Areas: Risk Factors for Employee Injury, *Journal of Occupational and Environmental Medicine*, 39(5):442-447 (1997)

⁹ Walsh, P.D.; Thornton, W.E.; Kent, D.R. Multiple Staffing to Prevent Robberies Linking Questionable Data to Practical Interventions, *Proceedings of the 2004 Homicide Research Working Group Annual Symposium*, Chicago, IL, V. Pottie Bunge, C.R. Block and M. Lane editors

entrances and exits at night. Install gates, locks or turnstiles. Access control also applies to cash. Use drop safes, limit cash on hand and post signage indicating this.

- **Surveillance**—maximize visibility into and out of the work site. Light up the store and parking areas. Remove posters from windows to provide clear sight lines. Remove displays that block visibility to the cashier from the outside. Use video surveillance. Train workers to recognize potential threats and report any issues.

These components are reflected in the additional requirements of Alberta's violence prevention plan for retail fuel and convenience stores.

Subsection 392.2(b) and parts of 392.2(f)(i) apply only to gas stations, retailing fueling outlets and conveniences stores open between 11:00 p.m. and 5:00 a.m. All other sections apply to all to gas stations, retailing fueling outlets and conveniences stores.

Subsection 392.2(a) Written procedure for safe cash handling

Applicable employers must develop and implement written safe cash-handling procedures that include steps to minimize the amount of cash readily accessible to a worker. Limiting access to cash may help to protect workers by making the store a less attractive target for criminal activity.

The written procedures should include the following:¹⁰

- (1) Locate cash handling areas away from entrances and exits.
- (2) Locate sales counters to be clearly visible from inside and outside the work site.
- (3) Keep as little cash in the cash register as possible.
- (4) Remove large bills from the register and store them somewhere secure and out of site, for example in a drop box or strong room.
- (5) Only one cash register should be used during certain (often late-night) hours of operation. The cash trays of unused registers should be left open and visible.
- (6) Guidelines for making bank deposits:
 - (i) avoid making bank deposits at night;
 - (ii) vary the time and route for making deposits;
 - (iii) carry money in unmarked bags or containers so that it is not obvious that money is being transported; and
 - (iv) make deposits with a co-worker, where practical. The co-worker should face away from the depository to watch other people in the area.

¹⁰ © WorkSafeBC (Workers' Compensation Board), used with permission.

Subsection 392.2(b) Time lock safe and limiting quantities of high-value items

This subsection only applies to work sites open between 11:00 p.m. and 5:00 a.m.

(i) Time lock safe

A work site open to the public between 11:00 p.m. and 5:00 a.m. must have a time lock safe on site. The safe cannot be opened by any worker who is working between, at minimum, these hours. This includes managers or supervisors. The intent is to make sure that no worker on the night shift can open the safe, reducing the likelihood of criminals forcing or intimidating a worker to open the safe. If there are multiple safes on the work site containing high-value items, none of the safes can be opened by any worker between, at minimum, 11:00 p.m. and 5:00 a.m. The employer can make this period longer, for example 10:00 p.m. to 7:00 a.m., but cannot make it any shorter.

The time lock safe may be a type of drop safe or time delay safe. If a drop safe is used, any worker working between, at minimum, 11:00 p.m. to 5:00 a.m. must not be able to open it. A time delay safe can be used as a time lock safe if the time delay is set so the safe cannot be opened by a worker between, at minimum, 11:00 p.m. and 5:00 a.m.

A time delay safe that dispenses limited amounts of cash without the safe opening is acceptable if:

- (a) the total amount of cash dispensed, and the time delay setting to dispense the cash, are strictly limited to meet operational needs; and
- (b) these operational needs have been determined by the employer based on a reasonable assessment of the cash required.

(ii) Limit quantities of accessible high-value items

High-value items include cash, lottery tickets, tobacco, and anything else that increases the risk of theft from a store. The quantities of high-value items visible and accessible to members of the public must be limited between, at minimum, 11:00 p.m. and 5:00 a.m.

The quantities of high-value items available to the public during this time period should be based on customer demand and predicted sales volumes. For example, over a two-week period, the employer could monitor the average number of lottery tickets and tobacco products sold between 11:00 p.m. and 5:00 a.m. This is the quantity of product that would be available for sale.

(iii) Storing remaining high-value items

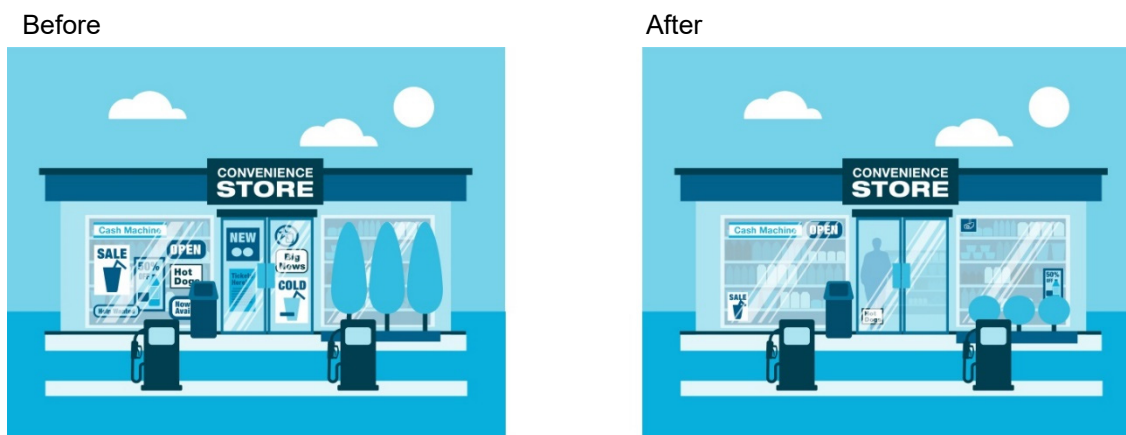
Remaining high-value items must be placed in a time lock safe or stored safely elsewhere. Examples of “stored safely elsewhere” may include a strong room, a locked storage room or a locked cage within a storage room. Locking away high-value items makes the store a less attractive target for thieves.

Subsection 392.2(c) Maintain good visibility into and out of the work site

Sight lines into and out of the work site should be clear of materials posted on windows or doors. Visibility should not be reduced by shelving units or product displays positioned inside or outside the store. The best placement of required posters and displays depends on the layout of the store. Objects outside the store such as trees, shrubs, and garbage bins should not block the view through the windows or doors. It should be easy for someone standing at the sales counter to see and be seen. A good guideline is that two-thirds of the windows should be clear.

To the extent possible, opaque or shaded window and door treatments should be avoided.

Figure 27.1 Improving sight lines



Subsection 392.2(d) Limit access by the public to the interior of any buildings

Reduce the number of ways into and out of buildings at the work site. Keep only one main door available for customers to use, especially at night and whenever a worker is working alone. The unlocked door should be the main one, visible from the sales counter and captured by video camera. Other entrances such as loading bays and emergency doors should be secured against unauthorized entry. These entrances must remain functional and accessible. This includes being free of clutter and waste materials.

If there is an adjacent business from which customers can enter the gas station or convenience store such as an attached restaurant, those entrances should be closed and locked when the adjacent business is closed.

Subsection 392.2(e) Video surveillance monitoring

The work site must be monitored by video surveillance. Surveillance cameras should be visible to the public and positioned to most effectively monitor workers and their interactions with customers. Key areas to monitor are the sales counter, the entrance/exit, and areas of the store not visible from the sales counter. The hazard

assessment required by Part 2 of the *OHS Code* may help the employer decide where to place cameras. This may include outside locations such as the parking lot.

Cameras installed outdoors can help workers check on activities from a safe location indoors.

Video surveillance monitors must be located where workers can view them. Workers can then safely take action if necessary based on what they see.

The surveillance system allows incidents to be easily reviewed by the employer, law enforcement officials and others as needed.

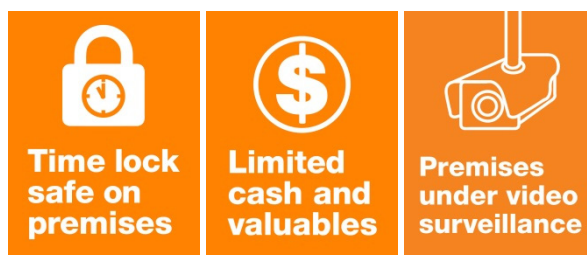
As per the *OHS Code*, Part 3, the video surveillance system must be maintained according to the manufacturer's instructions and tested regularly.

Subsection 392.2(f) Signs at the work site

- (i) If the work site is open to the public between 11:00 p.m. and 5:00 a.m., signs made visible to the public are required that indicate
 - the safe on the premises is a time lock safe that cannot be opened during the hours specified on the sign(s); and
 - the quantity of high-value items such as cash and lottery tickets at the work site is limited.
- (ii) All work sites require signs visible to the public indicating that the premises are monitored by video surveillance.

The purpose of the signs is to make the store a less attractive target for criminal activity. Signs tell would-be criminals that cash is difficult to access, is limited in quantity and a video camera records everything going on in the store. Examples of typical signs are shown in Figure 27.2.

Figure 27.2 Examples of typical signs



The employer decides on the exact wording used on the signs. The meaning of the signs must be clear. The signs should not obstruct sight lines into or out of the building.

Subsection 392.2(g) Monitored personal emergency transmitter

A worker working alone must be provided with a personal emergency transmitter (PET) that is monitored by the employer or their designate. The designate can be a security

company, a supervisor, another worker, or some other person designated by the employer. Monitoring ensures that assistance can be dispatched in case of an emergency. Whoever is responsible for answering a call for help must be able to respond immediately.

The transmitter is a critical piece of equipment for a worker needing help. To make sure it is working properly, the transmitter must be tested regularly according to the manufacturer's instructions.

The transmitter must have a panic button or other means that allows the worker to request immediate help. Some devices offer a "person down" feature that sends an emergency help request if the worker wearing the device does not move for a pre-set period of time.

Section 392.3 Additional training required

In addition to the instruction required by Section 391, the employer must train workers in all aspects of the violence prevention plan. To be effective, the training must provide information or explanation to the worker and require a practical demonstration that the worker has acquired knowledge or skill related to the subject matter. Simply having a worker read through a manual and sign a form to indicate that they have been "trained" is inadequate. This does not meet the intent of the legislation.

Training must:

- (a) provide the staff the information they need to do their jobs safely and follow the procedures to keep the store running smoothly;
- (b) be an ongoing process in which both staff and management have input;
- (c) include reinforcement, positive recognition for jobs well done, and constructive corrections until the job is consistently done safely and well; and
- (d) refresher training must be given whenever there are changes to the way things are done or if safety rules are not being followed consistently.

Training can mean all types of things and range from short staff meetings to in-person courses. There are many training methods, but all must result in the worker acquiring skills or knowledge. All training activities should be documented and the understanding/competence of the person being trained should be assessed.

Employers are required to keep records of employee training. This includes keeping notes about meetings, orientation sessions for new staff, and any situations in which employers communicate with staff about expectations for how they should do their jobs.¹¹

¹¹ Adapted from Safe Community Retailer Program—Program Guide (Saskatchewan Edition V2)
<http://thewcsa.com/sites/default/files/Program-Guide-Saskatchewan-Edition-2015.pdf>

Section 392.4 Review of violence prevention plan and worker training

The employer must review and, if necessary, revise, the violence prevention plan and training provided to workers. This review must happen:

- (a) every three years; and
- (b) whenever there is a change of circumstances that may affect the health and safety of workers.

Examples of workplace changes that could trigger a review include construction, renovations, or other changes in a store's design or layout. These physical changes could restrict visibility into and out of the store, affect video camera sight lines, or affect the ability of workers to safely respond to a potentially violent situation.

Other possible changes include changing store hours or adding new services or product lines that affect customer and sales volumes. Examples include adding a coffee/food station or cash machine.

Section 392.5 Personal emergency transmitter

A worker working alone must wear their personal emergency transmitter at all times during their shift. The transmitter might be the only means of getting help if the worker cannot get to a telephone. Examples of such situations include a personal medical emergency or getting injured in a storeroom.

Section 392.6 Mandatory fuel prepayment

Subsection 392.6(1) Mandatory fuel prepayment

The mandatory fuel prepayment requirement applies 24 hours a day, seven days a week to gas stations and other retail fueling outlets such as car washes or automotive shops that dispense fuel, convenience stores that dispense fuel and gas bars. The requirement applies to both full service and self-service stations. Fuel includes, but is not limited to, gasoline, diesel fuel, natural gas and propane.

The requirement applies regardless of the number of workers assigned and working at any given time at the work site. The prepayment requirement applies to fuel dispensed directly to a vehicle or boat (as in the case of a temporary, seasonal fuel dispensing outlet), as well as fuel dispensed to a portable container, such as a small-volume gasoline container or propane cylinder.

Methods of prepayment

Fuel prepayment includes pay at the pump or prepayment in the store. The employer determines which prepayment method to offer and can offer a combination of pay at the

pump and in-store prepayment options. Employers may consider other factors beyond safety, including fraud prevention, when deciding which in-store prepayment options will be offered.

Pay at the pump

Where available, customers can use a credit or debit card at the pump before fueling to preauthorize their purchase.

At gas kiosk or in-store

Prepay with cash, credit card or debit card—customers may prepay by cash, credit card, or debit card at a payment kiosk or in the store. The customer determines the amount of fuel to be purchased, then immediately pays for it. The payment transaction must be completed before fueling begins. The pump is either programmed to shut off at the preauthorized amount or the worker monitors the fueling process and shuts off the pump from inside the kiosk or store. If a customer prepays for more fuel than the customer dispenses, a refund will be issued. How the refund is issued is a business decision.

Preauthorize a debit or credit card—customers can preauthorize a credit or debit card for a specific amount of fuel with a worker at a payment kiosk or in the store. The pump is either programmed to shut off at the preauthorized amount or the worker monitors the fueling process and shuts off the pump from inside the kiosk or store. After fueling is done, the transaction is completed for the actual amount of fuel dispensed into the vehicle.

Leaving identification—before fueling, customers can leave a government issued ID with a worker. After fueling, customers retrieve their ID and pay for the fuel pumped. It is up to the employer to determine how to ensure IDs remain safe when in the possession of the worker.

Additional options are available if customers are known to the retail fuel outlet employer and workers.

Customer standing account—if the employer and workers are familiar with the customer and the customer does not pose a fuel theft hazard, the retailer and customer may create a standing account. Using a standing account, payment is arranged by agreement.

Fleet cards are a type of standing account.

Subsection 392.6(2) Alternate procedures or equipment

The explanation to subsection 392.6(1) describes approaches commonly used by customers to prepay for their fuel. If the flow of fuel cannot be controlled from inside the store, prepay cannot be enforced. Although the employer may require customers to

prepay for fuel, the hazard of fuel theft remains. In such cases the employer responsible for the fuel outlet can apply to a Director for an approval. A Director is an Alberta Labour employee designated by the Minister with the authority to issue approvals such as the one allowed by this subsection.

The following is the process for applying for an approval.

- (1) Fill out the [Application for Approval \(LI030-1TMP\)](#) form.
 - For additional information on the process for completing the application, please see the [Applying for an OHS approval \(LI030-1\)](#) bulletin.
- (2) Mail or email the application for approval to the Director of Inspections at:
Director of Inspections—Approvals
J.G. O'Donoghue Building Main Floor,
7000 - 113 Street
Edmonton, AB T6H 5T6
E-Mail: lbr.ohsaccept@gov.ab.ca

Any missing or incomplete information may delay processing of the application.

When considering an approval request, the Director must consult, as appropriate, or require the applicant to consult, the joint work site health and safety committee or health and safety representative, and individual workers or other persons respecting the application, if applicable.

Requests are considered on a case-by-case basis. Timelines for a Director to review and consider approval vary and typically take a number of weeks. Requests should be made well in advance of critical project deadlines where possible.


A Director may either grant or deny a request, in whole or in part, after considering all the information provided.

While the application is being processed and assessed, all existing requirements of the OHS legislation must continue to be met.

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- Western Convenience Store Association; and
- WorkSafeBC.

For more information

 *Workplace violence prevention plan employer guide: for retail fuel and convenience stores*
<https://open.alberta.ca/dataset/3a7e08e4-93ce-4827-bd8f-ba9a106d3307/resource/bfb94312-41a5-4551-b3f4-97679f0c8269/download/bill-19-guide-web.pdf>

Part 28 Working Alone

Highlights

- This Part applies if a worker is working alone at a work site where assistance is not readily available if there is an emergency or the worker is injured or ill.
- This Part requires employers to assess their workplace and take preventive measures that eliminate or minimize hazards associated with working alone.
- See Part 27, sections 392.1 to 392.6 for information specific to gas stations, other retail fueling outlets and convenience stores where workers are usually present during business hours.

Requirements

Section 393 Application

Subsection 393(1) Two conditions

The purpose of this Part is to ensure that workers working by themselves can do so safely. As a result, employers have responsibilities to minimize and eliminate risks associated with their workers who work alone.

Four other jurisdictions in Canada (Manitoba, Saskatchewan, British Columbia, and New Brunswick) regulate working alone. All use a regulatory approach very similar to the one adopted in Alberta. Each of those jurisdictions requires employers to conduct a hazard assessment and then to develop controls to reduce the risks associated with the identified hazards. No jurisdiction in Canada prohibits working alone.

The working alone requirements of this Part apply when *both* of the following conditions are met:

- a worker is working by himself or herself; and
- assistance is not readily available to the worker if there is an emergency or the worker is injured or ill.

Workers who work alone can be grouped into five broad categories:

- (1) Workers who handle cash. This includes convenience store clerks, retail and food outlet workers, and taxi drivers.
- (2) Workers who travel away from their base office to meet clients. This includes home care workers, social services workers, and bylaw enforcement officers.
- (3) Workers who do hazardous work but have no routine interaction with customers or the public. This includes workers in the forestry, oil and gas industries.

- (4) Workers who travel alone but have no routine interaction with customers or the public. This includes truck drivers and business people in transit.
- (5) Workers who are at risk of a violent attack because their work site is isolated from public view. This includes security guards and custodians.

A worker is considered to be working alone if the worker works by himself or herself at a work site in circumstances where assistance is not readily available when needed. Employers can eliminate the risk of workers working alone, as well as the need to comply with the working alone requirements if they choose to organize work schedules and procedures to eliminate the need for workers to work by themselves.

If two or more workers of the same employer are working together, the working alone requirements of this Part do not apply. If two or more workers of different employers are working together, the working alone requirements of this Part do not apply as it is reasonable to expect that the workers can provide assistance to one another.

Readily available—three assessment factors

Three factors must be assessed when determining if assistance is “readily available” in the event of an injury, illness or emergency:

- (1) *awareness*—will other persons capable of providing assistance be aware of the worker’s needs?
- (2) *willingness*—is it reasonable to expect that those other persons will provide helpful assistance?
- (3) *timeliness*—will assistance be provided within a reasonable period of time?

This assessment must consider the probability of injury associated with the circumstances of the work, e.g., type of work, location, hazards, etc. If the worker faces hazards that pose a high probability of injury, “readily available” may become “immediately available.” Worker expectations of the availability of assistance increase as the probability of injury associated with the work increases. Employers are reminded that this probability may change over time and with changing workplace conditions.

Example situations

The following examples describe typical workplace situations in very general terms. Circumstances at individual workplaces may vary, influencing whether or not a working alone situation is present.

Example 1:

A worker is the only staff member on duty at Bison Burgers in a food court where other workers are present at nearby food outlets.

Although the worker is by himself or herself, workers present at other food outlets could reasonably be expected to provide or get assistance. The working alone

requirements of the *OHS Code* would not apply in this situation since both conditions described above are not met.

However, a lone worker at a stand-alone food outlet would meet the “working alone” conditions because the worker, if seriously injured due to an accident or as a result of a confrontation with a customer, would have no way of getting assistance.

Example 2:

A worker, equipped with a portable two-way radio or cellular telephone, is working by himself or herself in an area where the worker cannot be seen or heard by persons capable of offering assistance.

The two conditions applicable to working alone apply in this example. The worker is working by himself or herself *and* assistance is not readily available because the worker cannot be seen or heard by persons capable of offering assistance. While it may be part of the solution, the fact that the worker has a portable two-way radio or a cellular telephone is irrelevant when assessing the situation against the two conditions.

Because the two working alone conditions are met, the employer is required to conduct a hazard assessment to identify existing or potential hazards arising from the conditions and circumstances of the worker’s work. The employer must also provide effective radio, telephone or other electronic communication between the worker and persons capable of responding to the worker’s needs. The assessment may show that the portable two-way radio or cellular telephone is effective, or it may suggest that alternatives are necessary.

Example 3:

A worker driving on the highway between Calgary and Edmonton versus a worker driving on a remote abandoned logging road.

It is reasonable to expect that during daytime hours, if a worker driving the highway requires assistance, other highway users will become aware of the need. It is also reasonable to expect that other highway users will willingly provide assistance and do so in a timely manner. The working alone requirements do not apply. However, if the driving occurs throughout the night, particularly on a less travelled roadway, the working alone requirements may apply.

By contrast, it is reasonable to expect that a worker driving on a remote abandoned logging road will not encounter anyone on the roadway. In the event of an injury, illness or emergency, it is unreasonable to expect someone will be aware or willing to provide assistance in a timely manner. The working alone requirements apply.

Example 4:

A nurse on night shift at a psychiatric unit versus a nurse on day shift at a children's unit.

The circumstances of the work in these two situations are quite different, although the worksite—the health care centre—is the same. The availability of assistance in each situation must be assessed individually from the perspectives of awareness, willingness and timeliness. Given the increased risk to personal safety of working the night shift on a psychiatric unit, expectations on the availability of assistance are also greater.

Particularly if the unit is large and few staff are on duty, it may not be reasonable to expect other persons capable of offering assistance to be aware of the nurse's needs. Given the potential hazards to which the nurse is exposed, the timeliness of a response for assistance should be faster. The situation of a nurse on night shift at a psychiatric unit may trigger the working alone requirements.

Example 5:

Table 28.1 describes situations that might be encountered involving two workers, one of which is a tradesperson and the other is the tradesperson's helper.

Table 28.1 Degrees of worker separation

Tradesperson and helper work together continually	Not working alone
Helper passes behind loading bins and is momentarily out of sight or cannot be heard	Not working alone
Helper goes to the next room to get supplies Helper goes to another floor to get supplies Helper goes to outside loading area to get supplies	Workers may be working alone—workers should be aware where each other is and the approximate return time. Factors that may influence whether this is a working alone situation include: <ul style="list-style-type: none">• how long the workers are separated• whether the work poses a high probability of injury• the presence of other persons at the work site
Helper gets into vehicle to go to warehouse to get more supplies	Working alone

Is the worker working alone?

A worker is *not* “working alone” if *all* of the following conditions are met:

- (1) *awareness*—the worker can get the attention of someone capable of providing helpful assistance when the worker requires it, e.g., by maintaining visual contact, staying within the hearing range of others, being continuously monitored by remote surveillance camera, sounding an alarm, making frequent contact with other workers or persons throughout the work period.
- (2) *willingness*—persons expected to provide assistance to the worker must be capable and willing to do so when required. There should be a reasonable expectation that the persons being relied on to provide assistance can and actually will provide that assistance. Depending on circumstances, those persons may need access to a telephone to call Emergency Services (dialling 9-1-1), access to some other type of communication device to call for assistance, or specialized skills, e.g., confined space entry training, the ability to use a self-contained breathing apparatus, etc. The employer must consider these factors when assessing the working alone situation.
- (3) *timeliness*—the required assistance will be provided in a reasonable period of time. What is reasonable depends on factors such as the nature of the illness, injury or emergency, the physical location of the work and workers, the type of work being performed, the likelihood of injury and others. In general, assistance must be provided as quickly as reasonably practical. Employers should discuss this and the other conditions with workers to ensure that worker needs are met.

Video Surveillance Camera

Maintaining contact with workers may be achieved through the use of video surveillance cameras. The employer’s hazard assessment should assess to what extent workers using this system can respond to other workers who require assistance. A remote video monitoring room, or a non-continuous surveillance system that regularly switches images between several monitoring cameras may or may not meet the “readily available” assistance criterion of this Part. The hazard assessment should help to determine if this is the case.

Employers can eliminate the risk of workers working alone, as well as the need to comply with the working alone requirements, if they choose to organize work schedules and procedures to eliminate the need for workers to work by themselves. Overlapping shifts, having multiple workers work together, and rearranging the physical location of the work so that workers maintain contact with one another are examples of how working alone situations can be avoided.

For more information



Working Alone Safely—A Guide for Employers and Employees
Alberta Government publication

Subsection 393(2) Hazard assessment

A work site hazard assessment is a common sense look at the workplace to identify existing hazards for workers working alone. To perform such an assessment, employers need to:

- (a) review records and past incidents; and
- (b) identify measures or actions needed to correct any hazards.

Completing those two initial steps is important to the success of any health and safety program. Section 8 of the *OHS Code* requires employers to involve affected workers in the hazard assessment and in the control or elimination of the hazards identified. Workers affected by the hazards identified in the hazard assessment must be informed of the hazards and the methods used to control or eliminate the hazards. Section 14 of the *OHS Act* requires that the hazard assessment report be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Employers having limited experience with assessing hazards, or who are unsure of what corrective measures or actions to take, may wish to contact outside experts. These may include the industry association to which they may belong, the provincial health and safety association that best represents their industry, or a private occupational health and safety consultant. Employers in the retail sector may also wish to contact the Crime Prevention Unit of their local police service.

One hazard assessment for multiple work sites

Hazard assessments are only required for each different set of working conditions. A taxi company for example, could complete one hazard assessment to cover all its drivers and the typical situations those drivers encounter. An assessment does not need to be completed for each driver individually. The same is true of a worker selling products door-to-door, or a worker inspecting a number of essentially identical transformer substations. A single hazard assessment can cover the hazards generically rather than assessing each taxi, house or substation individually.

Review of records and past incidents

When identifying workplace hazards, employers should talk to their workers and review the experience of the business over the previous two or three years. Collecting and examining the history of past events may reveal the risk of workplace incidents, injuries and violence. What happened before and during the incident should be

reviewed, with relevant details of the situation and its outcome noted. If an employer does not have any personal experience with past incidents, the employer should check with similar businesses so that a variety of potential problem situations and circumstances are identified and considered.

Employers should see if there are any trends in injuries or incidents relating to their type of business, a particular work site, job title, activity, or time of day or week. Employers should identify specific tasks that may be associated with an increased probability of injury.

Good sources of information include injury and illness records resulting from “working alone” incidents, workers’ compensation claims, and police department robbery reports that identify specific incidents related to working alone.

Inspect and analyze the workplace

After reviewing records or past incidents, employers need to carefully examine the workplace, day-to-day management practices and other situations that may put workers at risk. This will help to develop and put in place specific preventative measures to address these problems.

The employer’s review should look at:

- (a) all factors that may make the risk of violence more likely, such as physical features of the building and environment, inadequate lighting, lack of telephones and other communication devices, telephones that do not permit out-going calls, areas of unsecured access, and areas with known security problems such as parking lots;
- (b) factors that make the risk of occupational injury more likely or severe, such as high hazard work, e.g., tree cutting, isolation from first aid services, and inability to call for help; and
- (c) the effectiveness of existing safety measures. Find out whether these measures are actually being used and whether workers have been adequately trained in their use.

Appendix 1 of *Working Alone Safely—A Guide for Employers and Employees*, contains sample hazard assessment checklists (see Figure 28.1). The checklists present a series of questions that may help employers perform their work site inspection and analysis of hazards. In some cases (depending on the type of business and the hazards present), completion of the appropriate checklist may be all that is required. In other cases, the checklist is a starting point for a more comprehensive assessment.

Appendix 1.1: Working Alone

checklist for employees who handle cash
(e.g. convenience store clerks, retail and cash)

This checklist is intended to help employers implement best practices with substantial duty of robbery or other crimes. The questions in bold reflect mandatory requirements. Practices that are highly desirable.

Yes	No	N/A	CASH AND MERCHANDISE C
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have a policy to control cash?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have a procedure to ensure you have cash on the shop floor?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you post signs in prominent place kept on the premises?
Yes	No	N/A	VISIBILITY
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have good visibility in the area?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are windows visible, clear of signs?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is the check-out stand or cash register in the line of sight of the business entrance?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is the cash register visible from all areas?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are shelves and counters kept low and open?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are all windows large, bright and well lit?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is the entrance to the building easily visible?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is lighting bright in parking and adjacent areas?
Yes	No	N/A	EMPLOYEE TRAINING
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you ensure employees are trained in robbery training on working alone?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the training program include the use of the Robbery Awareness Poster Series as a requirement for all employees called by the business?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How is robbery training a robbery training in real-life situations and role-play?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does emergency response on site?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Regular maintenance of the security system and equipment?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Testing employees' knowledge at

Appendix 1.2: Working Alone

checklist for employees who meet clients away from their base office
(e.g. home care workers and nurses, social services workers, mail officers, agents, bylaw and government enforcement officers)

This checklist is intended to help employers implement best practices for employees who meet clients away from the employer's premises. The questions in bold reflect mandatory requirements. Practices that are highly desirable.

Yes	No	N/A	EMPLOYEE TRAINING
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you ensure employees are trained and competent to work alone safely?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are employees trained to recognize potentially unsafe situations?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are employees trained as non-violent negotiators?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Have employees been instructed to follow the exit procedures when meeting clients at their premises?
Yes	No	N/A	SAFE WORK PROCEDURE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have a safe work procedure for employees who meet clients away from the employer's premises?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the safe work procedure include an employee and take into consideration the following:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Client behaviour?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Location (unsafe environments, poor lighting, etc.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Presence of dangerous items (weapons, knives, etc.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Previous case history of abuse and locations?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Others' safety?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are employees required to have a safe exit plan in the event of an emergency?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the safe exit plan consider the following:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Use of a cellular telephone to maintain regular contact with designated person prior to and after leaving?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Backup person - arranged for a second person to be in a high risk location while on the visit?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Arrangements to meet the client at a safe location?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Use of security services?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Deferral until proper safety measures can be put in place?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Others' safety?
Yes	No	N/A	COMMUNICATION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have an effective means of communication contact persons capable of responding when in immediate situations?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the method of communication include one of the following:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Regular telephone, cell phone or radio contact?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check-in points with other employees?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Others' safety?

Appendix 1.4: Working Alone

checklist for employees who travel alone
(e.g. truck drivers, field workers, and business people in transit)

This checklist is intended to help employers implement best practices for employees traveling alone while working with no interaction with customers. The questions in bold reflect mandatory requirements. Other questions suggest recommended practices that are highly desirable.

Yes	No	N/A	EMPLOYEE TRAINING
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you ensure employees are trained and competent to work alone safely?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are employees informed of the hazards associated with working alone?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	For employees who have to travel alone to remote locations do they have some means of emergency response?
Yes	No	N/A	SAFEWORK PROCEDURE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have a safe work procedure for employees traveling alone?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do employees have adequate rest periods between work periods when they are traveling alone?
Yes	No	N/A	EQUIPMENT SAFETY
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you ensure vehicles used by employees are in good working condition?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Are all vehicles used by employees under regular maintenance programs?
Yes	No	N/A	EQUIPMENT AND SUPPLIES
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you provide employees with the appropriate first aid supplies?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do employees carry the required first aid supplies?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do employees carry emergency supplies when they travel in extreme cold or dangerous weather conditions?
Yes	No	N/A	COMMUNICATION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have an effective means of communication for employees to contact persons capable of responding when employees need immediate assistance?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you have a procedure for traveling "normal" employees that is appropriate to the hazard?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the method of communication include the following:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Regular telephone, cell phone, or radio contact?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Reporting to designated locations according to the "travel plan"?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Others' safety?

A new hazard assessment needs to be performed when the circumstances of the working alone situation change. For example, exchanging one worker for another may not substantially change a working alone situation but extending the worker's hours of work from 6 p.m. to midnight may have a substantial effect on their personal safety and the results of the existing hazard assessment. The change in working hours alters the working alone situation and triggers the need for a new hazard assessment.

Elimination and control of hazards

Reduction or control of hazards may only be a temporary measure and may be dependent on specific workers being able to make the control function as intended. For example, securing an access door that depends on a worker using a significant amount of force to close it and a special way of twisting the lock to get it to latch is unacceptable.

All of the employer's workers should be able to operate the door and lock, regardless of their strength or abilities. The hazard can easily be eliminated through repair or replacement of the door and lock.

Section 394 Precautions required

Subsection 394(1) Effective communication system

The purpose behind "effective communication system" is to provide workers with a method of signalling their need for assistance. Common devices that meet the intent of this subsection include portable two-way radios, telephones, cellular telephones, satellite telephones, personal alarms and computer-based systems that achieve the same results. The key point is that the communication system must permit a worker requiring assistance to send a message or signal to someone capable of providing assistance to them.

Even with the best communication equipment, there may be times when it is not useable, the worker is rendered incapable of using it, etc. To ensure there is contact even in such cases, the "effective communication system" must include regular contact appropriate to the situation. As stated in this subsection, the contact must be regular and initiated by the employer or designate at intervals appropriate to the nature of the hazard associated with the worker's work.

Subsection 394(1.1) Visit or contact

As alternatives to an "effective means of communication," an employer can establish a system that includes visiting the worker, scheduling check-ins with other workers or designated persons, reporting to an office or particular person upon completion of a task, and visual or audible contact with other persons who can offer assistance when needed. The frequency of contact must be based on a hazard assessment. At a work site involving minimal hazards, the requirement may involve a conversation between workers at the time of shift change or reporting to work the next day. A more hazardous work situation may require regular check-ins or visits by a supervisor.

An effective means of communication or contact must always be provided by the employer in working alone conditions. An employer cannot, upon performing the hazard assessment, decide that a means of communication or contact is unnecessary. If a worker works alone at a work site in circumstances where assistance is not readily available when needed, a means of communication or contact must be provided.

Part 29 Workplace Hazardous Materials Information System (WHMIS)

Highlights

WHMIS is the system used in Canada for classifying and labeling hazardous workplace chemicals.

WHMIS is enabled by both federal and provincial legislation. The federal *Hazardous Products Act* (Canada) (HPA), *Hazardous Products Regulation* (Canada) (HPR), *Hazardous Materials Information Review Act* (Canada) (HMIRA), and the *Hazardous Materials Information Review Regulations* (Canada) (HMIRR) administered by Health Canada are the WHMIS laws for chemical suppliers. Alberta employer and workplace WHMIS requirements are specified in this Part of the *OHS Code*. In some cases, federal law is incorporated by reference in the *OHS Code*.

In 2015, the federal government amended the WHMIS legislation to align with the *Globally Harmonized System for Classification and Labeling of Chemicals* (GHS). This new system is known as WHMIS 2015 and replaces the previous WHMIS 1988. While WHMIS 2015 includes new harmonized criteria for hazard classification, and safety data sheets (SDSs), the obligations for employers and workers have not significantly changed.

Changes to the WHMIS legislation include:

- changes in terminology (for example, “hazardous products” instead of “controlled products”);
- changes to hazard classes and more of them;
- new supplier labels;
- new pictograms;
- 16-section product safety data sheets (SDSs);
- no requirement to update SDSs every three years.

Resources

Canada’s national portal to WHMIS information for suppliers, employers, workers, and trainers can be found at www.WHMIS.org:

- Link to *Health Canada Technical Manual*
- Link to AB Labour publications on WHMIS

Requirements

Section 394.1 Definitions

“hazardous product”

Under the HPA, a “hazardous product” is a product, mixture, material or substance classified according to the criteria set out in the HPR in at least one category or subcategory of the health hazard or physical hazard classes listed in Schedule 2 of the HPA (see below).

Although Schedule 2 of the HPA refers to a hazard class for “Explosives,” the GHS hazard class for Explosives has not been adopted in the HPR. Explosives are currently excluded from WHMIS SDS and labelling requirements of the HPA.

Physical Hazard Classes

1. Explosives
2. Flammable gases
3. Flammable aerosols
4. Oxidizing gases
5. Gases under pressure
6. Flammable liquids
7. Flammable solids
8. Self-reactive substances and mixtures
9. Pyrophoric liquids
10. Pyrophoric solids
11. Self-heating substances and mixtures
12. Substances and mixtures which, in contact with water, emit flammable gases
13. Oxidizing liquids
14. Oxidizing solids
15. Organic peroxides
16. Corrosive to metals
17. Combustible dusts
18. Simple asphyxiants
19. Pyrophoric gases
20. Physical hazards not otherwise classified

Health Hazard Classes

1. Acute toxicity
2. Skin corrosion/irritation
3. Serious eye damage/eye irritation
4. Respiratory or skin sensitization
5. Germ cell mutagenicity
6. Carcinogenicity

7. Reproductive toxicity
8. Specific target organ toxicity—single exposure
9. Specific target organ toxicity—repeated exposure
10. Aspiration hazard
11. Biohazardous infectious materials
12. Health hazards not otherwise classified

“safety data sheet”

An SDS is a document that describes the hazards associated with a hazardous product, and provides information on safe use, handling, storage and disposal procedures as prescribed by the HPR. The SDS provides more detailed information about a hazardous product than the label.

The HPR sets out the requirements for information elements that must appear on a SDS, as detailed in Part 4 and Schedule 1 and Schedule 2 of the HPR. SDSs must have a standardized 16-heading format. The SDS must provide the headings set out in Column 1 of Schedule 1 of the HPR, in the order they are presented (see below). The SDS must also include the corresponding item (section) number, which is to be placed immediately before the heading. The specific information elements that correspond to the headings in column 1 must appear on the SDS, if required.

The information elements must be provided in both English and French. A supplier can provide either a single bilingual SDS that provides the required information in both languages, or an SDS consisting of two parts, in which one part provides the required information in English and the other part provides the required information in French. If the second option is selected, both the English and French versions must always be provided together. For example, a bilingual SDS could be provided to a purchaser by electronic means. The supplier could send an email to the purchaser and attach the SDS to the email (in the case where the English and French portions of the SDS are two separate parts, both the English and French parts must be attached to the same email).

The supplier could provide the purchaser with a universal serial bus (USB) stick or a compact disc (CD) on which the SDS has been saved (in the case where the English and French portions of the SDS are two separate parts, both the English and French parts must be saved on the same USB stick or CD).

It is not acceptable to provide an SDS by only providing the purchaser of the hazardous product with a website address or hyperlink from which the purchaser may download the SDS for the hazardous product.

A separate SDS need not accompany every single container of a hazardous product, nor does an SDS need accompany every single shipment of the same hazardous product to the same purchaser, provided that the most recent SDS that was provided to the purchaser remains compliant with the HPR.

The content categories that must be included in an SDS are:

- (1) Identification
 - Product identifier
 - Other means of identification
 - Initial supplier identifier (manufacturer/distributor)
 - Emergency telephone number
- (2) Hazard Identification
 - Classification of hazardous product
 - Label information
 - Other hazards known to supplier
- (3) Composition/Information on Ingredients
 - List of hazardous ingredients (including chemical name, common name and synonyms)
 - Chemical Abstracts Service (CAS) number
 - Chemical name of impurities, stabilizers, additives
 - Ingredient concentration
- (4) First Aid Measures
- (5) Fire Fighting Measures
 - Means of extinction
 - Specific hazards including hazardous combustion products
 - Special protective equipment and precautions for firefighters
- (6) Accidental Release Measures
 - Personal precautions, protective equipment and emergency procedures
 - Methods and materials for containment and cleaning
- (7) Handling and Storage
 - Precautions for safe handling
 - Conditions for safe storage, including incompatibilities
- (8) Exposure Controls/Personal Protection
 - Exposure limits with source
 - Engineering controls
 - Personal protective equipment
- (9) Physical and Chemical Properties
 - Physical state and appearance
 - Odour
 - Odour threshold
 - pH
 - Melting point and freezing point
 - Initial boiling point and boiling range
 - Flash point
 - Evaporation rate
 - Flammability (solids and gases)
 - Upper Explosive Limit (UEL) and Lower Explosive Limit (LEL)
 - Vapour pressure

-
- Vapour density
 - Relative density
 - Solubility
 - Partition coefficient
 - Autoignition temperature
 - Decomposition temperature
 - Viscosity
- (10) Toxicological Information
- Concise but complete description of toxic health effects and data used to identify them, including:
 - Likely routes of exposure
 - Symptoms related to physical, chemical and toxicological characteristics
 - Acute and chronic effects
 - Numerical measures of toxicity, including acute toxicity estimates (ATEs)
- (11) Stability and Reactivity
- Chemical stability
 - Incompatibility
 - Reactivity
 - Hazardous decomposition products
 - Possibility of hazardous reactions
 - Conditions to avoid (shock, static, vibration)
- (12) Ecological Information
- Ecotoxicity (aquatic and terrestrial)
 - Persistence and degradability
 - Bioaccumulative potential
 - Mobility in soil
 - Other adverse effects
- (13) Disposal Considerations
- (14) Transport Information
- UN number
 - UN shipping name
 - UN packing group
 - Environmental hazards (IMDG Code)
 - Bulk transport shipping information
 - Special precautions
- (15) Regulatory Information
- Safety, health and environmental regulations made within or outside Canada, specific to the product in question
- (16) Other Information
- Date of the latest revision of the SDS.

For hazardous products classified as biohazardous infectious materials (BIMs), the SDS must also include a nine-heading SDS appendix and the content of the specific

information elements listed in Schedule 2 of the HPR, which provide information that specifically pertains to the BIM(s). The Schedule 1 SDS and the Schedule 2 nine-heading appendix are not two distinct documents. They are intended to be provided together as one SDS for the hazardous product.

“supplier label”

A supplier label provides basic identification and hazard information on a hazardous product or its container. This label is provided as a condition of sale by the supplier (manufacturer, processor, packager or importer) of a hazardous product. The supplier label must meet requirements set out in Part 3 of the HPR with respect to hazard symbols, information categories and label design, format and language.

The supplier is responsible under federal law to ensure the information on the label is provided in both English and French. See Figure 29.1 for a sample supplier label. The seven label elements that must be included on a supplier label, unless an exemption applies, include:

- (1) product identifier
- (2) initial supplier identifier
- (3) pictogram(s)
- (4) signal word
- (5) hazard statement(s)
- (6) precautionary statement(s)
- (7) supplemental label information.

Section 3.3 of the HPR specifies that among the information elements, the pictogram(s), signal word, and hazard statement(s) must be grouped together on the label.


There are some cases when the supplier label may contain less information. These situations include hazardous products in small containers (100 ml or less), samples of hazardous products sent to laboratories for analysis, bulk shipments and hazardous products sold without packaging of any sort, regardless of whether they are shipped or picked up at the supplier’s location.

The label must also be legible without the aid of any device, other than corrective lenses. For example, a label in a QR code form that requires a scanner (a device, for retrieving information) would not meet the requirements of the HPA and HPR. Suppliers must ensure that the information elements required by the HPR are laid out on the label or container in a manner that will contrast and stand out from any other information on the label, or from any other information on the hazardous product or container in which the hazardous product is packaged.

The supplier is responsible for applying the label to the controlled or hazardous product. Employers must ensure that hazardous products received as bulk shipments or

unpackaged products that do not have supplier labels attached to them are properly labelled in the workplace. When needed, employers can create a supplier label by referring to the information provided in Sections 1 and 2 of the SDS.

Figure 29.1 Sample WHMIS 2015 supplier label (Image provided by the Canadian Centre for Occupational Health and Safety, 2015)

Product SHO-K1 / Produit SHO-K1	
	
Danger Fatal if swallowed. Causes skin irritation.	Danger Mortel en cas d'ingestion. Provoque une irritation cutanée.
Precautions: Wear protective gloves. Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product. Store locked up. Dispose of contents/containers in accordance with local regulations. IF ON SKIN: Wash with plenty of water. If skin irritation occurs: Get medical advice or attention. Take off contaminated clothing and wash it before reuse. IF SWALLOWED: Immediately call a POISON CENTRE or doctor. Rinse mouth.	Conseils : Porter des gants de protection. Se laver les mains soigneusement après manipulation. Ne pas manger, boire ou fumer en manipulant ce produit. Garder sous clef. Éliminer le contenu/récipient conformément aux règlements locaux en vigueur. EN CAS DE CONTACT AVEC LA PEAU : Laver abondamment à l'eau. En cas d'irritation cutanée : Demander un avis médical/consulter un médecin. Enlever les vêtements contaminés et les laver avant réutilisation. EN CAS D'INGESTION : Appeler immédiatement un CENTRE ANTIPOISON ou un médecin. Rincer la bouche.
ABC Chemical Co., 123 rue Anywhere St., Mytown, ON NON ONO (123) 456-7890	

“work site label”

A work site label is used at the workplace in some circumstances during the storage, handling and use of a hazardous product, such as during production or when products are transferred to another container. The employer may also apply a work site label when an existing supplier label becomes illegible or is accidentally removed and a replacement supplier label is not available. The product identifier on the work site label

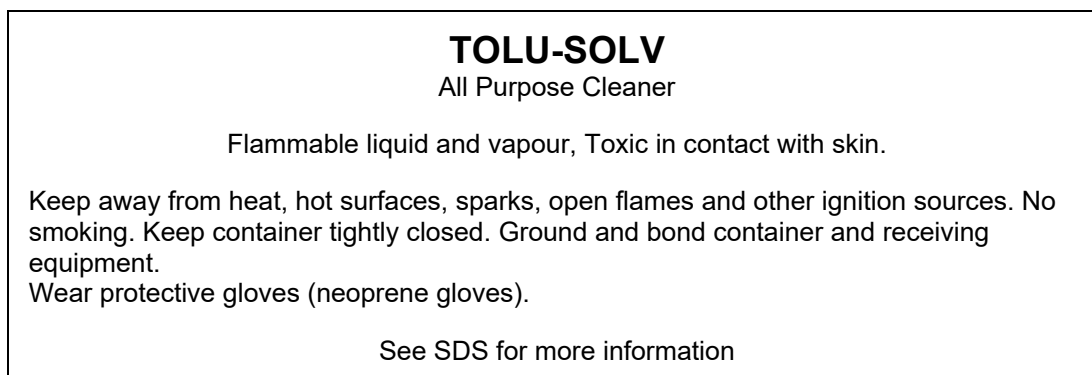
must be identical to that found on the SDS of the corresponding hazardous product. Information for safe handling means precautions that the worker must observe to minimize risk of adverse health effects or injury. If an SDS for the product is available, the work site label must include a statement to that effect. For some products, such as consumer products, an SDS may not be available, in which case the statement regarding the SDS is not required on the work site label.

While the definition specifies the type of information that must be present on the label, there is considerable flexibility in the label wording and format. The key considerations are that the label be legible, firmly affixed to the product or container and the wording/format be understood by workers at that workplace.

The label must be legible and prominently displayed on the part of the container that is visible under normal conditions of storage and use. If the employer wishes to provide hazard symbols on the work site labels that differ from those required on the WHMIS supplier label, then the symbols used must not result in worker confusion regarding the hazards represented by the product. For example, the colour and number symbols of the National Fire Protection Association (NFPA) apply to hazards created by short term exposure in fire or other emergency situations. They are not meant to apply to hazards associated with long-term exposures that are often found at the workplace. If NFPA symbols are used on a work site label, workers must be instructed in the differences between the NFPA and WHMIS systems.

Work site labels may be revised when new information becomes available. The information must be kept consistent with that provided on the SDS.

Figure 29.2 Sample WHMIS 2015 work site label (Image provided by the Canadian Centre for Occupational Health and Safety, 2015)













Section 395 Application

Subsection 395(1)

A product that meets the criteria to be classified in any one (or more) of the WHMIS hazard classes is a hazardous product. Each pictogram shows a symbol which is intended to convey information about the hazard of the product. The pictograms are shown in Figure 29.3. Each pictogram contains a black symbol on a white background surrounded by a red border in the shape of a square set on one of its points, except for biohazardous infectious materials. This pictogram is circular with a black border. The biohazardous infectious materials pictogram is distinct because it has been retained from WHMIS 1988 in the Canadian federal WHMIS legislation.

Figure 29.3 WHMIS 2015 pictograms (Image provided by the Canadian Centre for Occupational Health and Safety, 2015)

 <ul style="list-style-type: none"> • Flammables (gases, aerosols, liquids, solids) • Self-reactive substances and mixtures • Pyrophoric liquids, solids, and gases • Self-heating substances and mixtures • Substances and mixtures which, in contact with water, emit flammable gases • Organic peroxides 	 <ul style="list-style-type: none"> • Explosives* • Self-reactive substances and mixtures • Organic peroxides
 <ul style="list-style-type: none"> • Skin sensitization • Acute toxicity (harmful) • Hazardous to the ozone layer* • Specific target organ toxicity - single exposure (Cat. 3) • Eye irritation • Skin irritation 	 <ul style="list-style-type: none"> • Carcinogenicity • Respiratory sensitization • Reproductive toxicity • Specific target organ toxicity - repeated exposure • Specific target organ toxicity - single exposure (Cat. 1, 2) • Aspiration hazard • Germ cell mutagenicity
 <ul style="list-style-type: none"> • Acute toxicity (severe) 	 <ul style="list-style-type: none"> • Corrosive to metals • Serious eye damage • Skin corrosion
 <ul style="list-style-type: none"> • Oxidizing gases, liquids, solids 	 <ul style="list-style-type: none"> • Gases under pressure
 <ul style="list-style-type: none"> • Hazardous to the aquatic environment* 	 <ul style="list-style-type: none"> • Biohazardous infectious materials

*The Environmental hazard classes and the Explosives hazard class have not been adopted in the HPR.

Subsection 395(2)

Employers must ensure that products produced and used at their work place are used, stored and manufactured in accordance with the requirements in the *OHS Code*. Since the *OHS Code* defines hazardous products and SDSs as those complying with the federal WHMIS laws, the employer also has responsibility to ensure that products received in the workplace are properly classified and labeled. If an employer directly imports products from a foreign supplier for use in their workplace, they may have additional responsibilities as an “importer” under the federal law. The employer assumes the supplier responsibilities for classification, labels and SDSs.

Subsection 395(3)

There are some products that do not fall under the scope of WHMIS. Products completely exempt from the requirements of WHMIS are:

- (a) wood or products made of wood;
- (b) tobacco or a tobacco product as defined in the *Tobacco Act*;
- (c) a hazardous waste being a hazardous product that is sold for recycling or recovery and is intended for disposal; or
- (d) a manufactured article.

Note that while WHMIS does not apply, if these products meet the definition of a “harmful substance” in the *OHS Act*, other provisions, such as those in Part 4, will apply in the workplace.

Subsection 395(3)(a)

This exemption is meant to refer to a structural item composed entirely or in large measure of wood, but does not consist of products derived from wood such as turpentine, paper, wood pulp and wood dust. Examples of products to which this exemption applies include lumber of all sizes, laminated beams, plywood, chipboard, particleboard, wood chips, sawdust and products that have been coated with paints or preservatives. At facilities where specialized products made of wood are manufactured, additives such as adhesives, paints and preservatives are subject to all applicable WHMIS information provisions prior to being added to the finished product.

Subsection 395(3)(b)

The federal *Tobacco and Vaping Products Act* (Canada), section 2 defines a tobacco product as “a product made in whole or in part of tobacco, including tobacco leaves. It includes papers, tubes and filters intended for use with that product, a device, other than a water pipe, that is necessary for the use of that product and the parts that may be used with the device.” While products made of tobacco (including cigarettes, cigars, chewing tobacco and snuff) are exempt from the WHMIS provisions, products derived from tobacco, such as nicotine, are not.

Subsection 395(3)(c)

Examples of hazardous waste include solid and liquid materials such as waste insulation in asbestos removal projects, contents of tailing ponds or sewage systems and products for recycling such as engine oil. A by-product of a production process that is recycled or otherwise used on-site is not a hazardous waste, e.g., black liquor in the pulping process). A by-product supplied to a party off-site for use as-is (is not subjected to a conversion process such as recycling or recovery) is also not a hazardous waste. Only hazardous waste that is “intended for disposal” or is “acquired or generated for recycling or recovery,” as defined in section 394.1 falls within the definition of hazardous waste and is exempt from WHMIS requirements.

Subsection 395(3)(d)

A manufactured article is defined in the *OHS Code*, section 394.1. It is an article that meets three conditions:

- (1) it is formed to a specific shape or design during manufacture;
- (2) its intended use when in that form depends in whole or in part on its shape or design; and
- (3) when installed (if the product is intended to be installed) and under normal conditions of use, it will not release or otherwise cause a person to be exposed to a hazardous product.

“Normal conditions of use” means the normal conditions under which the article used for its intended purpose. It does not include maintenance, repair or where the product is mishandled or used in a way different from its intended use. If only trace amounts of hazardous products are released under normal conditions of use that will not pose a health risk to workers, the manufactured article exemption still applies.

To be “exposed to a hazardous product” at the end of the manufactured article definition does not refer only to a hazardous product present in the manufactured article, but also hazardous products released as a result of thermal or chemical degradation, or those released in an altered form (e.g., an oxide) that is also a hazardous product.

If a product does not contain a hazardous product when it is sold or imported, it is not subject to the HPA, even if a hazardous product is formed and released when the article is used under normal conditions of use.

The following are examples of how the manufactured article exclusion is applied:

- Welding rods are not a manufactured article because they release, during normal use, hazardous products that they previously contained (metal fume).
- Precut threaded piping is a manufactured article because it does not release contaminants during its intended use of conveying fluids.
- Friction products that contain asbestos are not manufactured articles (e.g., brake shoes fitted with pre-arc lined linings). However, a gasket containing asbestos would likely be a manufactured article. In the first case, the product can release asbestos both during installation and during use (braking). In the latter case, the product would not release asbestos fibres unless it is intended to be cut to size for installation.
- A cylinder produced to contain acetylene is a manufactured article. Once it is filled with acetylene, it becomes a container for a controlled product and when sold as such, must be provided with a WHMIS label and SDS.
- A refrigerator is a manufactured article consisting of various components, including a system containing compressed gases. However, unlike the compressed gas cylinder, the refrigerator is not considered to be a container of a hazardous product.

Subsection 395(4)

The *Alberta Dangerous Goods Transportation and Handling Act* deals with the shipping of hazardous products in the province. The *Alberta Dangerous Goods Transportation and Handling Regulations* made under the Act adopt, with some modifications, the federal *Transportation of Dangerous Goods Regulations* (TDGR) with respect to the classification and labelling of products being transported or offered for transport. TDGR and WHMIS are complementary systems. TDGR covers information requirements when products are shipped to or from workplaces, while WHMIS applies to products at the workplace. No overlap is intended; one system takes over where the other leaves off. Although WHMIS labels and SDSs may be provided with shipments, the WHMIS requirements apply at the point of sale, and at the workplace after the hazardous product is received.

Dangerous goods include a product, substance or organism listed in Schedule II of the TDGR or substances that are otherwise classified as dangerous goods through application of criteria described in the TDGR. The TDGR does not apply to the transport of oil or gas in a pipeline where this is governed by federal or provincial legislation. WHMIS does not apply when dangerous goods are covered by the TDGR; this includes handling and offering for transport, storing for transport, transportation and warehousing.

“Handling and offering for transport” refers to activities such as assembling, packaging, storing, loading and unloading for transport. For example, WHMIS does not apply to products while in temporary storage in a distribution warehouse.

“Storing for transport” is storage where goods will not be handled any further at the workplace other than to load them directly onto a transport vehicle for the purpose of removal from the workplace.

“Transportation” means to and from workplaces. WHMIS applies to circumstances where goods are transported from one point to another within a workplace, except for radioactive substances and explosives, in which case TDGR applies.

“Warehousing” means where a hazardous product is stored prior to transport. WHMIS would apply in a warehouse where the products are handled, repackaged, used, processed or sold.

The exemption for products being transported exists because training requirements for workers transporting dangerous goods are already covered in TDGR. However, drivers are often exposed to the hazardous product by being actively involved in its loading or unloading. Section 395(4) of the *OHS Code* requires SDSs to be readily available to the driver, and other transportation workers, who may be exposed.

Subsection 395(5)

Products exempt from the WHMIS requirements related to labelling and SDSs are:

- (a) explosives governed by the *Explosives Act* (Canada);
- (b) cosmetics, devices, drugs, foods governed by the *Food and Drugs Act* (Canada);
- (c) products governed by the *Pest Control Products Act* (Canada);
- (d) a nuclear substance that is radioactive governed by the *Nuclear Safety and Control Act* (Canada); and
- (e) a product, material or substance packaged as a consumer product as defined in the *Canada Consumer Product Safety Act* (Canada).

Employers must still provide education and training on health effects, safe use, and storage of these products.

Subsection 395(5)(a)

The *Explosives Act* (Canada) defines an explosive as “any thing that is made, manufactured or used to produce an explosion or a detonation or pyrotechnic effect, and includes any thing prescribed to be an explosive by the regulations, but does not include gases, organic peroxides or any thing prescribed not to be an explosive by the regulations.” In the Explosives Regulations, the definition includes “gunpowder, propellant powders, blasting agents, dynamite, detonating cord, lead azide, detonators, ammunition of all descriptions, rockets, fireworks, fireworks compositions, safety flares and other signals.”

The *Explosives Act* (Canada), which is administered by Natural Resources Canada, controls the manufacture, testing, sale, storage and importation of explosives. Explosives are distinct from substances such as ethers or furans which may form explosive peroxides, and picric acid which may become explosive when dry.

Subsection 395(5)(b)

The *Food and Drugs Act* (Canada), administered by Health Canada, defines cosmetics, drugs, foods and devices. The Act controls the sale, advertisement, manufacture, packaging and labelling of these products to prevent economic fraud and health and safety hazards.

According to the Act, cosmetic” includes any substance or mixture of substances manufactured, sold or represented for use in cleansing, improving or altering the complexion, skin, hair or teeth, and includes deodorants and perfumes.

“Drug” includes any substance or mixture of substances manufactured, sold or represented for use in

- (a) the diagnosis, treatment, mitigation or prevention of a disease, disorder, abnormal physical state or its symptoms, in human beings or animals;
- (b) restoring, correcting or modifying organic functions in human beings or animals; or
- (c) disinfection in premises in which food is manufactured, prepared or kept.

A drug includes any raw material that is itself a drug or is used to manufacture a drug in dosage form. Therefore, raw materials that are drugs or are used in the manufacture of drugs are also excluded from the labelling and SDS requirements of WHMIS. All drugs are issued a Drug Identification Number (DIN) which must appear on the product label.

Cosmetics and drugs are defined in terms of being sold or represented for specific purposes. A hazardous product sold as a drug or cosmetic would be subject to WHMIS requirements if it were sold for another use. For example, the chemical 2,4-diaminoaniline is excluded from WHMIS supplier requirements when sold in hair dye mixtures, but is included when used as a fur dye. Cosmetics and drugs are usually products that are applied on or taken into the body. A hair dye is a cosmetic, but the formaldehyde solution used to disinfect a hairbrush is not.

“Food” includes any article manufactured, sold or represented for use as food or drink for man, chewing gum and any ingredient that may be mixed with food for any purpose whatever.

When a product normally considered a food has a non-food use at the workplace, it is not excluded from WHMIS. For example, flour, which is a respiratory tract sensitizer, is covered by WHMIS if sold and used as an additive or as an industrial filler.

“Device” means an instrument, apparatus, contrivance or other similar article, or an in vitro reagent, including a component, part or accessory of any of them, that is manufactured, sold or represented for use in

- (a) diagnosing, treating, mitigating or preventing a disease, disorder or abnormal physical state, or any of their symptoms, in human beings or animals;
- (b) restoring, modifying or correcting the body structure of human beings or animals or the functioning of any part of the bodies of human beings or animals;
- (c) diagnosing pregnancy in human beings or animals;
- (d) caring for human beings or animals during pregnancy or at or after the birth of the offspring, including caring for the offspring; or
- (e) preventing conception in human beings or animals.

However, it does not include such an instrument, apparatus, contrivance or article, or a component, part or accessory of any of them, that does any of the actions referred to in paragraphs (a) to (e) solely by pharmacological, immunological or metabolic means or solely by chemical means in or on the body of a human being or animal.

Subsection 395(5)(c)

The *Pest Control Products Act* (Canada) defines a “pest control product” as

- (a) a product, an organism or a substance, including a product, an organism or a substance derived through biotechnology, that consists of its active ingredient, formulants and contaminants, and that is manufactured, represented, distributed or

used as a means for directly or indirectly controlling, destroying, attracting or repelling a pest or for mitigating or preventing its injurious, noxious or troublesome effects;

- (b) an active ingredient that is used to manufacture anything described in paragraph (a); or
- (c) any other thing that is prescribed to be a pest control product.

Examples of pest control products include insecticides, fungicides, algacides, herbicides, rodenticides, insect repellents, pet repellents, insect attractants, plant growth regulants, microbial control agents, disinfectant-type products and devices for pest control. The product is also classified as a pest control product if a claim is made that it disinfects or controls bacteria. For example, bleach that contains sodium hypochlorite is considered to be a pest control product if the manufacturer claims it is a disinfectant. Pest control products are labelled with pest control product numbers that indicate the product is registered under the *Pest Control Products Act* (Canada). There are exceptions to this where the product is used for research and for seed treatment or cleaning.

Like cosmetics and drugs, pest control products are defined in terms of intent for use. A hazardous product used in a pesticide, but manufactured and intended for another use is subject to WHMIS requirements. For example, Stoddard solvent is used as a herbicide, but has a variety of other industrial applications as a solvent and cleaning agent.

Subsection 395(5)(d)

The *Nuclear Safety and Control Act* (Canada), administered by the Canadian Nuclear Safety Commission, defines a nuclear substance as

- (a) deuterium, thorium, uranium or an element with an atomic number greater than 92;
- (b) a derivative or compound of deuterium, thorium, uranium or of an element with an atomic number greater than 92;
- (c) a radioactive nuclide;
- (d) a substance that is prescribed as being capable of releasing nuclear energy or as being required for the production or use of nuclear energy;
- (e) a radioactive by-product of the development, production or use of nuclear energy; and
- (f) a radioactive substance or radioactive thing that was used for the development or production, or in connection with the use of nuclear energy.

The overall objectives of the *Nuclear Safety and Control Act* (Canada) are to limit risks to national security and health and safety associated with the development, production and use of nuclear energy and the production, possession and use of nuclear substances, prescribed equipment and prescribed information, as well as implementing measures agreed to in international agreements around the production and use of nuclear energy.

Subsection 395(5)(e)

In the *Canada Consumer Product Safety Act* (Canada), a “consumer product” means a product, including its components, parts or accessories, that may reasonably be expected to be obtained by an individual to be used for non-commercial purposes, including for domestic, recreational and sports purposes, and includes its packaging.

Consumer products, which are chemicals, must be labelled and packaged in accordance with the *Consumer Chemicals and Containers Regulation* (CCCR). The CCCR establishes classification criteria, labelling and packaging requirements for chemical products used by consumers. The classification criteria are based on a scientific assessment of the hazards that a product may pose during foreseeable use. Labelling and packaging requirements are determined from the product classification. The labelling takes the form of hazard symbols, warning statements, safety instructions and first aid statements. If a consumer can buy a chemical product through the retail distribution network, then that product must meet the requirements of the CCCR regardless of whether it is also distributed to the more specialized commercial or industrial markets.

Quantities available to the consuming public vary from product to product. For example, paint may be available in containers in sizes up to 20 litres. Whether or not a product is a consumer product does not depend on how many containers are purchased at one time.

While these products are exempt from the WHMIS supplier information requirements, the employer must still provide work site labelling on containers into which the products are decanted and workers must be instructed in the hazards of the products and proper procedures for handling them.

Section 396 Hazardous waste

Although hazardous wastes are exempt from WHMIS, the employer is still required to ensure that they are safely stored and handled at the work site and that workers are appropriately trained. However, the employer may use discretion in selecting the method of storage and training, as long as workers are adequately protected. The key is to use a system that is appropriate to the workplace and that is understood and followed by workers. Acceptable methods of identifying the waste include placards, coded labels or work site labels, as long as they clearly identify the contents of the product containers.

Section 397 Training

Worker education and training for hazardous products is an integral part of the WHMIS information delivery system. Worker education includes all those activities that provide knowledge and skills to workers so that they may work safely with or near hazardous products at the workplace. WHMIS requires that a program of instruction be established

that not only provides training in specific work procedures, but also information about requirements for labels, MSDSs and information of significance to worker health and safety.

Information and instruction must be provided to all workers who work with or in proximity to a controlled product. A worker who works with a controlled product is any worker who stores, handles, uses or disposes of a controlled product or who immediately supervises another worker performing these duties. "In proximity" is the area in which the worker's health and safety could be at risk during storage, handling, use or disposal of the product, maintenance operations or in an emergency situation such as a spill or fire. The physical area of risk depends on the quantity of product, its form, the extent of enclosure during its use, scheduling of work activities and persistence of the product after its release.

The employer must do the following.

- (1) For each hazardous product supplied to the workplace, provide all hazard information received from the supplier and any additional information of which the employer is, or ought to be, aware of concerning the use, storage and handling of the product.
- (2) Develop and implement a program of worker instruction that includes
 - (a) the content required on supplier and work site labels and the purpose and significance of the information contained on them;
 - (b) the content required on an SDS and the purpose and significance of the information contained on it;
 - (c) procedures for the safe use, storage, handling or manufacture of hazardous products;
 - (d) methods of identification used in the workplace, where applicable;
 - (e) procedures to be followed where fugitive emissions are present; and
 - (f) procedures to be followed in an emergency.
- (3) Consult with the HSC or HS representative, if there is one, during the development and implementation of the training program.

Section 14 of the *OHS Act* requires health and safety information, which include procedures, to be readily available to the joint work site health and safety committee (or health and safety representative), if there is one, workers and the prime contractor, if there is one.

Subsection 397(2) builds on this requirement: employers must consult with the HSC or HS representative on site in developing and implementing their training program. Consultation is defined in the *OHS Act* and means sharing or seeking information and advice from affected persons, giving affected persons a reasonable opportunity to express their views and taking those views, information and advice into account.

An employer is considered to have consulted with the committee or representative regarding the program of WHMIS instruction if two conditions are met:

- Prior to finalizing the program, the committee has the opportunity to review and provide information or advice on the entire program, including its content, structure and means of implementation. Means of implementation consists of choice of instructors and the use of in-course evaluations.
- Secondly, once the program has been implemented, the employer asks for information and advice from the committee on the effectiveness of the program.

(4) While not specified in the *OHS Code* the employer should review the program of instruction on an ongoing basis to account for changes in the workplace and changes in products used. It is recommended this be done at least annually, but more frequently if required by a change in work conditions or available hazard information.

(5) If SDSs are available at the workplace on a computer system or in another electronic format, the employer must train workers in how to use the system and access the information.

The instruction and training provided by the employer must be site-specific and deal with specific products and procedures used at the workplace. Providing only generic WHMIS education through a training organization does not meet the WHMIS training requirements in this section. Generic instruction refers to the instruction of workers in WHMIS hazard information without reference to specific products or work sites.

Generic instruction is acceptable when providing information about

- types of content required on SDSs and labels;
- how WHMIS works;
- hazards of a group of products that have similar properties;
- work procedures for a group of products if the procedures are basically the same for all products in the group;
- work procedures that apply to a variety of work sites if the work procedures are basically the same at each site.

A product-specific and site-specific training component must be provided by the employer. The goal is that the program of instruction results in a worker being able to apply the information needed to protect the worker's health and safety. This requirement has several implications:

- While all workers who work with or near a hazardous product are likely to receive the same basic instruction, the content may vary somewhat from worker to worker depending on the type of work the worker does.
- Instruction must be integrated into the overall hazard prevention program at the workplace. Procedures training must take into account information available from the label and SDS, and also the particular circumstances of the workplace. For example, it is not enough to know that the SDS suggests a particular type of

respirator—the worker must know where to obtain it, locations in the plant where its use is mandatory, how to use it and how to maintain and store it.

- The proof of a successful program is the ability of workers to demonstrate safe work procedures with hazardous products and the knowledge of why those procedures are required.

OHS officers will usually speak with workers and ask four questions to determine the adequacy of their WHMIS training and to assess compliance with this section:

- (1) What are the hazards of the controlled product?
- (2) How are you protected from these hazards?
- (3) What do you do in case of an emergency?
- (4) Where can you get more information?

If a worker can correctly answer these questions regarding the hazardous product(s) they use or have contact with, the training program is considered to be adequate and meets the requirements of this section.

There is no requirement for workers to be “certified” under WHMIS, nor are workers required to have a card or certificate showing they have received training.

For materials exempted under section 395(5) of the *OHS Code*, the employer must provide worker education about SDSs and labels, even though these products are exempt from the SDS and labelling requirements. These substances are exempted because there are alternative methods for suppliers to provide information to users. This information should be used by employers in place of WHMIS SDSs and labels for the exempted substances. The employer must obtain the information available under the alternative legislation and train workers in the content, purpose and significance of this information. Under section 5 of the *OHS Act*, workers are responsible for participating in the instruction that the employer provides. In addition, workers must inform their employer or supervisor of any circumstances where they do not have adequate information about a product to ensure their health and safety or the health and safety of others at the work site.

Employers are not required to engage an outside organization to develop and deliver their WHMIS training program. This can be developed and delivered in-house.

Section 398 Label required

The employer must ensure that an up-to-date supplier label is applied to a hazardous product when it enters the workplace. The employer must take measures (e.g., worker education), to ensure that supplier labels are not removed, modified, defaced or altered. In facilities where containers may be recycled and reused, the employer must ensure that the original supplier label is removed from the container before the container is

reused and that the container is then appropriately labelled (with a supplier label or work site label) to reflect its contents.

The following information must be present on a work site label:

- product identifier (name of product)
- information for safe use of the product (for example, signal word, hazard statements and precautionary statements)
- a reference to the SDS.

Under the HPR, if a Canadian supplier becomes aware of information which changes the classification of the hazardous product or changes the hazard control methods (defined as “significant new data”), they must update the supplier label within 180 days. The supplier must provide this information, in writing, to a purchaser who buys the hazardous product within this 180-day time period. It is the employer’s responsibility to update the affected label as soon as the information is received and train workers on the significant new data.

The employer must ensure that a hazardous product is not used or handled at the workplace until the proper label has been applied. If a hazardous product is received from a supplier without the proper label, the employer may store the product only while actively seeking the supplier label information. The employer has 120 days from the day the hazardous product is received to obtain the label information and apply a supplier or work site label to the product or its container.

If the information is not received and a label is therefore not applied within 120 days of receipt of the product, the employer may no longer store the product at the workplace. In this case, the employer may ship the product back to the supplier or properly dispose of the product in accordance with the appropriate environmental legislation. During the 120-day period, the product may be stored with placarding as long as workers working near the storage area have received instruction in the content of the placard, the purpose and significance of the information contained on the placard, and procedures to be followed should the product give off fugitive emissions or in the event of an emergency.

Where a hazardous product is imported into Canada from a foreign supplier directly by the employer for use in the importer’s own work place, the employer is responsible for ensuring the product or its container are labelled in accordance with the WHMIS requirements. The employer must, at a minimum, apply a work site label.

Section 399 Production or manufacture

Where an employer produces a hazardous product at the workplace, the employer must develop and apply, at a minimum, a work site label to the product or its container, unless the product is:

- not in a container

- an intermediary in a reaction
- a hazardous waste
- a fugitive emission
- produced in a laboratory solely for research and development work in the laboratory
- is in a container or form intended for export
- is in a container that is intended for sale or disposition and is, or is about to be (within one work shift), appropriately labelled.

Section 400 Decanted products

This section presents requirements for the labelling of containers used for decanted products to ensure that hazardous products are not handled, used or stored at the workplace in unlabelled containers. This section does not apply if the worker requires all of the product for immediate use. “Immediate” means to be used at once, without delay. The following must also apply:

- the product will be under the exclusive control (not used by others) of the worker who filled the container and will be used only during that work shift;
- at the end of the work shift, the container must be empty. If not, the worker must apply a work site label or empty the contents into an appropriately labelled container.

Section 401 Placards

In some circumstances, the employer is permitted to use a means of identification other than a label to ensure that workers recognize the presence of a hazardous product. If the product is not in a container, is intended for export from Canada or is in a container intended for sale to be labelled at a later time (typically more than one work shift later, but without undue delay), the employer may post a placard in the area where the product is stored. The information provided on the placard must be the same as that which would be applied to a work site label. The placard must be sufficiently large and located in a manner to ensure that the information is clear and legible to workers.

Section 402 Transfer of hazardous products

Hazardous products in reaction vessels, transferred in piping within the workplace or contained or transferred in tank cars, tank trucks, ore cars, conveyor belts or similar conveyances are additional situations in which other means of labelling may be used. Warning signs, placards, symbols, colour coding, process flow charts or piping diagrams are all examples of the types of labelling that are acceptable if, when combined with worker education, workers are able to understand the meaning of the system. The labelling system must address the needs of individuals who are colour blind, illiterate or have English as a second language. The employer must ensure workers are trained to understand the system.

Section 403 Laboratory samples

A laboratory sample that is a sample of a hazardous product that is intended solely to be tested in a laboratory for purposes such as analysis, research and development, must also be properly labelled. Where it is a sample of a hazardous product, a WHMIS label and SDS are required. Laboratory samples do not include samples used by laboratories to test other products, mixtures, materials or substances or a sample being used for educational or demonstration purposes and must be packaged in a container that contains less than 10 kg of the hazardous product.

Laboratory samples are exempt from the labelling requirements in WHMIS where

- the chemical name, concentration of the hazardous product or the ingredients in the sample are unknown, or
- ownership of the sample is not transferred,

as long as the information required in subsection (2) is provided on the product label.

Examples of laboratory samples which may be subject to the exemptions include diagnostic specimens (infectious blood, mucosa or tissue samples), soil or water samples contaminated with hazardous substances or mixtures, chemical mixtures of hazardous products that are in the process of being developed, and quality control samples of hazardous products (developed products being tested for quality).

Section 404 Safety data sheet—supplier

The employer is responsible for ensuring that a supplier SDS that complies with the requirements of the *Hazardous Products Act* and the *Hazardous Products Regulation* is obtained from a supplier when a hazardous product is used at the workplace. This responsibility is not transferable to another organization or agency.

An SDS can be provided either as a paper document or as any type of electronic document that can be read using a computer or another device.

An employer may store a hazardous product at the workplace for 120 days while actively seeking a supplier SDS. If the SDS is not received within the 120-day period, the employer may

- develop an SDS for the product in accordance with the requirements of the *Hazardous Products Regulation*;
- ship the product back to the supplier; or
- properly dispose of the product in accordance with applicable environmental legislation.

Section 405 Safety data sheet—employer

If the employer produces a hazardous product that will be used at the work site, the employer must prepare an SDS that complies with the requirements set out in the HPR for that product. The exceptions to this are if the hazardous product is a fugitive emission or if it is an intermediate in a reaction (a product that is formed and consumed during reaction within the vessel).

If a product is recycled at the work site and its composition/characteristics may change with use, the preparation of an SDS by the employer will be more complicated. An example of such a situation is where crude petroleum is pumped from the ground and then used and reused as a drilling fluid. Crude petroleum fits the definition of a complex mixture and there are generic SDSs available for the product. However, the hazardous properties of the product, such as flash point, vapour pressure, hydrogen sulphide content, benzene content, vary within a wide range from field to field, and even within the same oil field.

The use of a generic SDS may not be specific enough to provide the necessary hazard information to workers. While it is possible that some crude oils will not meet the definition for a hazardous product as they do not fall into one or more of the WHMIS hazard classes, most will because of their flammable or combustible characteristics or their toxic properties. It is therefore assumed that any crude petroleum used at the workplace will be regulated by WHMIS unless the employer or supplier can produce test results showing that their particular crude is not. A generic SDS will only be acceptable where it is supplemented by hazard information applicable to the specific product at the workplace. For example, if the generic SDS has a flash point ranging from the flammable to combustible temperatures, it must be supplemented with the actual flash point of the product. The same situation applies to the use and reuse of drilling muds at well sites.

The employer may produce and make readily available an SDS in a format different from the supplier SDS as long as it contains no less information than the supplier's SDS and the supplier's SDS is available at the workplace. The advantage of this is the ability to include local regulatory requirements such as exposure limits and the incorporation of information about hazards and control measures specific to circumstances at the work site. The content of the employer SDS must cover the items specified in the HPR. The employer may also provide additional information if it is provided on the original supplier's SDS or add other hazard information of which the employer is aware regarding the product.

Simplification of the supplier SDS is acceptable as long as the intent of the supplier's SDS is not altered. However, the perceived level of risk may not be reduced. For example, if the supplier reports the results of a number of oral LC₅₀ tests, the employer

may summarize the information by reporting the LC_{50} for the most toxic effect and referring to the fact that the result was one of a series of tests.

If the employer chooses to use a standard format SDS that displays all of the information items in Schedule 1 of the HPR and the supplier's SDS does not provide information for one or more of those items, it is not appropriate to enter the expressions "Not Available" or "Not Applicable" unless the employer has searched reasonably available information sources, including making contact with the supplier, and has confirmed that the expressions apply.

Disclaimer statements provided on supplier SDSs do not enhance the information provided and need not be reproduced on the employer SDS. Disclaimer statements that contradict information on the SDS may not be used. The employer must reproduce the Preparation Information provided on the supplier SDS. The employer SDS may, but is not required to, show information about who prepared the employer SDS and the date of preparation. The employer SDS must indicate that the supplier's SDS is available at the workplace.

In some cases, the employer may wish to combine the SDSs of identical products from more than one supplier to produce a composite SDS. For example, the employer may purchase one chemical from several suppliers. This SDS must contain all of the information from each of the supplier's SDSs. The composite SDS must include all discrete trade names or other identifiers that appear on the supplier SDS. The composite SDS must identify beside each of these the supplier name and telephone number as well as the person responsible for preparing the SDS and its preparation date. If more than one use is identified on the separate SDSs, all uses must be reflected on the composite SDS. Precautionary measures specific to different uses must also be identified in this way. The composite SDS must meet all the other requirements for the content of an employer-produced SDS.

Where an employer has produced an SDS to replace a supplier SDS, the original supplier SDS must be located within the company and be available at the work site. This means that the SDS must be readily available to workers in hard copy either through an internal mail system, facsimile transmission or through electronic means.

Section 406 Information current

Under the HPR, the supplier is obligated to ensure the information provided on an SDS is always the most current information at the time of sale. There is no requirement to review or update the SDS at a particular interval. However, if significant new data is received, the supplier must update the SDS within 90 days. Similar to labels, if the product is purchased within this time period, the significant new data must be provided, along with the date the supplier became aware of this information to the purchaser, in

writing, with the SDS. The updated SDS is then provided to the purchaser on subsequent sales that occur after the 90 days.

When the employer receives significant new data from the supplier, they are responsible to update the SDS within 90 days of receipt of the information.

Under the *OHS Act*, section 6, a supplier must provide notice to all employers supplied with a harmful substance when they become aware (or reasonably ought to be aware) that a product does not comply with the regulations or *OHS Code*. An example of a situation of this type would be where government is working with a supplier to update an SDS to ensure it complies with the federal legislation. If an employer is concerned that an SDS may not comply with the federal legislation, they can file a complaint to government through the OHS Contact Centre.

In cases where an employer has stored a product in the workplace for an extended period of time (e.g., more than five years), the employer may need to evaluate the currency of the information they have available to ensure that appropriate health and safety training and instruction is provided and safe work procedures are accurate. They may wish to contact the supplier to find out if the SDS has been updated since they purchased the product. It should be noted that the supplier is not obligated to provide a new, updated SDS if the employer has not purchased the product.

Section 407 Availability of material safety data sheet

SDSs must be readily available to workers at the work site. “Readily available” is interpreted to mean that the SDS is located near workers in physical copy form or readily accessible through a computer or device during each work shift. Workers are not required to work with the product until they see the SDS, if they wish to do so.

SDSs may be made readily available to workers via an electronic storage and retrieval system or device if

- (a) the system is available for use during all work shifts;
- (b) a trained operator is available on each shift to retrieve the information or, alternatively, all workers are trained to retrieve the information;
- (c) the system is provided at all work sites; and
- (d) the system is capable of providing paper copies of SDSs.

Hard copies of SDSs must be at all work sites, including mobile work sites, unless the employer can demonstrate an equivalent means of providing this information by electronic means that is available to workers in all areas of the province they work. It is not acceptable to have the worker call in and have information read over the telephone.

Section 408 Claim for disclosure exemption

There may be situations where the release of certain information regarding a hazardous product may result in financial loss to the supplier or employer relative to its competitors. Such information is termed confidential business information and is generally considered to be technical information about a product or its manufacturing process that has economic value or advantage and is known only to the producer or supplier. WHMIS provides a mechanism that allows employers to withhold genuine confidential information under certain circumstances.

An employer may file a claim with Health Canada in accordance with the *Hazardous Materials Information Review Act* (Canada) (HMIRA) that certain information is confidential business information and is exempt from disclosure on a label or an SDS.

The following information may be claimed for exemption by suppliers or employers:

- chemical identity of an ingredient, substance or material (including impurities and stabilizing solvents);
- concentration or concentration range of an ingredient, substance or material;
- the name of a toxicological study that identifies the ingredient, substance or material.

Employers may also claim:

- product identifier (chemical name, trade name and/or other means of identification information);
- information that could be used to identify the supplier.

Note that the exemption does not apply to other types of information required on the SDS, such as hazard information.

Once a claim is filed, the information that is the subject of the claim must be replaced on the SDS. If it relates to the chemical identity and/or true concentration (or true concentration range) of an ingredient, this information must be replaced with a reference to the HMIRA claim for exemption information (e.g., the registry number). If the claim relates to the chemical name of the ingredient, it must be replaced with an appropriate generic chemical name, for example, "Alcohol." The CAS number may be replaced with a word such as "Proprietary" and the true concentration (or true concentration range) may be replaced with a word such as 'Proprietary' and/or a replacement concentration range.

Section 409 Interim non-disclosure

Once a claim for exemption to disclose confidential business information has been filed with Health Canada, the employer may modify the SDS by deleting the information that is the subject of the claim for exemption. The employer may also remove the supplier label and replace it with a work site label that complies with Part 29 of the *OHS Code*.

After a claim is filed and while an employer waits to hear the outcome of the claim, an employer can delete the exempted information as long as they include the following on the SDS and labels:

- (a) a statement that the claim for exemption was filed;
- (b) the date on which the claim was filed; and
- (c) the registry number assigned to the claim for exemption under HMIRA.

Once determined by Health Canada, an exemption is valid for 3 years.

Section 410 Exemption from disclosure

When a claim for an exemption to disclose confidential business information is determined to be valid by Health Canada, the employer must revise the SDS and label within 30 days of decision of the claim. The revision must include

- (a) a statement that an exemption was granted,
- (b) the date of the decision, and
- (c) the registry number assigned to the claim.

Where there is no appeal, the date of decision is, the date of expiry of the appeal period. Where a decision is appealed, it is the date of expiry of the appeal period that applies to the decision on the first appeal (unless that decision is appealed). Claims that are approved by Health Canada may include an order for changes to the SDS and/or label. These changes must be made unless successfully appealed.

Health Canada maintains a list of active claims: <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/workplace-hazardous-materials-information-system/claims-exemption-under-hmira/claims-exemption/active-claims-notice/list-active-claims-exemption.html>.

Section 411 Duty to disclose information

This section requires the employer who manufactures a hazardous product to disclose the source of toxicological data used in preparing the SDS as quickly as possible on request to an OHS officer or the joint work site health and safety committee or health and safety representative. In the absence of a joint work site health and safety committee or health and safety representative, the information can be disclosed to a representative of concerned workers at the work site. This disclosure of information is subject to exemptions received under HMIRA.

Section 412 Information confidential

This section outlines the rules that must be followed to protect the confidential business information exemption obtained by an employer. Federal legislation and provincial

legislation work hand in hand to control disclosure of the information when it is obtained for the purposes of compliance with the HPA or the *OHS Code*.

If an officer obtains information under paragraph 46(2)(e) of HMIRA, they must keep that information confidential and not disclose it to any person. A person to whom that information is disclosed must keep it confidential and not disclose it to anyone else.

The circumstances where information that is the subject of an exemption for disclosure must be disclosed:

- (1) Employers must provide information about a hazardous product to a medical professional who requests that information for the purpose of medical diagnosis or treatment of a person in an emergency.
- (2) An employer may appeal the decision regarding an application for a confidential business exemption. The Appeal Board established under HMIRA may order a claimant to disclose in confidence to one or more affected parties, information related to the subject matter of the appeal if, in the opinion of the Appeal Board, the information should be disclosed to protect health and safety at a workplace.
- (3) Confidential business information must be provided to any official of
 - (a) Health Canada or a designated federal WHMIS Inspector from Alberta Labour for the purposes of administration or enforcement of the HPA;
 - (b) Human Resources and Development Canada for the purpose of the administration or enforcement of Part IV of the *Canada Labour Code*;
 - (c) Department of Transportation for the purpose of making information available in cases of medical emergency through the Canadian Transport Emergency Centre; and
 - (d) Alberta Labour for the purpose of administration or enforcement of provincial legislation related to OHS.

In all cases, where confidential business information is disclosed, recipients must keep the information confidential. HMIRA provides for penalties in the event of contravention of any provision of the *Act*, including unauthorized disclosure of information.

Section 413 Information to medical professional

Employers must provide information about a hazardous product to a medical professional who requests that information for the purpose of medical diagnosis or treatment of a person in an emergency. The federal legislation also allows an officer working under the authority of the HPA to communicate information received from an employer regarding a claim for confidential business information to a medical professional who requests that information for the purpose of diagnosis or treatment of

a person in an emergency. The medical professional must also maintain confidentiality of the information, except where the information is needed for medical treatment.

Section 414 Limits on disclosure

No explanation required.

Part 30 Demolition

Highlights

- Section 417 requires that employers remove from structures to be demolished all chemical and biological substances that could be hazardous to workers during demolition.
- Section 418 requires employers ensure that a competent person develops a demolition procedure for the use of explosives during demolition activities. (Section 14 of the *OHS Act* requires that procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.)
- Section 420 requires employers to enclose particularly steep materials chutes. Chutes installed at an angle steeper than 45 degrees from the horizontal must be totally enclosed to prevent debris from falling or flying out of the chute.

Requirements

Section 415 Worker in charge

By its nature, demolition work is hazardous. A competent worker designated by the employer must be in charge of the demolition work at all times while work is in progress.

Section 416 Location of equipment

Because buildings or structures are being torn down or razed during demolition activities, falling materials are always a potential hazard at the work site. Temporary offices and tool boxes must be located to remain clear of falling materials and debris.

Section 417 Harmful substances

Subsection 417(a)

A structure that is being demolished may have at one time been used to store, manufacture or process a harmful substance. Harmful substances may also be present in the building structure.

A harmful substance is defined as a substance that, because of its properties, application, or presence, creates or could create a danger, including a chemical or biological hazard, to the health and safety of workers exposed to it.

This section of the *OHS Code* requires that all chemical and biological substances that could pose a hazard to workers during demolition be removed from the structure (or part of the structure being demolished) prior to demolition. This applies to a wide range of substances, including the following.

Chemical

- insulation (fiberglass, asbestos, refractory ceramic fibre)
- building materials containing asbestos (see Chapter 1 of the *Alberta Asbestos Abatement Manual* for examples)
- lead paint
- mercury (fluorescent lights, switches, gauges)
- polychlorinated biphenyls (liquid cooled electrical equipment, fluorescent light ballasts, paints, electrical insulating materials)
- paints and solvents
- oils and lubricants
- fuels (gasoline, diesel)
- batteries
- process chemicals
- glues
- air conditioning system or cooling system chemicals (freon, halon, other chlorofluorocarbons)
- compressed gases
- welding rods and solder

Biological

- mould
- bacteria (medical waste, human or animal waste)
- animal or human waste (sewage contamination, manure, bird droppings, rodent droppings)

The above list provides some examples of harmful substances that may be encountered, but is not a comprehensive list. The employer must, as part of the hazard assessment required by Part 2 of the *OHS Code*, identify harmful substances that may be present at the work site. The assistance of a consultant who can conduct a survey of the building for hazardous materials may be needed.

For all demolition projects, a written hazard assessment is required prior to work beginning. If substances are identified that may pose a hazard to workers during the demolition, these substances must be removed before work begins. The employer must consider both direct hazards, e.g., contact with lead paint, and indirect hazards, e.g., exposure to dust containing lead paint. Alternatively, the employer must develop work

procedures that reduce or remove the potential hazard, e.g., dust control measures, use of enclosures around demolition areas, etc.

Part 4 of the *OHS Code* requires that all asbestos-containing materials be removed prior to demolition. Asbestos-containing materials are considered to be materials that contain 1 percent or more asbestos by weight, i.e., in the individual material, not aggregate waste. However, regardless of the asbestos content, if asbestos fibres may be released in amounts that reach or exceed the occupational exposure limit for asbestos, then the work site is considered a “restricted area,” as defined in section 1 of the *OHS Code*.

For more information regarding asbestos removal prior to demolition, see Chapter 5 of the *Alberta Asbestos Abatement Manual*.

Although not addressed in the *OHS Code*, the employer needs to determine the appropriate method for disposing of the demolition waste. Requirements for waste disposal are covered under environmental legislation which is administered by Alberta Environment and Parks. The employer needs to contact the appropriate environmental authorities and the landfill to determine disposal requirements. In addition, the employer must ensure that the waste materials are contained in a manner so that they will not pose a hazard to workers transporting the waste or to workers at the disposal facility.

Subsection 417(b)

Any concrete that is to be included in the demolition must be assessed to determine if there are any facilities embedded in the concrete. As an example, there may be conduits carrying electrical lines, water/sewage lines, product lines, etc. It is important that workers know of the presence of such lines, their locations and whether or not they are carrying anything that might be harmful or injurious to workers. Concrete-embedded facilities must be identified, located and marked in accordance with section 447.

Section 418 Use of explosives

The use of explosives at the demolition site presents additional hazards. The employer must ensure that a competent person develops a demolition procedure for the use of explosives. The applicable requirements of Part 33, Explosives, must be met. As required by section 468, the employer must ensure that the blasting area is under the direction and control of a blaster having a valid Blaster's Permit.

Section 419 Disconnecting services

All electric, gas, water, steam, sewer, and other services lines should be disconnected, i.e., shut off, capped, or otherwise controlled, at or outside the structure before demolition begins. In each case, any utility company which is involved should be

notified in advance, and its approval or services, if necessary, should be obtained. Written confirmation of the disconnection is required. This written confirmation should be readily available at the work site to workers and an officer.

If it is necessary to maintain any power, water, or other utilities during demolition, such lines should be temporarily relocated as necessary and/or protected. The location of all overhead power sources should also be determined, as they can be especially hazardous during any machine demolition. All workers should be informed of the location of any existing or relocated utility service.

Section 420 Materials chute

To prevent debris from falling or flying out of a materials chute, chutes installed at an angle steeper than 45 degrees from the horizontal must be totally enclosed.

If material is being dropped, thrown or conveyed by a materials chute workers must be prevented from entering the area into which the material falls, e.g., barricades, guardrails, etc. Highly visible warning signs must also be posted in the immediate area to advise workers of the danger.

Section 421 Dismantling buildings

Subsection 421(a)

This is one of the very few requirements in the *OHS Code* that addresses protection of the public as well as worker safety. The intent of the requirement is self-evident.

Subsections 421(b), 421(e), 421(f) and 421(g)

All structures are loaded in some way or other, e.g., by external loads of various kinds, the weight of the structure itself, etc. The various parts—or in the case of framed structures, the members—transmit these loads to the foundations. In the complete structure the forces and reactions balance one another and equilibrium is achieved. The removal of a load-carrying member may unbalance the forces in that part of the structure, upset the equilibrium, and cause collapse.

In general, it is a sound rule to demolish in the reverse order to that used for construction. However, a deliberately engineered collapse, or a mechanical process, such as the use of demolition balls, pusher arms or explosives, may sometimes be the quickest and most economical way of demolishing some structures. Such work must always be carried out under expert supervision and measures taken to prevent injury to personnel or property.

Consideration should always be given to the following:

- (a) Can the proposed method lead to sudden or uncontrollable collapse of the part in question? If so, what alternative method can be used to allow the work to be carried out under control and in safety?
- (b) Is the member helping to support any other parts of the framed structure not intended to be demolished in this particular operation? If so, what measures will be necessary to prevent possible collapse of those other parts?
- (c) Are arrangements made for the proper use of temporary struts, braces, shores or guy ropes to control temporary instability or sudden springing of the structure?

Subsection 421(c)

The release of forces in structures where tensioned cables or bars have been used may produce unpredictable reactions. Information about the design and construction of the building should be obtained prior to demolition beginning. Demolition procedures must be prepared and supervised by a professional engineer who is at the work site to control and supervise all related work.

Subsection 421(d)

This subsection is necessary to protect workers from falling material or the collapse of any portion of the structure.

Section 422 Building shaft demolition

If the scaffold were anchored to the structure, a collapse of that portion of the structure might pull the scaffold down with it. A free-standing scaffold is required when a building shaft is being demolished from the inside.

Part 31 Diving Operations

Highlights

- Rather than specify detailed procedural requirements in this Part, section 424 requires employers to meet the requirements of CSA Standard Z275.2-04, *Occupational Safety Code for Diving Operations*, to ensure that diving operations are performed safely.
- Section 424 requires that divers meet the minimum requirements of CSA Standard Z275.4.02, *Competency for Diving Operations*.
- Section 437 amends CSA Standard Z275.2-04 to provide divers with an added level of safety by requiring that the intake mechanism of a pipe, tunnel or duct be locked out, as stopping the flow associated with the intake by itself is insufficient.

Requirements

Section 423 Application

This Part applies to commercial diving performed by workers who are diving at a work site. It does not apply to sport or recreational diving or to a person instructing others in sport or recreational diving.

Commercial diving involves a wide range of activities. Divers are exposed not only to the possibility of drowning, but also to a variety of occupational health and safety hazards such as respiratory and circulatory risks, hypothermia, low visibility and physical injury from the operation of heavy equipment under water.

The type of dive, its duration, the frequency of diving and the type of work being performed increase the already high risk of this strenuous work. Additional hazards are also associated with the actual work of underwater cutting and welding, materials handling, hull scrubbing and other types of work involving the use of hand and power tools.

Section 424 Employer responsibilities

To ensure that commercial diving operations are conducted safely, employers must meet the requirements of the listed CSA standards. In combination, these three standards establish the requirements for hyperbaric facilities required in the event that a diver requires decompression, safe work practices to be used during operations, and diver competency requirements.

Hyperbaric facilities

CSA Standard CAN/CSA Z275.1-93 (R2004), *Hyperbaric Facilities*, sets requirements for the design, construction, maintenance and testing of hyperbaric chambers. The primary function of these chambers is to be able to subject humans to pressure environments exceeding 1 atmosphere absolute, such as those required in diving operations, work under compressed-air conditions, medical treatment, training and research. The types of chambers included in the Standard are the transportable, evacuation, monoplace and submersible chambers.

A submersible compression chamber is a chamber that is intended to be submerged and is designed to transport a person at atmospheric pressure, or divers at pressures greater than atmospheric pressure, from the surface to an underwater work site and back. This type of chamber includes the compression chamber of a diving submersible.

A lock-out submersible is a self-propelled submersible fitted with a submersible compression chamber from which a diving operation can be carried out and that has a separate 1 atmosphere chamber from which the submersible is operated.

Safety code for diving operations

Commercial diving operations must meet the requirements of CSA Standard Z275.2-04, *Occupational Safety Code for Diving Operations*. This standard applies to occupational diving operations conducted in connection with all types of work and employment, and describes the requirements for occupational safety. The Standard addresses equipment requirements for:

- (a) SCUBA diving systems;
- (b) surface-supply diving systems;
- (c) deep-diving systems; and
- (d) diving in contaminated environments.

The Standard specifies requirements for:

- (a) medical certificates and medical examinations;
- (b) diver logbooks;
- (c) dive procedures;
- (d) emergency services and contingency planning;
- (e) breathing mixtures and their purity;
- (f) decompression procedures and tables;
- (g) diving equipment;
- (h) crew sizes; and
- (i) diving in contaminated environments.

Diver competency

Each occupational diver must meet the requirements of CSA Standard Z275.4-02, *Competency Standard for Diving Operations*. Competency documents must be available at the dive site for inspection by an officer. Sport diving competency documents alone are not acceptable for commercial diving purposes. In the case of “restricted scuba diving,” a sport diving certificate is a prerequisite, supplemented with significant theoretical and practical training.

The CSA Standard applies to occupational diving operations conducted in connection with all types of work and employment, and describes the requirements for minimal competency levels for all personnel directly associated with the techniques of diving identified in the Standard.

The *OHS Code* requires all workers to be competent to perform the work assigned to them. Divers must be competent in both the theory and use of the type of diving equipment they use. The Standard provides diver training facilities and the diving industry with a uniform minimum level of training course content necessary for the various levels of diver techniques.

The Standard addresses competency requirements for the following:

- (a) occupational (open-circuit) SCUBA diving;
- (b) surface-supplied diving;
 - (i) air—both restricted and unrestricted surface-supplied; and
 - (ii) mixed gas;
- (c) deep diving;
 - (i) bell techniques (bell);
 - (ii) saturation techniques (SAT); and
 - (iii) atmospheric diving system techniques (ADS); and
- (d) diving and hyperbaric physicians.

The Standard addresses competency requirements for the following personnel associated with the diving techniques listed above:

- (a) divers/pilots;
- (b) tenders;
- (c) diving supervisors;
- (d) hyperbaric chamber operators;
- (e) hyperbaric life-support technicians (LST) and certified hyperbaric technicians (CHT);
and
- (f) medical physicians.

The employer is responsible for ensuring that divers meet the requirements of the Standard. To do this, an occupational diver must be assessed by the employer as meeting the minimum requirements of CSA Standard Z275.4-02 and is therefore competent to dive at a work site.

In cases where the employer is unable to make the assessment of worker competency, a diver would be considered to meet the requirements if the diver were to

- (a) possess a valid certificate issued by the Diver Certification Board of Canada (DCBC) (an example of the certificate appears on the DCBC Web site). DCBC is a federally incorporated not-for-profit body that was set up to certify commercial divers and dive supervisors. Divers and supervisors must demonstrate that they have sufficient training and experience to enable them to meet the competency requirements of the appropriate clauses of the CSA Standard;
- (b) possess a valid graduation diploma or certificate from one of the commercial diver training schools accredited by DCBC. A list of accredited training schools, and other information related to diver certification can be found at the DCBC web site. If the diver cannot demonstrate proof of successfully completing an accredited diver training course, but has many years of diving experience and personal log books with records of commercial dives that are stamped and signed by the dive supervisors, the diver can attend an assessment course at one of the diver training schools accredited by DCBC. The assessment allows the diver to demonstrate his or her competency at the level described in CSA Standard Z275.4-02, *Competency Standard for Diving Operations*. If the diver can demonstrate the required competency, the assessment organization may recommend to DCBC that a diver certification certificate be issued to the diver. If the diver lacks competency in any area, the diver may be trained in those competencies;
- (c) possess a valid diving certificate issued by the Association of Diving Contractors International; or
- (d) possess a valid diving certificate issued by the International Marine Contractors Association.

Commentary regarding “restricted scuba diving” activities

“Restricted scuba diving” refers to diving activities involving the use of scuba gear to a maximum depth of 20 metres. Occupational Health and Safety regularly receives inquiries about the qualifications a scuba diver must possess in order to perform activities such as:

- (a) minor routine cleaning and maintenance using hand tools (and a limited range of power tools) in pools of water to a maximum depth of 20 metres;
- (b) entering large volume water holding tanks to display animals held in those tanks or to clean out waste materials produced by those animals; and
- (c) entering bodies of water on golf courses or similar facilities to retrieve golf balls or other items.

Section 424 of the OHS Code references CSA Standard Z275.2-04, *Occupational Safety Code for Diving Operations* and CSA Standard Z275.4-02, *Competency Standard for Diving Operations*. The requirements of these diving standards must be met unless the employer is granted a written “acceptance” from Occupational Health and Safety to deviate from

the stated requirements. When applying CSA Standard Z275.2-04 to the work activities described above, the following requirements within the Standard apply:

- (a) divers must meet the requirements for regular medical examinations by a qualified hyperbaric physician as described in Clause 3.2.1 Medical qualification; and
- (b) divers must have the skills training required by Clause 3.2.2 Training qualifications. This means compliance with the appropriate portions of CSA Standard Z275.4-02, *Competency Standard for Diving Operations*. CSA Standard Z275.4-02 also includes competency requirements for those workers functioning as scuba tender and scuba supervisor.

Based on the work activities described above, divers doing this work are classified as “restricted scuba divers.” According to Clause 4.1.2 of CSA Standard Z275.4-02, a restricted scuba diver must have the following prerequisites:

- (a) a recreational scuba diving certification or equivalent—a certificate issued by NAUI, PADI or similar organization is sufficient;
- (b) commercial diving medical certificate; and
- (c) a minimum of 10 hours bottom time with a minimum of 20 logged dives.

Having met these prerequisites, candidates can then undertake to meet the additional restricted scuba diver requirements of Clause 4.4 of the Standard, *Competency Elements for Restricted SCUBA Divers*. This training can be done by an external agency or by someone within the employer’s organization who has the skills necessary to competently teach the divers and evaluate their performance. To assist persons delivering this material, CSA has issued a companion standard that describes the teaching objectives and course curricula in greater detail. This information can be found in CSA Standard Z275.5-05, *Occupational Diver Training*.

In reviewing CSA Standard Z275.2-04, *Occupational Safety Code for Diving Operations*, additional requirements apply. The following clauses within the standard must be met:

- (a) 3.3 Diving records;
- (b) 3.4 General dive procedures, i.e., dive plan, presence of dive supervisor and standby diver, etc.;
- (c) 3.5 Diving hazards, i.e., includes approaches to intakes and exhausts;
- (d) 3.6 Emergency services and contingency planning;
- (e) 3.7 Breathing mixtures;
- (f) 3.8 Purity of breathing mixtures;
- (g) 5 General equipment requirements; and
- (h) 6 SCUBA diving.

In essence, employers can take divers with recreational diving certificates and train them up to the level expected of an occupational diver performing restricted scuba diving activities.

Physician qualifications

Commercial divers need to anticipate the progression of natural diseases, detect any long-term consequences of diving and ensure that they are capable of safely performing their work. A physician, knowledgeable and competent in dive medicine, must regularly assess a diver as fit for work.

CSA Standard Z275.4-02, *Competency Standard for Diving Operations*, specifies the minimum competency requirement for physicians offering services related to diving, i.e., hyperbaric medicine. A general practitioner or specialist is not qualified to issue a diver's medical certificate unless the physician has received additional training in hyperbaric medicine as described below.

The CSA Standard divides competency in hyperbaric medicine into three broad categories as follows:

Level 1—a physician with basic training in diving medicine who is capable of screening workers for exposure to pressure and advising on the management of pressure-related accidents. To be certified at this level, physicians must be able to demonstrate that they:

- (a) are in possession of a license to practice in Alberta;
- (b) have completed a basic training course in diving medicine;
- (c) have an effective working knowledge of the physical laws affecting the diver and the underwater operation;
- (d) have an understanding of the interaction that occurs between these physical laws and the diver's physiology and on the implications of this interaction for the diver;
- (e) have a sufficient awareness of the pathological conditions that can arise as a consequence of exposure to pressure;
- (f) have the ability to perform a competent physical evaluation of diving candidates, divers, and caisson workers;
- (g) are familiar with the management steps to be followed in the event of an accident or other adverse condition arising as a consequence of diving operations; and
- (h) are knowledgeable with respect to the appropriate steps to be taken in the initial investigation of any diving incidents, accidents, or fatalities, including but not limited to the appropriate autopsy protocol to be followed in the event of death.

Level 2—a physician with advanced training in diving medicine who is capable of all the activities of a Level 1 physician and additionally is able to manage all aspects of pressure-related accidents, including entering the chamber to attend the injured worker.

Level 2 physicians must:

- (a) meet all requirements for Level 1 physicians;
- (b) be familiar with the general principles of management for all forms of decompression illness, including the various tables and the appropriate application;
- (c) be sufficiently physically fit to participate in chamber diving operations (They are not required to meet the physical fitness standard where they are able to delegate to

other qualified personnel all medical acts that would require exposure to elevated pressure);

- (d) have completed training with regard to the safe operation of hyperbaric facilities, and be familiar with CSA Standard Z275.1-93 (R2004), *Hyperbaric Facilities*; and
- (e) have sufficient practical experience with any chamber systems in use to ensure appropriate application of CSA Standard Z275.1.

Level 3—a physician who has advanced training in diving medicine and has practical experience with management of diving-related illness and injury such that he or she is thoroughly familiar with all aspects and hazards of pressure and underwater exposures and can manage any pressure-related accident, including saturation and long-term management.

Level 3 physicians must:

- (a) meet all requirements for Level 1 and Level 2 physicians;
- (b) have additional training and/or experience in the management of pressure-related accidents, including the use of saturation methods and long-term follow-up;
- (c) be thoroughly familiar with all aspects and hazards of pressure and underwater environments; and
- (d) have an understanding of the various standards applicable to the safe conduct of the diving operations underway and of their application.

Section 437 Intakes, pipes and tunnels

This section amends the referenced CSA standard, providing the diver with an added level of safety by requiring that the intake mechanism of a pipe, tunnel, duct or similar mechanism be locked out. Stopping the flow associated with the intake is by itself insufficient—someone could inadvertently turn on a pump or motor and re-establish the flow, exposing a diver to a preventable life-threatening hazard. The amendment prohibits work to proceed unless the flow is stopped.

Part 32 Excavating and Tunnelling

Highlights

- Section 441 defines the terms “buried facility” and “hand expose zone” which reflect current industry practices in Alberta and requirements under the *Pipeline Act*. Section 441 also describes what is meant when the “ground is disturbed.”
- Section 442 classifies soils into three categories: hard and compact; likely to crack or crumble; sandy or loose. The categories dictate how the walls of excavations and trenches are cut back or sloped.
- Section 447 requires that ground not be disturbed until buried facilities have been identified and their locations marked.
- Sections 447 and 448 clarify requirements that affect work involving buried facilities.
- Section 451 requires that if walls of an excavation in soft, sandy or loose soil are cut back, they must be sloped from the bottom of the excavation and the walls must be at an angle of not less than 45 degrees (measured from the vertical).
- Section 453 requires that loose materials be scaled and trimmed from spoil piles.
- Section 455 requires that a safe point of entry and exit be located within 8 metres of any worker in a trench that is more than 1.5 metres deep.

Requirements

Section 441 Disturbing the ground

Before excavating activities actually begin, the location of buried facilities that may be encountered during digging must first be located. Buried or underground facilities include anything below the ground that transports or stores products and services such as

- water;
- sewage;
- oil;
- natural gas;
- chemicals;
- cablevision services;
- electric energy; and
- electric, telephonic and telegraphic communications.

These facilities may be contained in pipes, conduits, ducts, cables, wires, valves, manholes, catch basins, storage tanks and attachments associated with these items. Striking any of these facilities could result in personal injury and injury to other workers, electrocution, explosion or the release of a harmful substance(s). In addition to these health and safety consequences, vital services may be disrupted and repair costs may be incurred.

Disturbing the ground does not include

- (a) routine, minor road maintenance, such as patching, street sweeping and the grading of gravel roads;
- (b) agricultural cultivation to a depth of less than 450 millimetres below the ground surface over a pipeline; or
- (c) hand-digging to a depth of no more than 300 millimetres below the ground surface, so long as it does not permanently remove cover over a buried facility. Buried facilities tend to be more than 300 millimetres below the surface.

However, there are many activities that disturb the ground and have the potential to contact a buried facility. These include

- (a) excavating, digging and trenching;
- (b) plowing, drilling, tunnelling, auguring and backfilling;
- (c) driving posts, bars, pins, etc., topsoil stripping, land leveling and quarrying; and
- (d) tree planting, rock picking, grading, blasting and clearing.

Section 442 Classification of soil type

The employer is responsible for classifying the soil being excavated into one of the three types described in this section and summarized in Table 32.1.

The soil type helps to determine how stable the walls of an excavation will be. When the walls of an excavation are composed of layers—seams of gravel or debris may lie behind seemingly solid walls—the weakest layer is most likely to slump or slide. The total cross-section of soil must therefore be classified as the weakest soil type and the support system designed accordingly. Assume the worst and base precautions on the most unstable soil type that is likely to be present.

For example, a stronger layer overlain by a weaker layer could result in the uppermost, weaker layer slumping into the excavation, exposing workers to risk of injury. Similarly, if a stronger layer lies above a weaker layer, the slumping of the weaker layer could cause a large block of the upper layer to become unstable. Either case presents an unacceptable risk of injury or death to workers.

Because of the nature of classifying soil types, a competent person should be assigned to carry this out. A geotechnical engineer (a professional engineer) experienced in soil classification can assist with this.

Table 32.1 Classification of soil types

Soil characteristics	Soil type		
	Hard and compact soil	Likely to crack and crumble soil	Soft, sandy or loose soil
Consistency	Hard, very dense in compactive condition	Stiff, compact in compactive condition	Firm to very soft, loose to very loose in compactive condition
Ability to penetrate	Only with difficulty by a small, sharp object	With moderate difficulty with a small, sharp object	With ease
Appearance	Dry	Damp after it is excavated, has low to medium natural moisture content	Appears solid but flows or becomes unstable when disturbed. Can be dry, running easily into a well-defined conical pile, or wet
Ability to excavate with hand tools	Extremely difficult	Moderately difficult	With ease
Water seepage	Shows no signs of water seepage	Shows signs of localized water seepage	
Other	Does not include previously excavated soil	Shows signs of surface cracking	<ul style="list-style-type: none">Is granular soil below the water table, unless the soil has been dewateredExerts substantial hydraulic pressure when a support system is used

Trench wall failure

Worker injuries and deaths resulting from trench wall collapse are common and completely preventable. The material removed from the ground to form a hole, trench or cavity is extremely heavy. It may weigh more than 1476 kilograms/cubic metre, the equivalent weight of a car in a space less than the size of the average office desk. Wet soil, rocky soil or rock is usually heavier.

Undisturbed soil is kept in place by the horizontal and vertical forces of adjacent soil. Once soil is removed to create a trench, it is no longer available to provide support for the soil left behind in the trench wall. Without support, soil from the trench wall eventually moves downward and inward into the excavation. This creates a serious life-threatening hazard for workers in the trench.

Figure 32.1 shows the three areas of failure in a trench wall. The first failure occurs in Zone 1 at the base of the trench wall. This movement creates an undercut area, allowing

soil in Zone 2 to collapse. The failure of Zones 1 and 2 leaves the remaining trench wall, Zone 3, unsupported. Zone 3 will break away from the wall under its own weight and fall into the trench. How long it takes for Zones 2 and 3 to collapse is unpredictable. Many rescue attempts are unsuccessful because rescuers attempt to save victims before the second and third failures occur. The would-be rescuers are often trapped along with the first victim(s).

Figure 32.1 Mechanics of trench wall failure involving previously disturbed soil

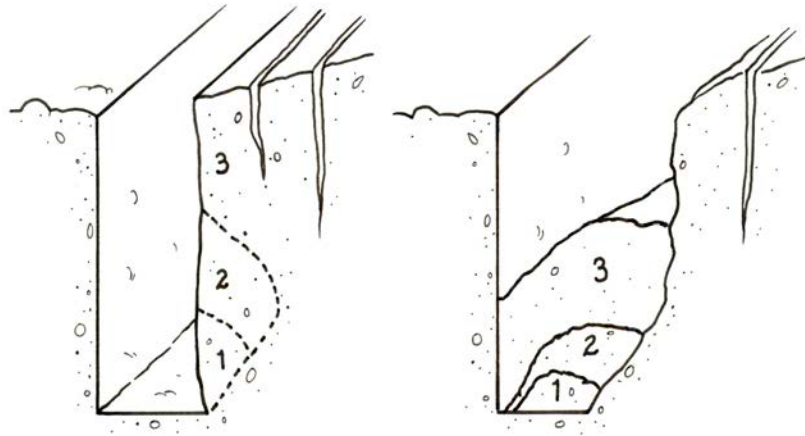
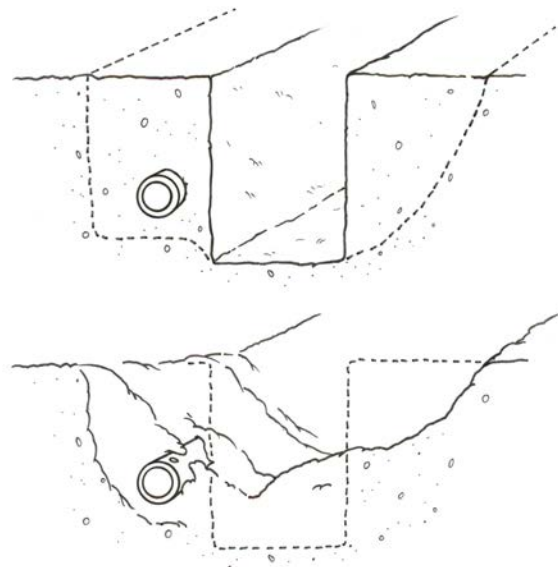


Figure 32.2 shows where soil that has already been excavated and backfilled is most likely to collapse. Previously disturbed soil takes a long time to return to its previous condition.

Figure 32.2 Areas of a trench in previously disturbed soil most likely to collapse



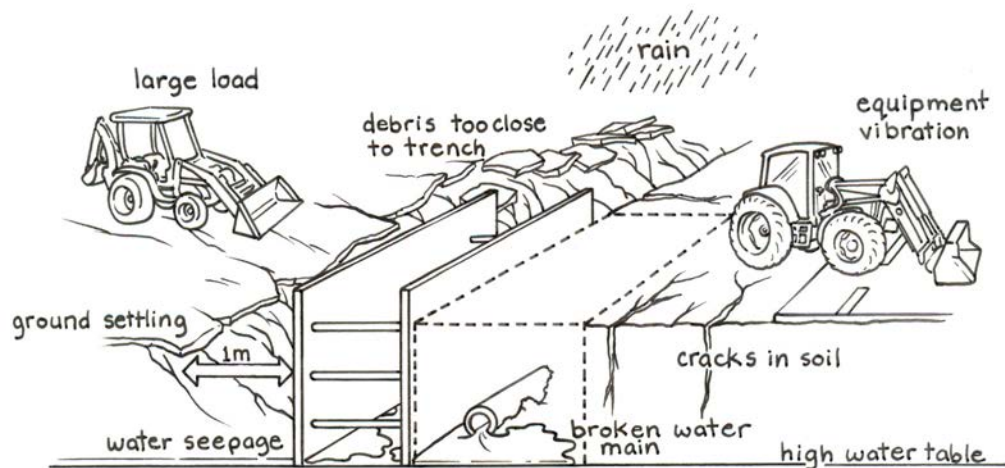
A trench wall collapse might involve 2.5 to 4 cubic metres of soil, weighing from 3700 to 7400 kilograms. The human body cannot support such heavy loads without injury.

A worker buried to a depth of less than 1 metre of soil experiences enough pressure on the chest to prevent the lungs from expanding and drawing in a breath. Suffocation occurs within approximately three minutes. Even if the worker is quickly rescued, the heavy weight of the soil is likely to cause serious injuries, particularly if the worker's body comes to rest in an awkward position.

Factors that may cause wall collapse

Figure 32.3 shows examples of factors that may cause the wall of an excavation to collapse. Moisture in soil reduces its strength. Once an excavation is opened, the walls are exposed to the elements. Moisture content and soil stability can change rapidly.

Figure 32.3 Factors that may cause cave-in of an excavation or trench



Any large, heavy movement near an excavation causes vibration of the surrounding soils. This movement can result in soil failure. Moving machinery, nearby traffic, pile driving and blasting all cause vibration in surrounding soils.

Vibration-related soil failures can occur in all types of soil. However, certain types of soils are more susceptible to vibration failures than others. For example, sandy soils tolerate less vibration than clay soils. Since soil conditions may be a mixture of more than one soil type, it is better to play it safe when protecting an excavation from wall collapse.

Adjacent buildings and structures can reduce soil stability by placing extra pressure on the walls of an excavation. An excavation can cause nearby building walls to collapse because the soil that otherwise provided support to the walls has been removed.

Spoil piles and supplies placed near the excavation, and mobile equipment operating nearby, can put extra pressure on the walls of the excavation. These sources of pressure or loading should be kept as far away from the excavation as reasonably practicable.

For more information



A Guide to the OSHA Excavations Standard, North Carolina Department of Labor, 2011

Section 443 Soil stabilization

Subsection 443(1)

The *OHS Code* defines an excavation as a dug out area of ground that does not include a tunnel, underground shaft or open pit mine. As a result, a trench is considered to be a type of excavation having one special feature—it is deeper than its width at the bottom. Where the term “excavation” is used in this Part, it is meant to include trenches unless otherwise stated.

Subsection 443(2)

A number of artificial stabilization techniques are acceptable as alternatives to shoring an excavation, tunnel, underground shaft or open pit mine. Artificial methods such as freezing or grouting (injecting a chemical or cement grout into the voids of pervious soils, allowing the injected material to solidify and form an impervious barrier to groundwater), may require defined periods of time in which to “set.” Once “set,” the soil is stable.

Because of its critical importance to worker safety, this subsection makes it mandatory that a professional engineer design any artificial soil stabilization process. The employer is responsible for ensuring that the professional engineer’s specifications are followed.

Subsection 443(3)

Natural freezing is subject to changing temperature and weather conditions and cannot be controlled. Even if the soil is frozen to a specified depth, fluctuating temperatures could result in unexpected or unplanned thawing of surface layers. As such, the structural integrity of the excavation could be compromised and the risk to workers significantly increased. Natural freezing as a means of soil stabilization is therefore unacceptable under any circumstances.

Section 444 Marking an excavation

An open excavation can present a serious hazard to workers and equipment. Almost any device that clearly marks, blocks or safeguards the opening is acceptable. Examples include barricades formed by aligned concrete blocks, erected snow fencing, guardrails,

piles of excavated material or total enclosure/hoarding. In all cases the solution must be effective and its purpose clearly understood by workers.

Section 445 Water hazard

Water creates a hazard since it can weaken excavation walls, increasing the potential of slope failure or complete collapse. The presence of water can also create poor under-foot conditions for workers, resulting in possible slips, trips and falls. In the worst case, accumulated water presents a drowning hazard. The employer must therefore control the accumulation of water and ensure that workers do not enter an excavation until hazardous accumulations are eliminated.

Section 446 Worker access

Subsection 446(1)

A safe means of entering or leaving an excavation could include a ladder, scaffold or a mechanical device such as a stairway. It could also include appropriate sloping of the ground or soil so that a worker can safely walk into or out of the excavation.

For a tunnel or underground shaft, a safe means of entry or exit could include separate entry and exit points. Each entry or exit point could be constructed as a ramp that allows workers to safely walk to and from the working location. A tunnel or underground shaft could include, or be combined with, a system of stairs, ladders, mechanical lifts or hoists that provide alternative routes of escape in case of an emergency.

Subsections 446(2) and 446(3)

An employer must not require a worker to enter, and a worker must not enter, a trench that is deeper than 1.5 metres unless it is properly cut back, shored using the methods and materials specified in this Part, or protected by a trench box or cage designed by a professional engineer.

An employer must not require a worker to enter, and a worker must not enter, an excavation deeper than 1.5 metres and work closer to the wall than the depth of the excavation unless the wall is properly cut back, shored or protected by a temporary protective structure.

These requirements do not apply to trenches cut in solid and stable rock (see subsection 450(2)), or excavations in a ground formation certified by a professional engineer as stable (see section 449).

Section 447 Locating buried facilities

Subsection 447(1)

Major hazards can be encountered when digging into or otherwise disturbing an underground pipeline or other buried facility. In the case of natural gas or oil, a major explosion and fire are possible if the pipeline is penetrated or damaged. In the least case an environmental spill may result. Digging into a buried electrical cable could result in an electrical flash, a fire or worker electrocution.

Sometimes buried facilities are embedded in concrete. These may include conduit or utility lines placed under a parking area, roadway or concrete sidewalk. To prevent damage to the facility, the owner may have encased the line(s) in concrete. The locating requirements of this section also apply in such cases.

If a buried facility might be affected by activities that disturb the ground, then the employer must advise the owner of the buried facility of the proposed activities and request that the buried facility be identified and its location marked. The owner or the owner's designate must be advised before the ground is disturbed.

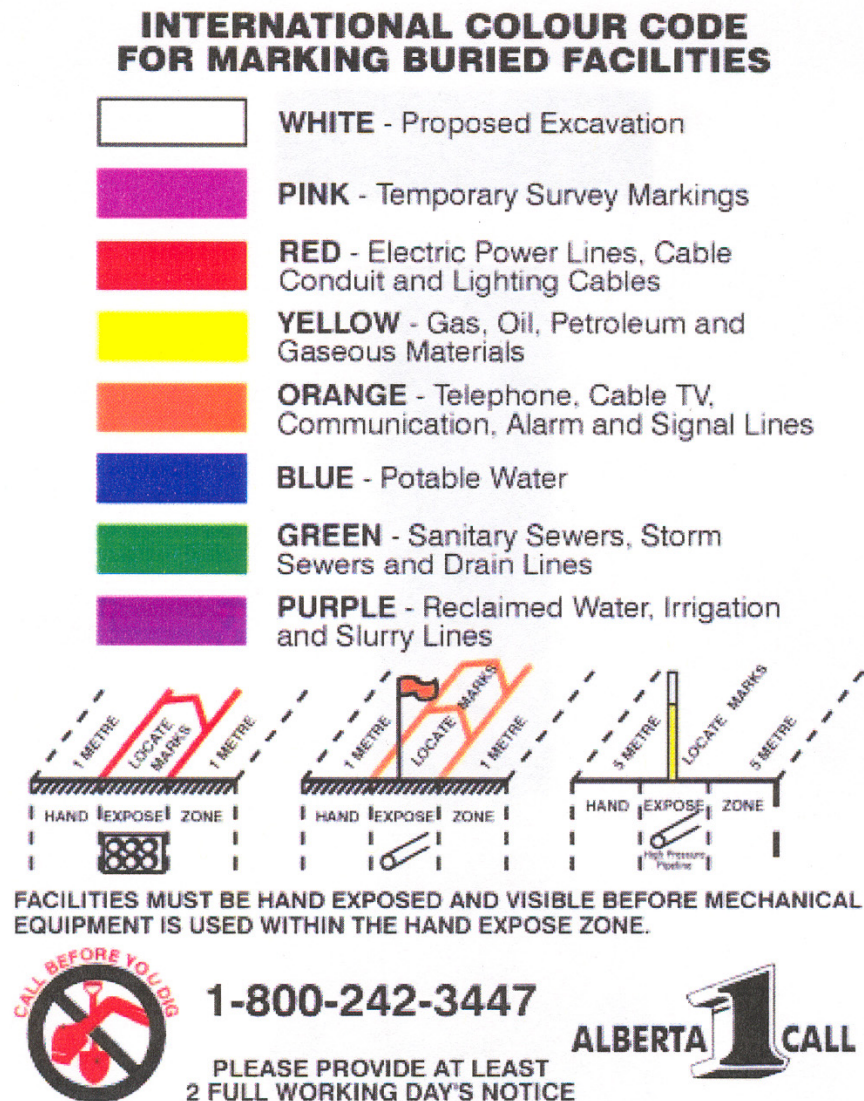
Situations may arise in which the employer does not know the type of buried facility that may be present and therefore cannot contact the owner or the owner's designate. Despite this, the employer must not begin disturbing the ground until buried facilities have been identified and their locations marked. In this case, the employer should request the locate.

Alberta One-Call Corporation (Alberta One-Call) is a good starting point because its mandate is to prevent damage to buried electrical, gas and communication facilities. There is no charge to the owner or employer for using this service. Alberta One-Call can be reached toll free at 1-800-242-3447.

However, other facilities such as underground storage tanks and sewer lines, unregistered gas and power lines, etc., may also be present. Finding these may require placing a second call to obtain the assistance of a different locator service. For a listing of companies offering locator services, readers should search the internet for "Alberta Contract Locators" to view the contractor listing prepared by Alberta One-Call.

Figure 32.4 shows the international colour code used for marking buried facilities.

Figure 32.4 International colour code used for marking buried facilities



Subsection 447(2)

Once a survey has been completed and all appropriate buried or concrete-embedded facilities marked, the employer must ensure that workers have been informed accordingly.

Subsection 447 (3)

Since the original locate marks can be disturbed or destroyed by activities at the site or with progressive excavation, the marks must be re-established as often as necessary to ensure the safety of workers.

Subsections 447(4) and 447(5)

If the planned activity does not involve excavation or removal of overlying material and overall penetration of the ground is 1 metre or less—placement of survey stakes, pin flags, etc.—the employer may use as-built drawings of the facilities for locating purposes rather than contacting Alberta One-Call for a locate. The use of as-built drawings to locate the facilities, in combination with the shallow depth of ground penetration, protects workers from potential injury. Although the employer is not required to notify the facility owner of the planned activity, doing so should be done as a matter of good practice.

As-built drawings change to reflect modifications to, or maintenance of, installed buried facilities. The as-built drawings used by the employer must therefore be certified by the owner as being the most current drawings of record available.

Section 448 Exposing buried facilities

Subsection 448(1)

The “hand expose zone” is the zone lying within 1 metre of each side of the locate marks that identify the location of the buried facility. Before allowing mechanical excavation equipment to be used within this zone, the employer must ensure that the buried facility is exposed to sight by hand digging, a non-destructive technique acceptable to the owner of the buried facility, or an equivalent method. New water-jet or hydrovac excavation systems for example, can quickly remove soil and under the right operating conditions, do so without damaging buried facilities.

Because of the potential for damage, particularly in the case of water jets cutting through or damaging electrical cables, any non-destructive technique used as an alternative to hand digging must be acceptable to the owner of the buried facility. The employer is responsible for checking with the owner.

Manitoba Hydro has determined that water-jet excavation systems are capable of damaging almost any type of electrical cable, especially 5 kilovolt to 15 kilovolt cables installed prior to 1974. The most susceptible cables cannot be exposed while energized and can be damaged at extremely low water pressures. If the water stream is applied directly to these types of cables, damage can be expected.

Some water-jet excavation systems can reach temperatures approaching 66°C and pressures approaching 20.6 megapascals. As good practice, it is recommended that when excavating within 1 metre of any energized or de-energized cable, the water temperature should be limited to 38°C and the pressure limited to 10.3 megapascals. The water-jet excavation system should allow workers using it to monitor both temperature and pressure to ensure that the limits are not exceeded.

Wand tips should be of the oscillating type to prevent the release of a concentrated water stream. This type of tip can be identified by the circular pattern created by the water leaving the wand when pressure is first applied to the wand. Tests performed by Manitoba Hydro showed that cables could be damaged when a single stream nozzle end was directed toward a specific location on the cable. Damage was also observed when the single stream nozzle end was used in a sweeping motion.

The damage to a cable created by excessive water pressure appears as a slice of unknown depth, or the outer surface looks as though it has been torn and pulled outward. Cable damaged by excessive water pressure can fail immediately or at a later time as moisture penetrates broken sheathing. Before backfilling, all cables exposed by water-jet excavation should be inspected for damage.

Hand digging requires the use of hand tools. Hand tools are defined in the *OHS Code* as hand held equipment that depends on the energy of the worker for its direct effect and it does not have a pneumatic, hydraulic, electrical or chemical energy source for its operation.

Subsection 448(2)

Hand digging to expose buried facilities is an important safe work practice that protects workers from potential injury and reduces the likelihood of facilities being damaged. However, hand digging to expose buried facilities that are no longer in use can be avoided if the employer ensures that the planned work does not present a hazard to workers and the employer has notified and receive the written approval of the facility owner to remove the facility.

An electrical cable or conduit can be mechanically excavated only if it is grounded and isolated so that its disconnection is visible.

Written approval is necessary because the owner may have important knowledge about the facility. For example, a hydrocarbon or gas pipeline could still contain explosive hydrocarbon residue or quantities of a chemical. “Dead” gas mains may contain residual natural gas concentrations in the 5-15 percent range—this is the explosive range for natural gas—making it potentially more hazardous than a live or operating line. Hand digging is still required in such instances.

Subsection 448(3)

If a high-pressure pipeline (operating pressure of 700 kilopascals or more) falls within the scope of the *Pipeline Act*, then a mandatory 5 metre hand expose zone must be maintained. If the *Pipeline Act* does not apply to the high-pressure pipeline, then the pipeline may be treated like any other buried facility and the 1 metre on each side of the buried facility hand expose zone requirements apply. If the employer plans to reduce

the hand expose zone to the 1 metre limit, the employer must get the written approval of the owner of the high-pressure pipeline to do so.

Subsection 448(4)

Even if the planned disturbance lies more than 30 metres away from a buried facility, the operator or licensee of a pipeline right-of-way must be contacted if the disturbance is to take place within that pipeline right-of-way. The owner or licensee's approval must be obtained before any ground disturbance begins.

Subsection 448(5)

Where the use of mechanical equipment is required to excavate within 600 millimetres of a buried pipeline, the activity can only be undertaken under the direct supervision of an owner's representative. The owner's representative is the person most knowledgeable about the characteristics of the buried pipeline. This knowledge will help to ensure that workers and the pipeline are protected from injury or damage. Whenever possible, powered excavation equipment should be operated to dig parallel to the direction of the buried pipeline.

Subsection 448(5.1)

This subsection establishes an acceptable option for situations involving emergency work.

Subsection 448(6)

Once a buried facility is exposed, the employer is responsible for making sure the facility is protected and supported so that workers are not injured.

Subsection 448(7)

Once a pipeline is exposed, the operator or licensee must be notified before the excavation is backfilled. This notification provides the operator or licensee with an opportunity to examine the exposed pipeline and to ensure that appropriate protective measures are taken before backfilling proceeds. The operator or licensee also has the opportunity to oversee the backfilling operation.

Section 449 Exemption

If a professional engineer has analyzed the ground formation and certified that it is stable and the workings safe, and will remain so throughout the work period, sections 450 to 459 and sections 461 to 464 do not apply.

Section 450 Methods of protection

Subsection 450(1)

The history of fatalities associated with work in excavations is such that protective measures must be taken unless the excavation is constructed in solid rock or the ground stability is certified by a professional engineer.

Workers must be protected from cave-ins or sliding materials that could cause personal injury. The listed alternatives reflect industry practice and provide an employer with some measure of flexibility in selecting the most appropriate method for the job. Cutting back or sloping the upper walls so that the remaining vertical height is no more than 1.5 metres above the floor of the excavation, installing temporary protective structures such as the trench shields shown in Figure 32.5, or a combination of these methods is acceptable under this section. The objective of the requirement is to ensure that any worker entering an excavation is protected. Figure 32.6 summarizes the options available.

Subsection 450(2)

Subsection (1) does not apply if a trench is constructed in solid rock throughout its entire length. Since the interpretation of “solid rock” is somewhat subjective—due to fractures, formation dips, etc.—it is recommended that, where at all in question, the services of a professional engineer be engaged. This decision is at the discretion of the employer unless ordered by an officer.

Figure 32.5 Examples of trench shields

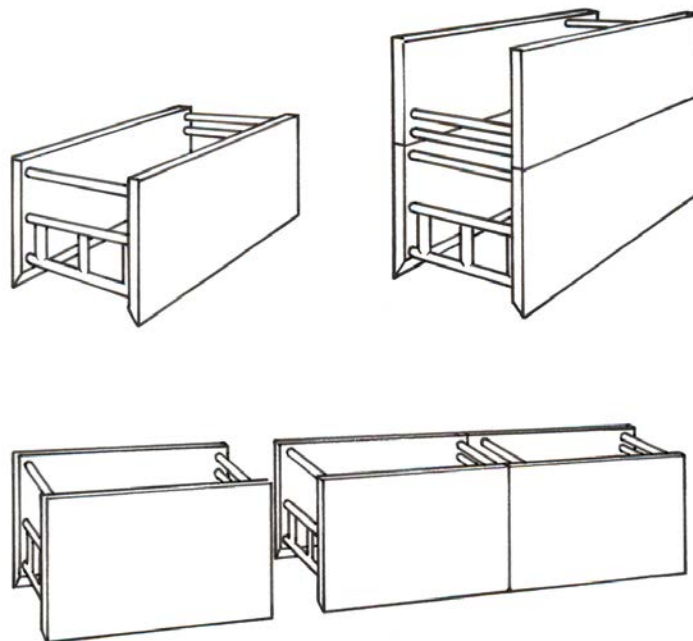
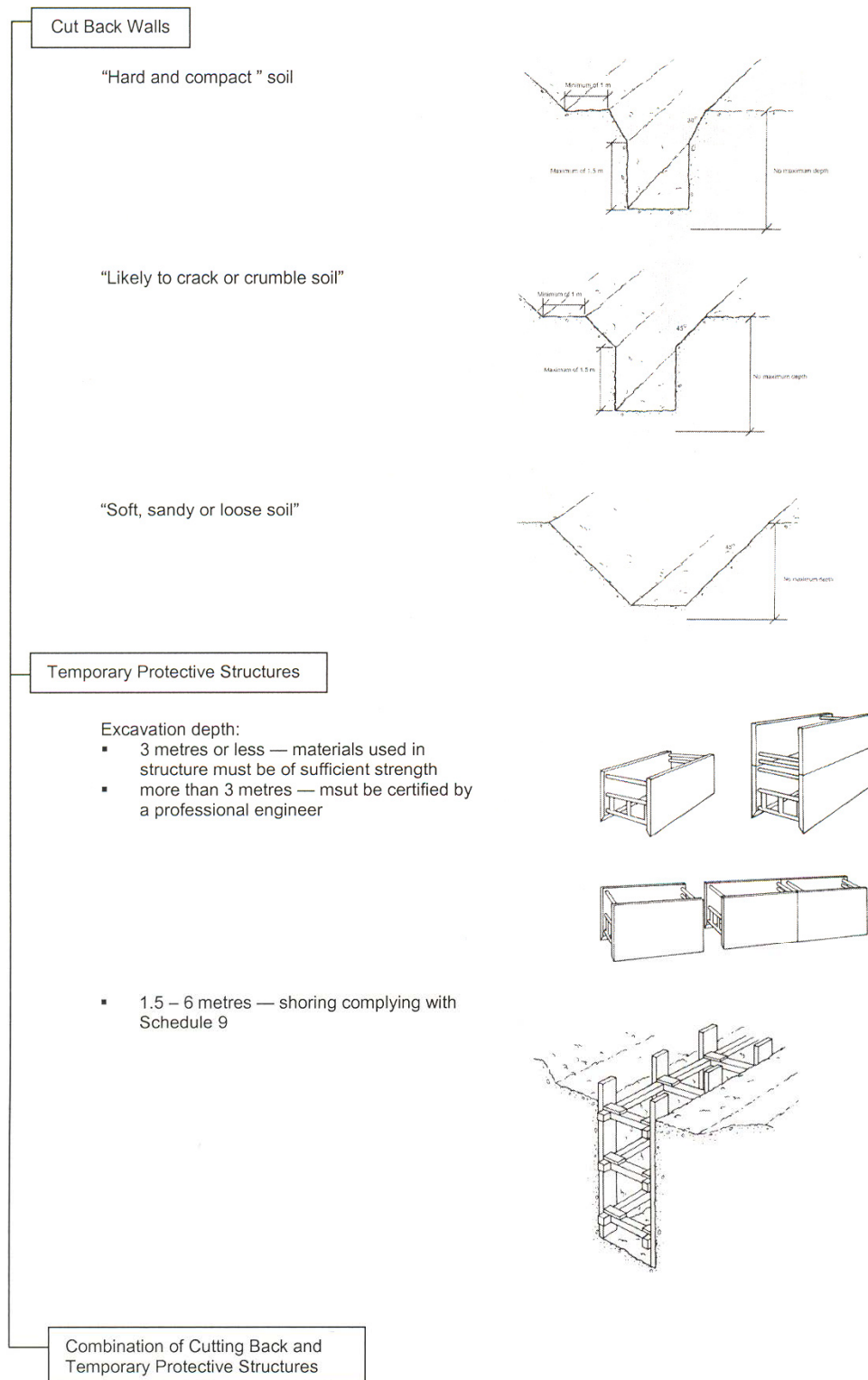


Figure 32.6 Protecting workers in excavations



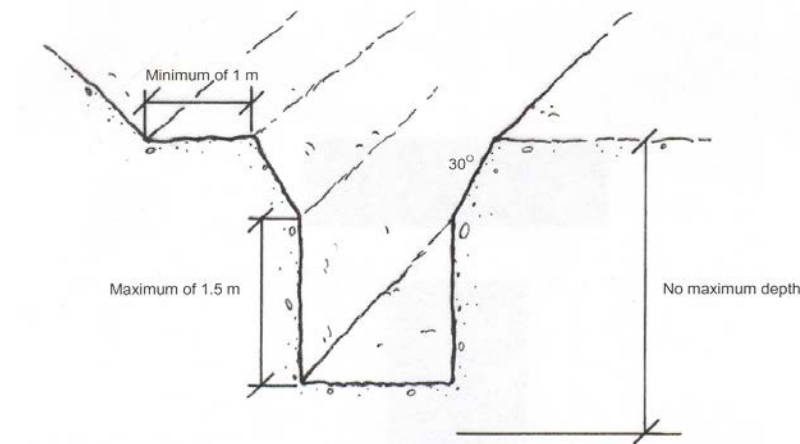
Section 451 Cutting back walls

If the walls of an excavation are cut back, the design specifications of this section must be followed. Since the specifications are based on a subjective interpretation of soil type, a professional engineer should be consulted whenever there is a question of doubt related to the soil type and potential risk to workers. The regulatory responsibility for compliance rests with the employer, who must make the related decision.

Hard and compact soil

As shown in Figure 32.7, the walls must be sloped to within 1.5 metres of the bottom of the excavation at an angle of not less than 30° measured from the vertical.

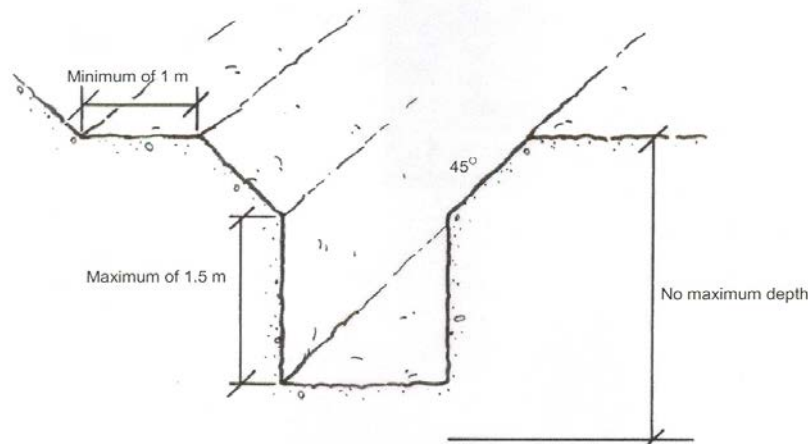
Figure 32.7 Cut back of excavation walls in “hard and compact soil”



Likely to crack or crumble soil

As shown in Figure 32.8, the walls must be sloped to within 1.5 metres of the bottom of the excavation at an angle of not less than 45° measured from the vertical.

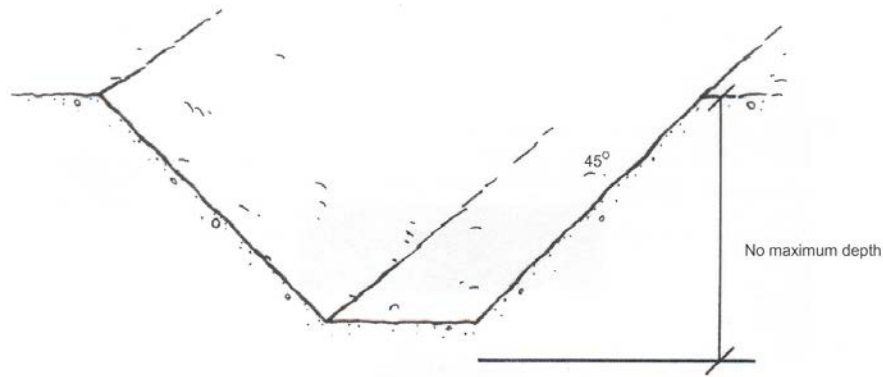
Figure 32.8 Cut back of excavation walls in “likely to crack or crumble soil”



Soft, sandy or loose soil

As shown in Figure 32.9, the walls must be sloped from the bottom of the excavation at an angle of not less than 45° measured from the vertical.

Figure 32.9 Cut back of excavation walls in “soft, sandy or loose soil”



Benching as a safe alternative to cutting back

Based on the results of a report prepared for Occupational Health and Safety by a geotechnical engineer (March 2009), benching is an acceptable alternative to the practice of cutting back the walls of an excavation as required by section 451. If benching is used by an employer, the following practices need to be followed:

- (1) benching can be a safe alternative to the straight cutting back of excavation walls in hard and compact, and likely to crack or crumble soils. Benching is not acceptable for soft, sandy or loose soil;
- (2) the rise and run for hard and compact soil should be at least 1 Vertical: $\frac{3}{4}$ Horizontal (or flatter) with a maximum rise of 1.2 metres. The maximum unsupported vertical cut at the base is 1.2 metres rather than the 1.5 metres allowed by section 451 if the walls are sloped. The run of the first bench must be twice that of the succeeding benches. This wide first bench provides a more stable slope base. See Figure 32.10;
- (3) the rise and run for likely to crack or crumble soil should be at least 1 Vertical: 1 Horizontal (or flatter) with a maximum rise of 1.0 m. The maximum unsupported vertical cut at the base is 1.0 metre rather than the 1.5 metres allowed by section 451 if the walls are sloped. The run of the first bench must be twice that of the succeeding benches. This wide first bench provides a more stable slope base. See Figure 32.11;
- (4) the maximum depth of a benched excavation is limited to 6 metres. Increasing the depth of the excavation or increasing the height of the slope and benches increases the risk of slope failure, compromising the safety of workers within the excavation. Benched excavations deeper than 6 metres need to be certified by a professional engineer;

- (5) heavy equipment and spoil piles of soil should not be allowed within 1.2 metres of the edge of the uppermost bench. Vibration caused by construction equipment may cause instability of the bench;
- (6) although benching may result in an overall more stable slope, it may have some adverse effects on the sidewalls. Benching exposes more surface area which allows more evaporation and drying of the soil. This can lead to cracking and fissures in some soils. Also, water can pool on the horizontal bench surfaces and then infiltrate the slopes and benches. The employer should provide surface drainage such as drainage ditches on benches, minimize the infiltration of water and try to minimize any rise in the ground water table. Horizontal bench surfaces should not be sloped away from the wall to drain water collecting on the bench. Doing so will cause water to cascade over each bench and run down the slope, causing erosion of the soil; and
- (7) benches need to be formed during the excavation process and not by cutting the slope from the bottom. Cutting a slope at its base can momentarily destabilize the slope until the soil at the top is removed. Therefore, top down construction of the benches is required.

Figure 32.10 Benching profile for hard and compact soil

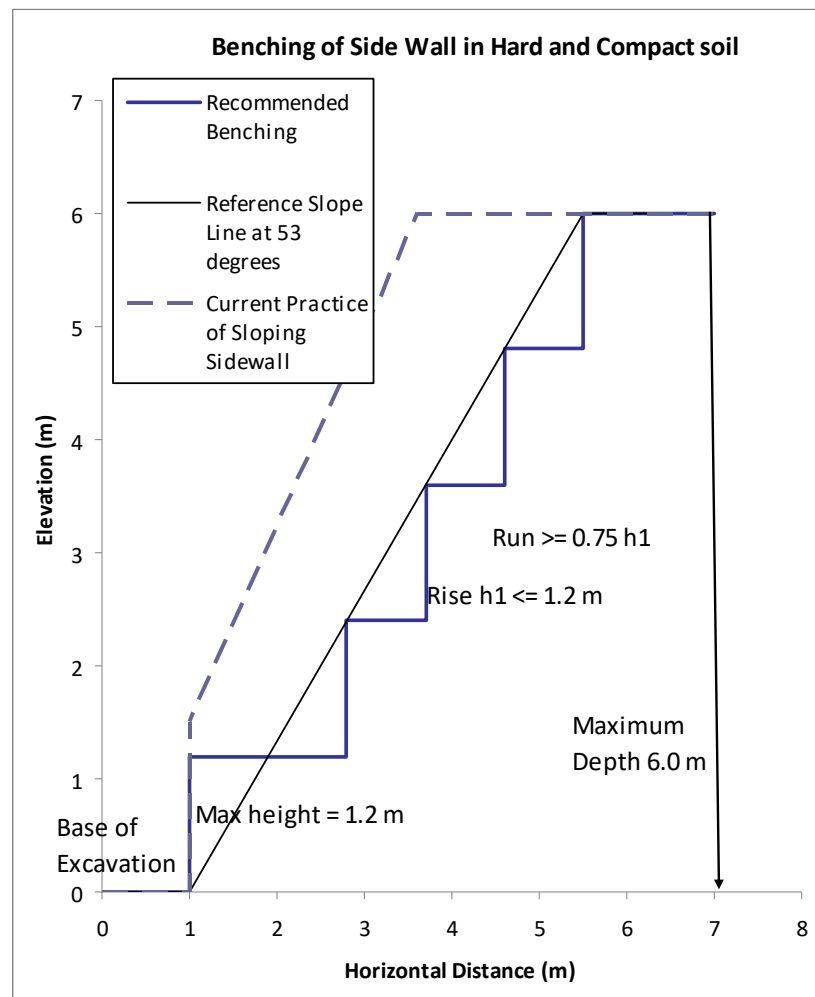
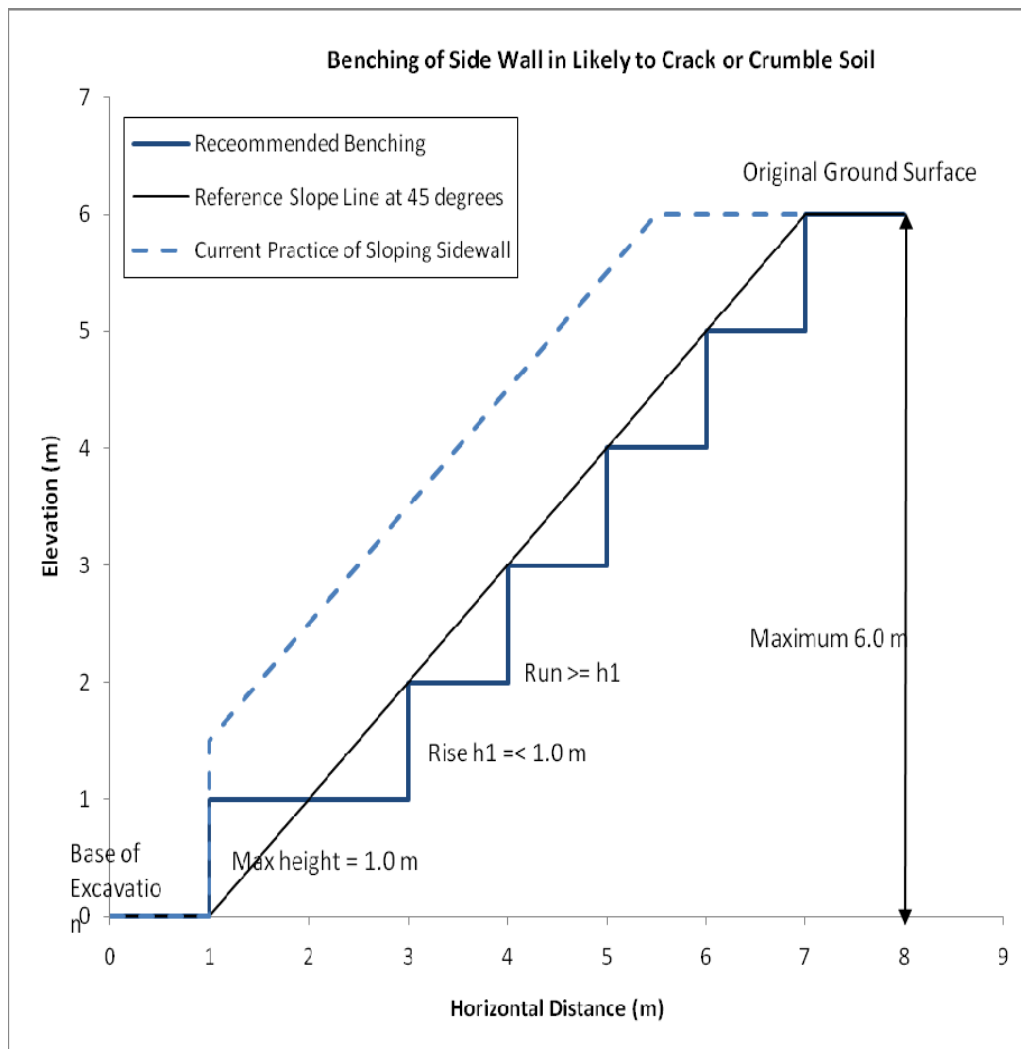


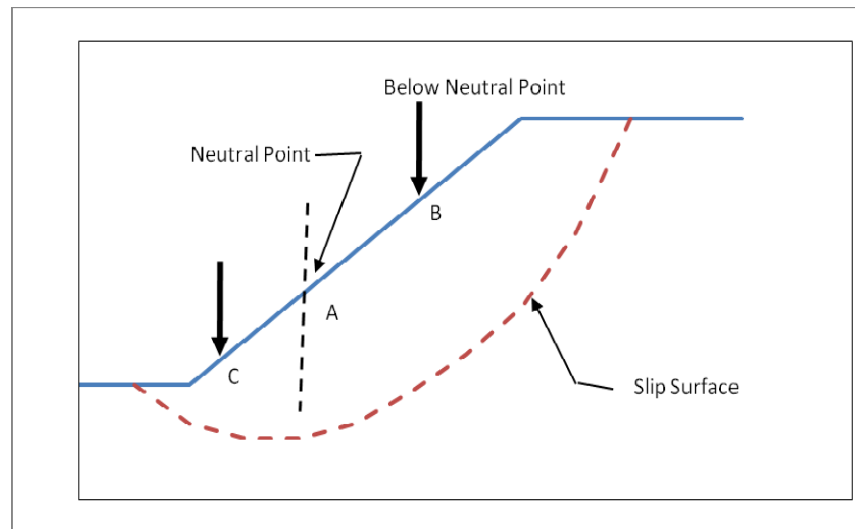
Figure 32.11 Benching profile for likely to crack or crumble soil



The effect of benching on overall slope stability

To see the effect of benching on the overall stability of a slope, it is necessary to understand the effects of applying a force on the surface of the slope. A force applied on the surface of a slope has a stabilizing effect if it is applied above the neutral point. The neutral point is defined as a point on the surface of a slope where a force has neither a stabilizing nor destabilizing effect (see point A in Figure 32.12). A downward force applied above a neutral point will have a destabilizing effect.

Figure 32.12 Neutral point on a slope



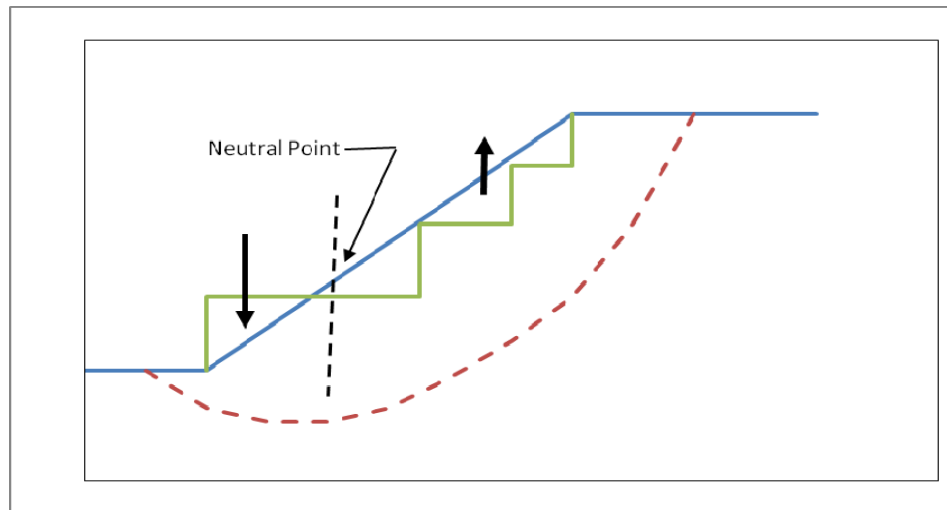
On the other hand, if a downward force is applied below the neutral point, it will have a stabilizing effect. The reverse is true if upward forces are applied. It should be noted that the neutral point is not a fixed point on the slope. In slope stability analysis, it is the critical slip surface that is the most important slip surface in considering stability.

A slip surface is a potential failure surface on a slope which separates the slide soil mass from the unmoving ground. The critical slip surface is the one that has the lowest factor of safety, i.e., the most likely to fail. The critical slip surface not only depends on the geometry of the slope and properties of the soil, but it also depends on the forces applied on the boundary of the sliding mass. If the location of the applied force is moved along the surface, the critical slip surface changes, which also changes the location of the neutral point.

Benching can be viewed as adding and removing soil masses from the surface of a slope. As shown in Figure 32.13, adding a bench at the bottom of the slope has a stabilizing effect since a force is applied below the neutral point due the weight of the bench. Creating a bench by removing soil at the top of the slope also has a stabilizing effect since it is the equivalent of applying an upward force above the neutral point.

Therefore benching, if carried out properly, should enhance the overall stability of the slope.

Figure 32.13 Loading which enhances the stability of a slope



Although benching has an overall stabilizing effect on a slope if it is carried out properly, it does have adverse effects on a slope. As stated earlier, benching creates a larger surface area than a plane cut, exposing more soil to evaporation which promotes drying. This may lead to cracking and fissures in cohesive soil.

Benching creates a flat surface on top of each bench which can potentially promote infiltration of water and pooling of water in localized areas. Increased water content in the soil and a rise in the ground water table have destabilizing effects on a slope and bench. Therefore, infiltration of water needs to be minimized.

Section 452 Loose materials

Loose material that can be dislodged through natural settling and routine worker activities must be scaled or trimmed from the sides of an excavation where workers are, or will be present. Even a moderately-sized rock or clump of soil can cause a serious injury if it falls from a height. Fallen debris in the bottom of an excavation can create a slip, trip or fall hazard. All scaled or trimmed materials should be removed to a location where they have no potential to cause injury.

Section 453 Spoil piles

The distance between the edge of the excavation and the leading edge of any spoil pile must be at least 1 m. The slope of the spoil pile cannot exceed 45° from the horizontal. These measures are intended to reduce the possibility of the spoil pile slumping into the excavation and loose materials rolling down the pile into the excavation. Spoil pile materials have rolled into excavations as a result of natural settling and daytime warming of frozen excavated material.

Spoil piles should also be located away from the edge of an excavation because the weight of excavated materials can exert unnecessary pressure on the walls of the excavation. Such pressure can cause excavation walls to collapse.

Section 454 Power pole support

The collapse of a power pole could expose workers to both a falling pole structure and to one or more energized power line conductors. The employer must therefore ensure that when disturbing the ground in the vicinity of an overhead power line, doing so does not reduce the original pole support provided.

When the impact of the planned activity is uncertain, it is suggested that the owner of the power pole or utility be contacted before any work begins. Readers are reminded that the requirements of Part 17 of the *OHS Code* must be met when working in the vicinity of overhead power lines.

Section 455 Safe entry and exit

The employer must ensure that workers required to enter a trench have a safe means of entering and leaving the trench. This could include a ladder, scaffold or a mechanical device such as a stairway. It could also include appropriate sloping of the ground or soil so that a worker can safely walk into or out of the excavation.

When a trench is more than 1.5 metres deep, a safe point of entering and leaving must be located no more than 8 metres from the worker. The trench walls located between the worker and the safe point of entering and leaving must be supported or sloped as required by this Part.

Section 456 Temporary protective structures

Subsections 456(1) and 456(2)

In an excavation 3 metres or less deep, the type of temporary protective structure used is left to the discretion of the employer, as long as the structure is of sufficient strength to protect workers. In common practice, protective structures are often pre-fabricated from steel, or built in place from wood materials for shoring, stringers and bracing.

If an excavation is more than 3 metres deep, the risk of injury to workers increases dramatically. It is therefore mandatory that any temporary supporting structure be designed and certified by a professional engineer. The engineer's specifications must indicate all details related to the design, including the type and grade of materials to be used and the calculated loads the structure is designed to support.

Subsection 456(3)

Where an excavation could affect an existing foundation, the foundation must be supported by a temporary protective structure. The structure must be designed, constructed and installed in accordance with the specifications of a professional engineer. This extra precautionary measure reduces the risk of injury to workers working near the foundation, as well as the risk to persons in or near the structure supported by the foundation.

Section 457 Alternative to temporary protective structures

Subsection 457(1)

Instead of complying with section 456, this section permits an employer to use shoring, stringers and bracing constructed of lumber (see Figure 32.14) that complies with Schedule 9, or alternate materials, in trenches 1.5 metres to 6 metres deep. If alternate materials are used, they must possess equal or greater properties than those of lumber. For ease of reference, Schedule 9 is shown as Table 32.2.

Exterior grade plywood can be installed as a substitute for 38 millimetre shoring elements if the plywood meets the requirements of either of the two referenced CSA Standards.

Figure 32.14 Trench protected by shoring

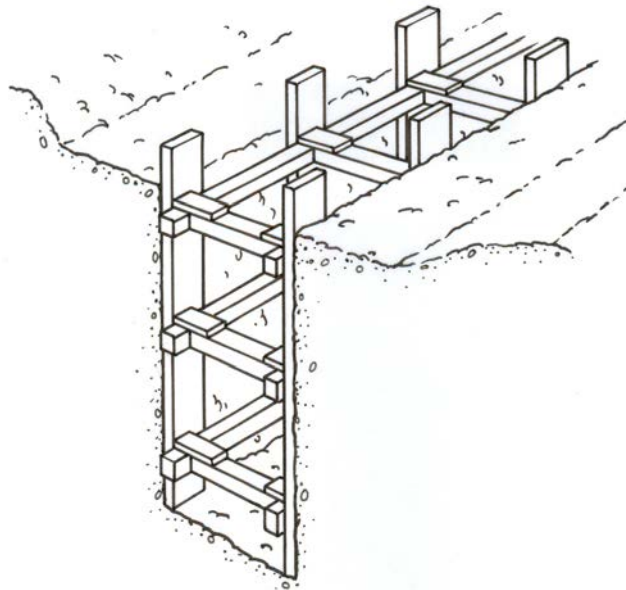


Table 32.2 Shoring component used in excavations, trenches, tunnels and underground shafts (appears in the *OHS Code* as Schedule 9)

Soil type	Depth of excavation (metres)	Uprights		Stringers		Cross-braces			
		Minimum dimensions (millimetres)	Maximum horizontal spacing (millimetres)	Minimum dimensions (millimetres)	Maximum vertical spacing (millimetres)	Minimum dimensions (millimetres)		Maximum spacing (millimetres)	
						Width of trench		Vertical	Horizontal
						Less than 1.8 metres	1.8 to 3.7 metres		
Hard and compact	1.5 to 3.0	38 x 235	1800	89 x 140	1200	89 x 89	140 x 140	1200	1800
	More than 3.0 to 4.5	38 x 235	1200	89 x 140	1200	89 x 140	140 x 140	1200	1800
	More than 4.5 to 6.0	38 x 235	10	140 x 140	1200	140 x 184	140 x 184	1200	1800
Likely to crack or crumble	1.5 to 3.0	38 x 235	1200	89 x 140	1200	89 x 140	140 x 140	1200	1800
	More than 3.0 to 4.5	38 x 235	900	140 x 140	1200	140 x 140	140 x 184	1200	1800
	More than 4.5 to 6.0	38 x 235	10	140 x 184	1200	140 x 184	140 x 184	1200	1800
Soft, sandy or loose	1.5 to 3.0	38 x 235	10	140 x 140	1200	140 x 140	140 x 184	1200	1800
	More than 3.0 to 4.5	38 x 235	10	140 x 184	1200	140 x 184	184 x 184	1200	1800
	More than 4.5 to 6.0	38 x 235	10	184 x 184	1200	140 x 184	184 x 235	1200	1800

Subsection 457(2)

Mechanical devices such as screw jacks and hydraulic equipment can be used in place of the shoring, stringers or bracing described in Schedule 9. The devices must be at least equivalent in strength and reliability to the shoring, stringers or bracing.

Subsection 457(3)

The use of stringers in trenches less than 2.4 metres deep in “hard and compact soil” is optional.

Subsections 457(4) and 457(5)

Where there is a risk of additional stress, vibration or weight being placed on the walls of a trench (see Figure 32.3), additional protection certified by a professional engineer must be used. In assessing the risk to workers, the employer must consider any of the following being placed, passing by, or working within a distance equal to the depth of the trench:

- (a) vehicular traffic;
- (b) machinery, which may include road compaction equipment or compaction equipment used during backfill activities close to the excavation; and
- (c) heavy object(s).

Additional protection is also required to compensate for the stress, vibration or weight resulting from the trench being adjacent to, or abutting, a building or other structure.

Section 458 Installation of shoring, stringers or bracing

Subsection 458(1)

The greatest potential for worker injury exists at the bottom of a trench having unsupported walls. To reduce the likelihood of being injured by a trench wall collapse, workers must use a ladder and install shoring, stringers or bracing downward from the top of the trench, installing each brace in descending order.

Following this sequence, workers are always working in the protected zone. As the protection is installed, workers progress downward until the bottom of the trench is reached.

Subsection 458(2)

When removing shoring, stringers or bracing, workers must work in a sequence that is the reverse of the installation sequence. Specifically, the removal sequence must proceed upwards from the bottom of the trench so that workers are located above the zone of greatest potential for injury. Again, a ladder must be used to keep workers above any possible trench wall collapse.

Subsection 458(3)

Workers must install and remove shoring, stringers or braces as required by subsections (1) and (2). This means that workers must receive training in the employer's safe work procedures for performing the work, be made aware of the requirements of subsections (1) and (2), and may require supervision by the employer.

Subsection 458(4)

If ground conditions deteriorate to the point that it is unsafe to remove shoring, stringers or bracing using the method described in subsection (2), the employer must develop a removal method that does not require a worker to be in the trench. Removal methods could involve use of equipment such as a crane, backhoe or other lifting/excavating equipment rigged or equipped, as necessary, to complete the job safely.

Section 459 Access for powered mobile equipment

Section 444 requires all excavations to be flagged and marked to prevent workers or equipment from falling into the opening. This section deals with the access route that is used by powered mobile equipment to enter and leave the excavation. In this case the barrier can be of any construction that is suitable for the purpose intended, although common practice is to use concrete blocks, a large piece of timber or even a pile of excavated material as a berm.

Section 460 Dumping block

Dumping blocks are required where equipment may back into or over a dump location. The dumping point may include hoppers, stock piles or waste dumps. Dumps of this type can be very high and a flip-over or rollover could cause serious injury. To reduce the risk to workers and their equipment, physical barriers are required to assist in stopping.

Section 461 Underground shafts

Subsection 461(1)

No explanation required.

Subsection 461(2)

No explanation required.

Subsection 461(3)

A variety of workers and equipment is likely to be present around a location where an underground shaft is being excavated. A means of protection must be provided to prevent workers, materials and equipment from falling into the shaft opening. This could involve the use of a solidly built fence, a barricade of concrete blocks, a retaining wall, or other equally effective means.

To provide a means of worker access to each underground shaft entrance, gates not less than 1 metre in height must be installed. The employer must ensure that the gate design, gate operating procedures and worker practices are such that the gates are kept closed except when being used.

Subsection 461(4)

In addition to the employer having to ensure that the gates required by subsection (3)(b) are kept closed when not in use, each worker is also responsible for keeping the gates closed when not in use. Section 5 of the *OHS Act* requires each worker to take reasonable care to protect the health and safety of himself or herself, and other workers present while that worker is working.

Subsection 461(5)

Water can introduce an unacceptable hazard since it can cause the walls or supporting structures of an underground shaft to deteriorate. The accumulation of water must therefore be controlled. The employer must ensure that suitable, efficient machinery or devices are available for this purpose.

Section 462 Drilled or bored underground shaft

Subsections 462(1) and 462(2)

Large-sized mechanical drilling or boring devices are sometimes used to excavate underground shafts. Before a worker is required to enter the shaft, the employer must ensure that protective structures have been installed. Such structures can be an installed casing or a temporary protective structure certified by a professional engineer. The professional engineer must certify that the installed protective structure is of sufficient strength to resist shifting of the surrounding materials.

To prevent materials at the surface from falling into the shaft and onto workers, the casing or temporary protective structure must be designed and constructed to extend at least 300 millimetres above surface level.

Subsections 462(3) and 462(4)

During the removal of excavated material, a worker in the belled area of an underground shaft can be exposed to falling material unless it is possible to stand clear. If the worker is unable to stand clear of falling material, then the worker must return to the surface ahead of (precede) each load going to the surface.

If it is not possible to precede each load to the surface, then the worker must accompany the load to the surface using equipment designed to do so, following written safe work procedures prepared by the employer. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Section 463 Prohibition

The area at the bottom of a shaft can become belled—enlarged to a greater diameter than the designed shaft—as a result of excessive excavation, slumping or unplanned ground failure. Such a belled area presents a major hazard to workers and additional temporary structures must be installed before workers are allowed to enter the belled area.

Section 464 Tunnel

Subsection 464(1)

Temporary protective structures used to retain the walls of a tunnel while it is being excavated must be certified by a professional engineer. This ensures that the structures are designed and installed to prevent the walls from collapsing or caving in.

Subsection 464(2)

Water can introduce an unacceptable hazard since it can cause the walls or supporting structures of a tunnel to deteriorate. The accumulation of water must therefore be controlled. The employer must ensure that suitable, efficient machinery or devices are available for this purpose.

Part 33 Explosives Safety

Highlights

- Section 467 requires employers to prepare safe work procedures specific to the blasting activities. Safe work procedures for the handling of pyrotechnic and special effects devices and explosives must be based on the referenced National Fire Protection Association (NFPA) standards. (Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.)
- Section 503 refers to new and revised minimum-separation distance tables applicable to radiofrequency transmitters and explosives. The tables distinguish between fixed radiofrequency transmitters, such as television transmitter towers, and mobile transmitters, such as portable two-way radios and cellular telephones.
- Section 515 permits the pre-priming of charges during avalanche control activities. The priming of charges is normally restricted to blasting sites. The Canadian Avalanche Association has demonstrated that the pre-priming of explosive charges and their subsequent careful transport is a safe practice for avalanche control purposes.
- Section 516 presents requirements specific to oil well blasting and perforating.
- Section 466 prohibits the presence of burning materials in the vicinity of explosives. Section 517 recognizes that seismic drills operating in remote locations under cold conditions routinely using an open flame to thaw frozen water and water pipes required during drilling. The section therefore permits the use of an open flame heating device during seismic drilling if the listed conditions are met.

Requirements

Section 465 Application

The use of explosives at a mine site is subject to specific requirements presented in Part 36, Mining.

Section 466 Burning material

The 15-metre safe distance is intended to prevent explosives from being accidentally detonated.

Section 467 Safe work procedures

Subsection 467(1)

Employers are required to prepare safe work procedures specific to the employer's blasting activities. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. Section 13 of the *OHS Regulation* requires the employer to make sure that workers affected by the procedures are familiar with them before work begins.

Where the procedures are held is dependent on the employer and the particular work situation. In some cases, they are best held at a centralized location; at other times, they may need to be at the work site.

Subsection 467(2)

This subsection references two National Fire Protection Association (NFPA) standards specific to pyrotechnic and special effects work. The NFPA standards are recognized within the industry as presenting "best practices" and are often referenced by local authorities such as fire departments when performance permits are requested.

NFPA Standard 1123, *Code for Fireworks Display*, applies to the construction, handling and use of fireworks intended solely for outdoor fireworks display. The Standard includes requirements for special firework aerial shells and equipment, site selection and operation of the display. The Standard does not apply to the use of common (Class C) fireworks by the general public or to the use of pyrotechnics devices in the performing arts. The purpose of the Standard is to provide requirements for the reasonably safe conduct of outdoor fireworks displays.

NFPA Standard 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, applies to the use of pyrotechnics in the performing arts in conjunction with theatrical, musical or similar productions before a proximate audience (closer to pyrotechnics devices than permitted by NFPA Standard 1123), performers or support personnel. The Standard applies to any indoor or outdoor use of pyrotechnics. The purpose of the Standard is to provide requirements for the reasonable protection of pyrotechnic operators, performers, support personnel, viewing proximate audiences, property and buildings where pyrotechnics are used indoors or outdoors.

Section 468 Blasters

Subsection 468(1)

The intent of the blaster's permit system is to set the minimum competency requirements for workers who use explosives at a work site. The *OHS Code* defines the handling of explosives to include "preparing, loading, firing, burning or destroying explosives or detonators."

Reflecting this definition and the requirements of this section, a worker engaged in the preparation, firing, burning or destruction of explosives is required to either hold a valid blaster's permit or be under the direct supervision of a person who holds a valid blaster's permit. The term "direct supervision" means:

- (a) the worker being supervised is under the personal and continuous visual supervision of the blaster—the two workers must be capable of interacting with one another on a one-on-one basis and must maintain visual contact with one another throughout the performance of the work for which direct supervision is required; and
- (b) the two workers must be able to readily and clearly communicate with each other—in noisy or distracting circumstances, hand signals may be appropriate. These signals must be clearly understood by both workers.

The employer is responsible for making sure that these requirements are met and that blasters have a valid blaster's permit.

Two additional situations can arise in which a worker is not required to have a blaster's permit:

- (1) a worker transporting explosives; and
- (2) a worker designated by an employer who delivers explosives to, and/or collects unused explosives from, a blaster(s) at a work site.

The employer must ensure that the worker transporting or delivering/collecting the explosives is competent and trained to do the work safely. The worker must also meet all of the federal government's requirements under the *Dangerous Goods Transportation and Handling Act* and *Explosives Act* (Canada) when transporting explosives.

Subsection 468(2)

The employer is responsible for making sure that the blasting area—the area extending at least 50 metres in all directions from any place in which explosives are being prepared, fired, destroyed or in which armed charges are known or believed to exist—is under the direction and control of a blaster. A blaster has the knowledge, training and experience required to safely direct and control activities taking place in the area. The blaster must have a valid blaster's permit.

Subsection 468(3)

At work sites where there is more than one blaster with a valid blaster's permit, the employer must designate one blaster to be in charge of all blasting operations. Well-defined control and management of the blasting area is critical to worker safety. Specific individuals must be designated to make decisions and be accountable for work practices and safety at the work site. To avoid problems related to communication and responsibility, one blaster must be designated as the "blaster-in-charge."

Subsection 468(4)

The blaster must have direction and control of the blasting area. All work involving blasting must be done according to the employer's written safe work procedures (see section 467) and current safety regulations.

The blaster and other workers are required to use the safeguards, safety appliances, personal protective equipment and other devices required by the *OHS Code*.

Section 469 Reporting incidents involving explosives

As required by section 40 of the *OHS Act*, serious injuries or accidents must be reported to Alberta Labour. The employer must complete an accident investigation report that is then kept on file by the employer for a minimum period of two years.

The serious injuries and accidents that must be reported by law are those that

- (a) result in death;
- (b) cause a worker to be admitted to hospital;
- (c) involve an unplanned or uncontrolled explosion, fire or flood that causes a serious injury (or has the potential of causing a serious injury);
- (d) involve the collapse or upset of a crane, derrick, or hoist;
- (e) involve the collapse or failure of any component of a building or structure necessary for the structural integrity of the building or structure; or
- (f) Involve any injury or incident or a class of injuries or incidents specified in the regulations.

The list of items in this subsection reflects the requirements of the *OHS Act*. The need for reports is limited to those events involving an unplanned or uncontrolled explosion or fire, whether or not any person was injured. This serves to eliminate the reporting of minor accidents such as misfired explosives or a worker slipping and tripping while carrying a box of explosives.

For more information



Reporting and Investigating Injuries and Incidents, Alberta Labour

Handling Explosives

Section 470 Canadian guidelines

To avoid unnecessary duplication of requirements among provincial and federal regulations, this section refers to federal guidelines and standards rather than restating their requirements. The referenced publications are available from:

Explosives Regulatory Division
Natural Resources Canada
3303 33 Street NW
Calgary, AB T2L 2A7
Phone: (403) 292-4766

Explosives Regulatory Division
Mineral and Metals Sector
Natural Resources Canada
580 Booth Street, 10th Floor
Ottawa, ON K1A 0E4
Phone: (613) 948-5200
E-mail: ERDmms@nrcan.gc.ca

The revised *Storage Standards for Industrial Explosives* as published by Natural Resources Canada came into force on May 31, 2001. The Standards update and supercede the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators*.

The Explosives Regulatory Division (ERD) of Natural Resources Canada, in conjunction with the Royal Canadian Mounted Police (RCMP), has developed and adopted a redesign of the walk-in magazine door to ensure a higher degree of security. This new standard makes the laminated door mandatory for walk-in-type magazines and introduces many barriers to prevent a break-in. The new door concept referred to in this document was adopted on all new walk-in magazines immediately upon introduction of the standard on May 31, 2001. For existing magazine installations, it is to be phased in over the next 5 to 10 years as a replacement, with particular emphasis in areas prone to break and enters (B&E) or attempted break-ins.

In the interest of security, ERD has, on the advice of the RCMP, moved from heavy-duty locks to high-security locking hardware and emphasized better key control for magazines. There will be no grandfathering on locking hardware and, thus, licensees will have from three to five years from May 31, 2001, to upgrade to the newer, higher security standards.

Recent ballistic threat assessment tests using readily available ammunition for hunting have resulted in upgrading the wall thickness, particularly for the new Type 4 magazine standards, from 5 centimetres to 7.6 centimetres for washed hard crushed gravel and to 15 centimetres for sand. In most cases, existing magazine wall construction will be grandfathered.

With the publication of this standard, Type 2, 3, 5 and 7 magazines will no longer be permitted as an option for new magazines built after May 31, 2001, due to inherent weaknesses and duplication in the case of Type 7. Existing magazines built to the above

designs will need to be replaced with an appropriate magazine over the next five to 10 years depending on the risk as determined in consultation with the RCMP Bomb Data Centre and other police authorities.

Type 9 magazines, as known now, will be phased out over a five-year period and be replaced with an updated design with many similarities to a Type 4 magazine.

Type 11 magazine standards have been revised and use an ISO container commonly known as a “seacan,” which has been upgraded to include the newer door concept with ballistic materials in the walls. This bullet-resistant structure has many of the attributes of the former Type 5 magazine standard plus metal studs in the walls. Magazines built to this standard will have limited use as they are not considered an equivalent replacement for a Type 4 or 4S steel magazine. This standard has been upgraded to reflect the higher sensitivity of UN 1.1D classified explosives stored in northern regions, but may also be considered for use in other parts of Canada to meet particular circumstances.

Type 12 magazine standards have been reworded to allow more flexibility for novel designs related to particular circumstances.

ERD has taken a fresh approach to the electrical classification for magazines, particularly for interior lighting and recognizes the minimal hazards associated with finished packaged products. Along the same lines, heating guidelines have been included as has the referencing of *Electronic Intrusion Alarm Systems for Magazines* (ERD Bulletin Number 45).

In the past, it has been customary for any welding shop to build a walk-in type magazine from the published magazine standards. With the publication of these revised standards, the intimate details of the door design will be controlled and issued to “approved” shops or facilities across Canada to maintain consistent quality of construction and to limit the design details to those who have a “need to know.” As has been the case in the past, any welding shop will be able to construct the balance of the magazine if it so wishes.

Each magazine will now have a unique code composed of numbers/letters with a corresponding tag installed in the magazine and noted on the licence.

Section 471 Intermittent storage

Only magazines can be used to store explosives. Explosives removed from a magazine must be returned as quickly as possible if they are not used. Explosives cannot be left in any other location between periods of work because of the potential for them to be lost, stolen or accidentally detonated.

Section 472 Light sources in magazines

Artificial light sources such as flashlights, headlamps, vehicle headlights and lanterns must be of such a type, or constructed or positioned in such a way, that they eliminate the possibility of explosives contained in the magazine from being exposed to sparks, open flames or other sources of ignition. Some of these light sources might be designed and approved “for use with explosives.” In other cases, the light sources may need to be positioned outside the magazine with their light shining into the magazine.

Section 473 Transporting explosives

Subsection 473(1)

The transportation of explosives is a federal matter. Alberta Labour does not regulate the transportation of explosives.

Subsection 473(2)

Limiting the number of persons travelling in a vehicle that is transporting explosives and detonators reduces the number of persons at risk of serious injury in the event of an accidental detonation.

Subsection 473(3)

Electric detonators are safest to handle when their leg wires are twisted together and shunted or grounded. Doing so prevents accidental premature ignition. The wires are to remain shunted until the detonators are ready to be connected to the blasting circuit.

Subsection 473(4)

In the event of a fire, fire extinguishers are to be used to prevent the fire from reaching the explosives. Fire extinguishers are not intended to be used to fight a fire directly involving the explosives. Vehicles transporting less than 25 kilograms of explosives must be equipped with at least one fire extinguisher.

A vehicle transporting 25 to 2000 kilograms of explosives must be equipped with at least one 10 BC fire extinguisher (the federal *Explosives Act (Canada)* requires one 5 BC fire extinguisher). The increased rating for Alberta complements the new requirement for a fire extinguisher when transporting small quantities of explosives and reflects the greater quantity of explosives being transported. The requirement for two 10 BC fire extinguishers when transporting more than 2000 kg of explosives is consistent with the *Explosives Act (Canada)*. The requirements for fire extinguishers appear in Schedule 10 of the *OHS Code*, shown below as Table 33.1.

Table 33.1 Fire extinguisher requirements (appears as Schedule 10 in the *OHS Code*)

Quantity of explosive	Quantity and type of fire extinguisher required
< 25 kilograms	1—5 BC fire extinguisher required
25 kg to 2,000 kilograms	1 (minimum)—10 BC fire extinguisher
> 2,000 kilograms	2 (minimum)—10 BC fire extinguishers

Section 474 Oldest used first

Over time, some types of explosives can deteriorate and become less effective. To limit the likelihood of explosives being kept in storage for extended periods of time and being allowed to deteriorate, an “oldest first”—older explosives should be stacked in front of newer ones—practice must be followed. This ensures constant turnover of explosives that limits how long they are stored before being used.

Section 475 Deteriorated or damaged explosives

Deteriorated or damaged explosives must not be used in any blasting operation. Blasting operations may be ineffective with such explosives and damage may make the explosives unnecessarily dangerous during handling. Deteriorated or damaged explosives must be destroyed or disposed of safely by a blaster.

Section 476 Unused explosives

Unused explosives, fuse assemblies or detonators must be stored in accordance with the *OHS Code*. These products must be destroyed or disposed of according to the manufacturer’s recommendations by a blaster having a valid blaster’s permit.

Section 477 Appropriate quantities

The purchase and selection of charge sizes and the removal of appropriate quantities of explosives from the magazine should be based on the tasks being undertaken. This reduces the likelihood of larger charges being partitioned and excess explosives having to be returned to the magazine. This also eliminates unnecessary handling and reduces the possibility of an incident.

Section 478 Cutting or piercing

The requirements are intended to reduce the possibility of unintentional detonation caused by a spark created in the work area.

Section 479 Cartridge explosives

The outer cover of cartridge explosives provides a protective barrier and a means of preventing granular explosives from spilling. Both the employer and the worker are responsible for ensuring that safe practices are followed and outer covers are not removed.

Section 480 Tools

Crimping tools continue to be used in some explosives operations. Where this is the case, the employer must provide the tools and a safe location in which fuse cutting can be performed.

Section 481 Priming

Charges must be primed as close to the site of their detonation as possible. This reduces or eliminates unnecessary handling of a charge that has been primed, limiting the possibility of injury from unintended detonation. No more explosive than is required to perform the work should be removed from the magazine. This eliminates unnecessary handling and reduces the possibility of an incident.

To prevent the unintended detonation of stored explosives, charges must not be primed in any location where explosives are stored.

Primed charges must not be assembled in advance of the hole drilling operation. Only one charge must be prepared and loaded at a time prior to moving to the next hole.

Section 482 Length of safety fuse assemblies

This section requires safety fuse assemblies to be at least 1 metre long. Workers must not cut the fuse to a shorter length. Safety fuses must be of sufficient length to permit easy connection and allow enough time for the blaster to retreat to a safe location.

Section 483 Detonators

The timing, delay and blasting characteristics of detonators can vary. Requiring all detonators to be produced by the same manufacturer ensures performance consistency and effective blasting operations.

Section 484 Storms

An electrical or severe dust storm can develop sufficient electric energy in the air to initiate susceptible unshunted electric detonators. Both the employer and the blaster are responsible for suspending blasting operations during or upon the approach of such storms.

Section 485 Drilling location

The requirement is intended to prevent the detonation of explosives remaining in a hole.

Section 486 Bootleg

A bootleg is a portion of a drill hole or bore hole that has not been destroyed after detonation of an explosive charge. It may or may not contain explosives. Examination of the bootleg helps to determine if it contains explosives that could cause problems.

When a misfired explosive is discovered in a bootleg, it must be blasted to eliminate it from detonating unexpectedly at some future time.

Section 487 Size of drill hole

Excessive insertion force may cause unintended detonation of the explosive charge.

Section 488 Prohibition

Looking directly into a drill hole or borehole during loading operations is a dangerous practice. If an explosive detonates unexpectedly, some of the blast energy will be directed upwards, potentially injuring any person looking down into the hole.

Section 489 Unwinding detonator leg wires

To prevent misfires resulting from damaged leg wires, leg wires must be unraveled or unwound slowly.

Section 490 Static electricity

This requirement is intended to remind employers and blasters that care must be taken to minimize static build-up during the handling of explosives. Methods of limiting static build-up include static drain traps, work surfaces covered with static-free or static-dissipating materials and workers using static discharge wrist straps connected to ground.

Section 491 Tamping explosives

Loading or tamping poles and fittings must be made of non-sparking anti-static materials so they do not become a source of ignition.

Limiting tamping force reduces the likelihood of unintended detonation and damage to explosives during loading.

Section 492 Sequential firing

If charges are not fired properly in sequence, loaded holes can be cut off and result in misfired charges. This unnecessarily complicates the blasting operation and must be avoided.

Section 493 Detonation within 30 days

The time limit is intended to make sure that the charged holes are not forgotten and that the charges themselves remain effective and are not allowed to deteriorate.

Section 494 Detonator leg wires

These requirements reflect current best practices in the seismic industry. They are applicable to all circumstances where public access to exposed leg wires may be an issue.

Section 495 Testing detonators and circuits

Subsection 495(1)

Verifying proper operation of the detonator and complete firing circuit ensures that there are no broken wires or short circuits and the resistance of the circuit is compatible with the capacity of the power source. In the event of a misfire, section 509 requires that the worker wait for a period of 10 minutes before approaching the misfire. Doing so prevents the worker from being injured by a slow-to-fire electric detonator. Testing each detonator and its firing circuit detects suspect detonators and avoids the 10-minute waits associated with a misfire.

Subsection 495(2)

Standard ohmmeters or multimeters cannot be used for testing blasting circuits because they can introduce a test current capable of unintentionally and unexpectedly detonating the detonator under test. As written, this section does permit the use of alternate test instruments as long as they are “designed for use with detonators.” Either the product’s manufacturer or a professional engineer can confirm that a particular test instrument is appropriate for use with detonators.

Section 496 Damaged leads and wires

A damaged wire will not activate the charge because current is unable to pass through the wire to the charge. The result will be a misfire that could have been prevented.

Section 497 Connecting down lines to trunk cords

This requirement is intended to reduce the likelihood of unintended detonation and damage to down lines and trunk cords.

Section 498 Community protection

Protecting people and property from injury and damage is extremely important. This can be done by limiting explosive charges, using suitable protective devices in the blasting area to limit the movement of debris and restricting access to the blasting area. Both the employer and blaster are responsible for ensuring that appropriate precautions are taken.

Section 499 Safe distance

The minimum safe distance recognized as an industry-wide practice in seismic blasting operations is 30 metres. Unlike other industries, charge size and depth remain relatively constant, permitting the use of a single safe working distance.

In the case of operations involving pyrotechnics and special effects, the distances cited in the referenced NFPA standards must be followed.

Section 500 Stray electric currents

Stray electric currents can result from differences of potential (voltage) within a blasting area, inadequate grounding, or induced currents resulting from electromagnetic radiation. Both the employer and blaster must ensure that precautions are taken to prevent premature detonation caused by stray electric currents.

Section 501 Overhead power line

In an electric blasting system, electromagnetic radiation may introduce sufficient electric current to prematurely initiate detonation devices. The 60 metre distance is intended to limit this possibility.

Use of the term “overhead power line” makes this requirement very specific, eliminating the possibility of cable TV and telephone lines incorrectly restricting blasting operations.

Section 502 Above-ground charge

This requirement is intended to prevent injury and damage to persons and property.

Section 503 Radiofrequency transmitters

Subsection 503(1)

Table 2 of Schedule 10 presents minimum separation distances between explosives and fixed radiofrequency transmitters based on transmitter power. Table 3 presents minimum separation distances between explosives and mobile radiofrequency transmitters and cellular telephones. Both tables are based on information appearing in the *Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (Safety Library Publication No. 20)*, December 2011, published by the Institute of Makers of Explosives.

Subsection 503(2)

Safety is best assured when detonators are shunted. Communications transmissions are permitted within the minimum separation distance limits specified by Table 2 or Table 3 of Schedule 10 as long as the detonator leg wires are shunted.

Subsections 503(3) and 503(4)

These requirements recognize that:

- (a) cellular telephones present a potential hazard as the radiofrequency energy they transmit may cause unexpected detonation of electric blasting detonators; and
- (b) cellular telephones transmit signals at periodic intervals to their network, even when on one is speaking into the telephone. In contrast, portable two-way radios transmit only when the push-to-talk button is depressed.

Section 504 Length of fuse assembly

As required by section 482, a safety fuse assembly must be at least 1 metre long. It must also protrude from the borehole and be long enough to allow the blaster to reach a safe location after igniting the safety fuse.

Section 505 Blasting machine

Subsections 505(1) and 505(2)

Blasting machines have safety features that reduce the likelihood of unintentional detonation of explosives. Many blasting machines incorporate circuit test features that check the continuity of the blasting circuit to ensure that a successful detonation occurs.

A battery or system of batteries is in general an unsafe alternative to a blasting machine and its use is prohibited for electric blasting.

Subsection 505(3)

While compact blasting machines are available for field use, batteries are far less expensive and their use for detonating unrecoverable explosives is permitted. Because charge sizes and hole depth are relatively uniform, seismic activities can rely on a minimum safe working distance when such activities are conducted. The exemption is restricted to the seismic industry.

Section 506 Shunting the firing line

When the controls of a blasting machine are set to their safe or unarmed position, the firing line to which it is connected is effectively shunted. This is functionally equivalent to the firing line being shunted by hand.

Section 507 Loaded hole

During seismic blasting and drilling operations, loaded holes are a natural consequence of preparing an area for detonation. Operationally, it is impractical to post clearly visible signs around loaded holes and is unnecessary when other safety conditions are met.

Section 508 Standards

No explanation required.

Section 509 Misfire waiting period

This requirement reflects current best practices. In some cases, the manufacturer, based on the specific safety fuse assembly and delay detonators in use, recommends intervals that differ from the 10 and 30 minute intervals stated. In these cases, the manufacturer's recommendations must be followed.

Section 510 Withdrawing misfire

During oil well blasting and perforating operations, misfired perforating guns containing undetonated charges can be retrieved, repaired and returned to the hole.

Section 511 Destroying a misfire

Blasters are given the opportunity to assess local conditions to determine if blasting a misfire is both possible and practicable. If it is, then the blaster is directed as to where the second charge is to be placed.

Section 512 Abandoned charge

Subsection 512(1)

Charges must not be abandoned if they can be safely detonated. By extension, charges that cannot be safely detonated can be abandoned but the conditions stated in subsection (2) must be met.

Subsection 512(2)

Certain conditions must be met when a misfire or unfired charge is abandoned. Unless they can be safely removed or detonated, misfired explosives are left in the ground, their lead wires cut and buried beneath the surface and the location of the misfire marked. Shunting of misfires is not necessary and the wires must be hidden below surface to prevent entanglement with people, animals and machinery.

The company that placed the misfire or unfired charge in the drill hole, i.e., “the employer responsible for detonating the explosive charge,” must keep a permanent record of its location and the charge.

Section 513 Removal of waste

Waste materials may have residues of explosives on them. Such residues are capable of detonating under the appropriate conditions, potentially injuring persons or damaging property. All waste materials must be removed from the blasting area prior to the area being abandoned.

Section 514 Loss or theft

Both the RCMP and the Chief Inspector of Explosives must be informed of suspicious incidents involving the loss or theft of explosives.

Section 515 Avalanche control

Subsection 515(1)

The special needs of avalanche control have resulted in the inclusion of separate, specific requirements in the *OHS Code*. Unless stated otherwise, all other requirements of the *OHS Code* also apply to avalanche control activities.

Subsections 515(2) and 515(3)

The Canadian Avalanche Association has demonstrated that the pre-priming of explosive charges and their subsequent careful transport is a safe practice for avalanche control purposes. Hand deployment of charges takes place from helicopters, with

avalaunchers, during cornice blasting and along long and narrow ridgelines under conditions that can make on-site priming difficult and dangerous.

Subsection 515(4)

This requirement is intended to prevent primed charges and lighters from coming together and detonating unintentionally. It is a safety precaution required because the charges are pre-primed.

Subsection 515(5)

Because of the difficult circumstances and conditions under which avalanche control can take place (poor weather, from a helicopter, etc.), added safety precautions are required.

Section 516 Oil well blasting

Subsection 516(1)

No explanation required.

Subsection 516(2)

Alberta Labour recognizes the *Perforating Industry Code of Practice* as a set of practices approved by a Director of Inspection.

The Petroleum Services Association of Canada (PSAC) publishes the *Perforating Industry Code of Practice* (Code) which defines safety standards applicable to the perforating industry. Compliance with the Code is a condition of the operating license issued by Natural Resources Canada (NRCan), Explosives Regulatory Division and applies to both PSAC and non-PSAC members. The Code is updated as necessary by provincial and federal representatives to promote industry best practices. Because of NRCan's reliance on the Code for regulatory purposes, NRCan has final approval of any revisions prior to publication. NRCan conducts annual, unannounced inspections of license holders, basing their inspection on the requirements of the Code.

The purpose of the Code is to inform personnel in the perforating sector of safety standards applicable to their business. The Code includes:

- (a) storage requirements—explosives in a magazine, loaded perforating guns and during transportation on motor vehicles;
- (b) safe shop handling procedures—in loading and charging area;
- (c) standard operating procedures—for the preparation, handling, loading and disposal of explosives;
- (d) emergency procedures and reporting—of incidents involving explosives, vehicle breakdowns and the theft or loss of explosives; and
- (e) firefighting procedures—for shop or vehicle fires.

Copies of the Code of Practice can be purchased by contacting PSAC.

Subsections 516(3) and 516(4)

In oil well blasting and perforating, loaders handle stable charges when loading perforating guns at the workshop and do not handle detonators. As a result, this section exempts loaders from having to hold a valid blaster's permit. However, the employer continues to be responsible for ensuring that loaders are competent at their work and have access to a blaster whenever assistance is required. Access to the blaster can include telephone and portable two-way radio.

The task of "arming" perforating guns is restricted to blasters having a valid blaster's permit.

Subsection 516(5)

Tubing Conveyed Perforating (TCP) is a method of operating perforating guns that are run on pipe, including tubing strings, drill pipe and coiled tubing. TCP guns are fired by dropping a drop bar or can be pressure activated once in position.

Regardless of the initiation method, all detonation of explosives and the retrieval of a perforating firing system (including perforating gun or down hole tool) from the well bore must be conducted by a blaster with a valid Alberta blaster's permit.

For any TCP operation, the following procedures are expected to be observed by the employer.

- (1) A licensed blaster, employed by the company providing the TCP service, must arm the TCP system.
- (2) The dropping of a TCP Drop Bar must be performed by a licensed blaster employed by the company providing the TCP service.
- (3) In the event of a suspected misfire or the lack of a positive indication of a mechanically activated TCP firing system, every effort must be made to retrieve the Drop Bar. A licensed blaster must be on site before and while the gun is removed from the well bore.
- (4) In the event the Drop Bar cannot be successfully retrieved, then procedures developed by the manufacturer of the TCP system, the company providing the TCP services and the operator of the well site must be followed before removing the tubing from the well bore.

Subsection 516(6)

During oil well perforation activities, perforating guns failing to detonate are removed from the drill hole, disassembled and the problem(s) corrected. During this time, it may be impractical for a perforating gun to be connected to the blasting machine.

Subsection 516(7)

A blaster must ensure that if an armed device is at the surface, all electronic and power devices within 20 metres of the armed device must be turned off.

Section 517 Seismic blasting and drilling

Subsection 517(1)

The special needs of seismic blasting and drilling have been grouped together in this section. Unless stated otherwise, all other requirements of the *OHS Code* also apply to seismic blasting and drilling activities.

Subsections 517(2) and 517(3)

Seismic blasting operations require running water when holes are drilled in the ground. During winter operations, the only practical method of warming water tanks and valves on seismic drills in remote locations under severe climatic conditions is to use an open flame. Recognizing that under normal circumstances open flames are not permitted within 15 metres of explosives but that the practice is widely followed by industry, the listed conditions must be met so that the practice can be performed safely.

Part 34 Forestry

Highlights

- Section 521 requires skidders, grapple skidders and crawlers to be equipped with operator protective structures that meet the requirements of the Society of Automotive Engineers (SAE) Recommended Practice J1084-APR80 (R2002), *Operator Protective Structure Performance Criteria for Certain Forestry Equipment*.
- Section 524 allows logging trucks to exceed their manufacturer-specified load weights if the listed conditions are met.

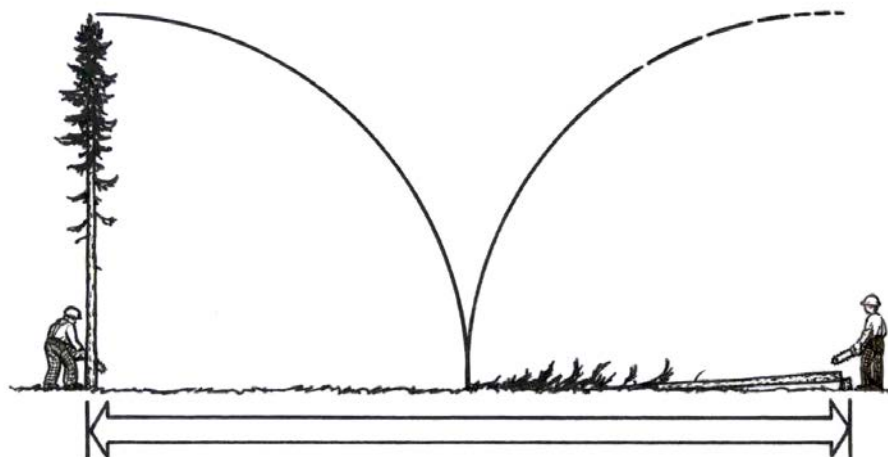
Requirements

Section 518 Felling and bucking

Felling is the activity of cutting a standing tree and having it fall to the ground. Bucking is the cutting of a fallen tree into smaller segments. Limbing is the activity of cutting limbs or branches from a tree trunk.

A falling tree must never be allowed to strike a worker. Enough space needs to be provided so that workers can easily get out of the way when a tree falls. Workers not directly involved in cutting down a particular tree must keep a safe distance away—at least twice the distance of the height of the tallest tree in the area where cutting is taking place (see Figure 34.1). This safe distance may be greater in cases where a self-propelled mechanized feller is used. The feller manufacturer's instructions usually specify a minimum distance of 100 metres.

Figure 34.1 Workers must remain at least two tree-lengths apart from each other when carrying out tree felling activities.



All trees, branches or foliage that could pose a danger to a worker must be removed before a particular tree is cut. A notch, $\frac{1}{4}$ to $\frac{1}{3}$ of the tree's diameter deep, must be made near the base of the tree. The undercut must be completely cleaned out.

Trees must fall in a planned direction and not break, slip or twist off the stump. Enough holding wood must be left between the undercut and backcut to control the line of fall (see Figure 34.2). Workers who fell trees by hand must use wedges to topple the tree in the correct direction (see Figure 34.3).

Figure 34.2 Undercut, holding wood, and backcut

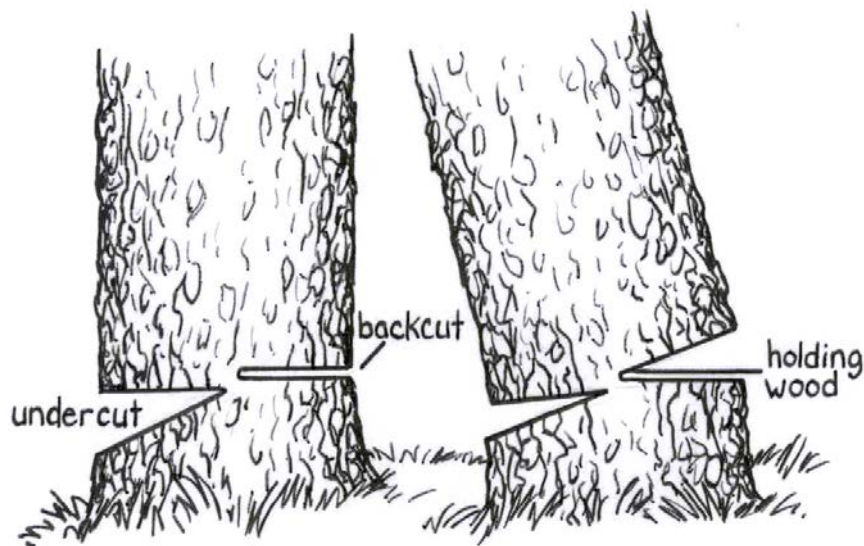
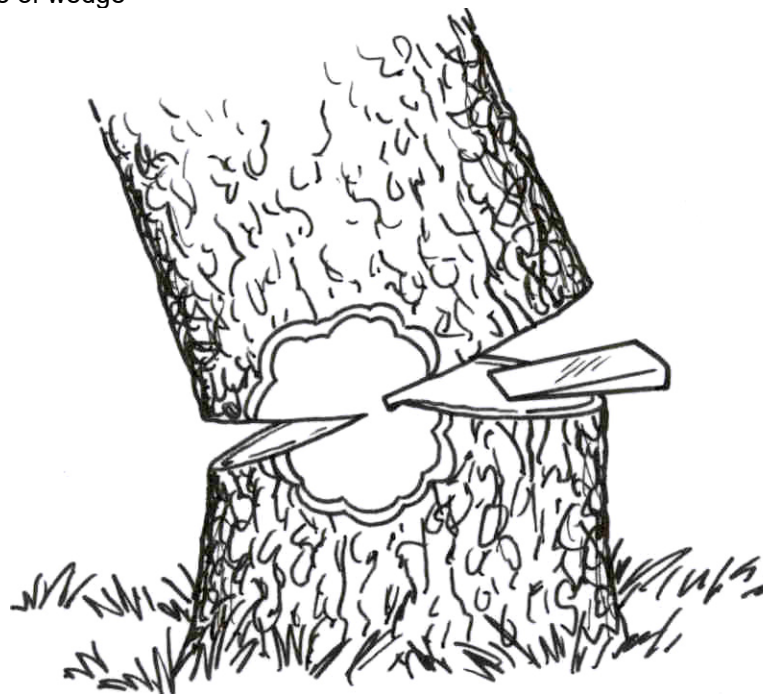


Figure 34.3 Use of wedge

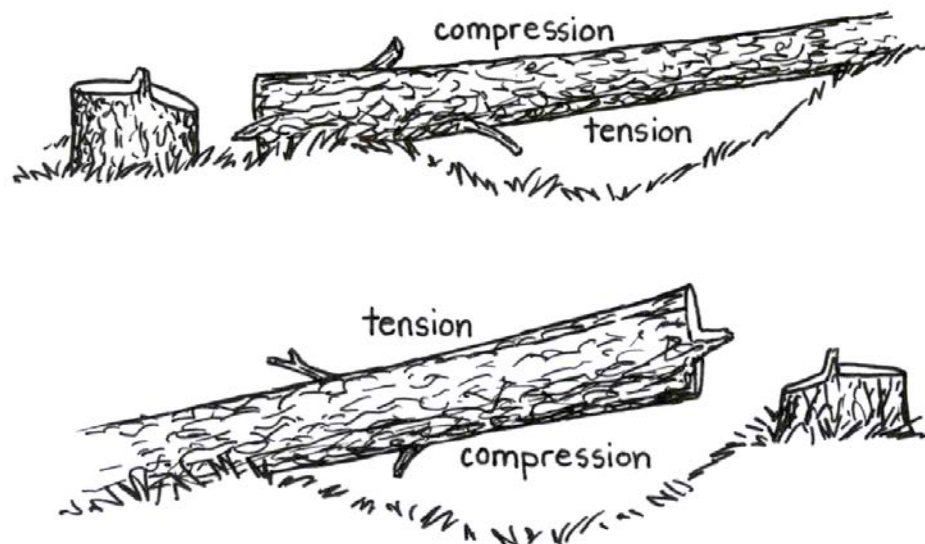


Before bucking up a fallen tree, the worker must clear away all brush and other objects that could get caught in the chainsaw. Doing this reduces the likelihood of the chainsaw kicking back at the operator.

Employers must protect workers from trees that may move while being cut. Workers must not work on hillsides directly below a faller where there is a danger of trees or logs striking them. When working on inclines or hillsides, a worker must stand on the uphill side to prevent being hit by a moving tree or log.

It is important that buckers determine where the tension is in a tree they are about to buck. Doing so ensures that the tree does not spring up and towards workers once the tension is released (see Figure 34.4).

Figure 34.4 Trees in compression and tension



Section 519 Hand felling

Hand cutting of trees is not permitted during adverse weather conditions. Strong winds and lightning in or near the immediate area could be hazardous to workers.

Section 520 Mechanized feller or limber

The cabs of feller bunchers and limbers must have two exits through which an operator can escape in case of an emergency. Both exits must function properly.

Section 521 Operator protective structures

SAE Recommended Practice J1084-APR80 (R2002), *Operator Protective Structure Performance Criteria for Certain Forestry Equipment*, establishes a consistent, repeatable

means of evaluating operator protective structures (OPS) on skidders, grapple skidders, and crawlers used to harvest trees.

OPS are structures/enclosures that minimize the possibility of operator injury from hazards such as whipping saplings, branches, jill-poking (spear-like objects), and snapping winch lines. OPS must do this without adversely affecting operator visibility, comfort, and protection from other hazards. The Recommended Practice describes test procedures and the minimum performance criteria that the OPS must meet.

Depending on the type of equipment, it may also be equipped with a rollover protective structure (ROPS). See sections 270 and 271 of the *OHS Code* for information about ROPS.

Section 522 Road warnings

Trees cannot be felled within range of a travelled road unless specific precautions are taken. These precautions involve:

- (a) placing a designated signaller (see section 191 of the *OHS Code* for requirements that apply to signallers) on the road; or
- (b) locating flags or warning signs at the side of the road at a distance of 30 metres to 90 metres from each approach to the place where the tree is to be felled.

Section 523 Partially cut trees

A tree that has had its branches removed can be left standing. Once the trunk of a tree has been cut however, the tree must be felled. This eliminates the possibility of the tree falling over at some later time. A tree left standing with a cut in its trunk poses a danger to workers.

Section 524 Logging trucks

Subsection 524(1)

Repealed

Subsection 524(2)

Repealed

Subsection 524(3)

Instead of complying with the manufacturer's specifications as per requirements of section 12 of the *OHS Code*, logging trucks that exceed their manufacturer-specified load weights can be operated if:

- (a) a written hazard assessment meeting the requirements of Part 2 has been completed; and

(b) controls that ensure safe operation of the logging truck have been implemented.

The assessment and controls do not need to be reviewed by a Director of Inspection prior to being implemented. If an officer inspects a work site and considers the assessment or controls insufficient, then the assessment and controls may need to be reviewed by a Director of Inspection. A Director of Inspection is a member of the professional staff of Alberta Labour, appointed by the Minister under section 42 of the *OHS Act*.

To be acceptable, the hazard assessment must address each of the following topics:

- (a) weight monitoring;
- (b) speed monitoring and control;
- (c) route control and communications;
- (d) signage;
- (e) driver management;
- (f) truck and trailer mechanical inspection;
- (g) truck and trailer maintenance; and
- (h) any other factors affecting safety.

The controls used must be based on the outcome of the hazard assessment and must ensure that workers are safe.

The Alberta Forest Products Association (AFPA) has developed a *Log Truck Hazard Assessment Checklist* to help its members with this process. Non-members can purchase the checklist by contacting the AFPA.

Section 525 Traffic safety

Subsection 525(1)

All bridges, platforms and other structures used by vehicles in forestry operations must be engineered, constructed, and maintained so that they are safe for use. It may be necessary for these structures to be certified by a professional engineer.

Subsections 525(2), 525(3) and 525(4)

Logging roads often include sections that are too narrow for two or more vehicles to pass one another at the same time. Where this is the case, an effective traffic control system must be installed for use by all vehicles on the road. Subsection (4) further requires that vehicles involved in forestry operations operate with their headlights turned on at all times.

Part 35 Health Care and Industries with Biological Hazards

Highlights

- Section 525.2 describes requirements for safety-engineered medical sharps.
- Section 526 specifies requirements applicable to sharps containers.
- Section 527 prohibits the recapping of waste needles.
- Section 528 requires employers to establish policies and procedures for storing, handling, using and disposing of biohazardous materials (Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one).
- Section 530 requires employers to establish policies and procedures for the post-exposure management of workers exposed to biohazardous material (Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one).

Requirements

Section 525.1 Exposure control

This section serves to remind employers and workers that worker exposure to blood borne pathogens is a hazard that must be controlled according to the hazard elimination and control requirements of Section 9.

Section 525.2 Medical sharps

Subsections 525.2(1), 525.2(2) and 525.2(3)

Safety-engineered medical sharps

A “safety-engineered medical sharp” is a medical sharp that is designed to, or has a built-in safety feature or mechanism that eliminates or minimizes the risk of accidental parenteral contact while or after the sharp is used; parenteral contact means piercing mucous membranes or the skin.

Specially designed medical sharps, e.g., hollow-bore needles, suture needles, scalpels, etc., reduce the risk of needlestick injuries and other puncture wounds from contaminated sharps. Self-sheathing needles have a built-in sheath or sleeve that extends to cover the needle. Retractable syringes are designed so the needle can be pulled up inside the syringe.

Needleless systems use threaded ports on IV tubing, so healthcare workers can remove the needle from the syringe after drawing up medication, and then simply screw the syringe directly into the port. Disposable safety scalpels have a built-in sheath that covers the blade between use and disposal, and suture needles for sewing tissues other than skin are available with blunted tips.

Alberta's *OHS Act* defines a work site as a location where a worker is, or is likely to be, engaged in any occupation and includes any vehicle or mobile equipment used by a worker in an occupation. Examples of work sites where subsections (2) and (3) may apply include, but are not limited to:

- hospitals;
- ambulances;
- homecare sites where a community health nurse visits;
- blood collection clinics;
- correctional institutes;
- dental offices;
- medical and dental laboratories;
- health clinics, including those located in industrial facilities;
- outpatient facilities (including renal dialysis clinics and cancer treatment centres);
- hemodialysis centres;
- drug treatment centres;
- hospices;
- residential care facilities;
- assisted living residences;
- physicians' offices;
- veterinary clinics;
- naturopaths' offices;
- acupuncture clinics; and
- tattoo parlours.

The requirements in subsections 525.2(2) and (3) apply to all work sites where medical sharps are used, unless a work site party has previously applied for and been granted an acceptance by a Director of Medical Services.

Despite subsection (2), there are times when a safety-engineered medical sharp cannot be used because its use is not clinically appropriate or the required safety-engineered sharp is unavailable in commercial markets.

The person who determines that use of the required safety-engineered medical sharp is not clinically appropriate should have the clinical knowledge and experience necessary to make that assessment. This person should also have expertise in the procedure in question, as well as knowledge of the devices that are commercially available for the procedure. The reason(s) why the device required under subsection 525.2(2) is not clinically appropriate should be well documented for each procedure or type of procedure where that determination is made. In some situations, it may be clinically appropriate to use the required device even though its use in turn requires modification of a medical procedure.

The person determining that the required safety-engineered sharp is not available in commercial markets should have similar clinical knowledge and a comprehensive knowledge of what products are commercially available. A record of the suppliers and manufacturers contacted or other information relied upon to make this determination should be kept.

As a best practice, the availability and/or appropriateness of using a safety-engineered sharp should be reassessed annually, as there may be changes in commercial availability or available technology in the intervening time.

Subsections 525.2(4), 525.2(5) and 525.2(6)

Safe work procedures and training

The employer must establish safe work procedures for the use and disposal of medical sharps if a worker is required to use or dispose of a medical sharp. The joint work site health and safety committee or health and safety representative may be involved in developing and evaluating work procedures.

The procedures should include a discussion of:

- (a) the hazards associated with the use and disposal of medical sharps;
- (b) the proper use and limitations of safety-engineered medical sharps; and
- (c) procedures to eliminate accidental contact with medical sharps.

Additional relevant information can also be included as necessary.

As required by section 14 of the *OHS Act*, a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. The purpose of the procedures is to limit the possibility of workers coming into contact with medical sharps that could cause a cut or puncture wound. Workers must be trained in the safe work procedures so that the procedures are understood and followed.

Workers are required to use and dispose of medical sharps in accordance with the training they have received.

Section 526 Sharps containers

Biohazardous material

Sharps include needles, knives, scalpels, blades, scissors and other items that can cut or puncture the skin, and may also be contaminated with a biohazardous material.

Typically, only those workers involved in health care are thought of as being at risk of contracting disease from biohazardous materials. However, other workers can also be exposed to biohazardous materials. This includes workers involved in law enforcement, workers who provide fire and rescue services, workers who work at correctional institutions and funeral homes, and workers who function as first aiders at worksites.

The definition of “biohazardous material” in this section applies to organisms that may cause disease in humans. In particular, it applies to pathogens that are or would be classified by the Public Health Agency of Canada *Canadian Biosafety Standard (CBS), Second Edition (2015)* as Risk Group 2, 3 or 4.

Risk Group 2 (moderate individual risk, low community risk)

A pathogen or toxin that poses a moderate risk to the health of individuals or animals, and a low risk to public health and the animal population. These pathogens are able to cause serious disease in a human or animal but are unlikely to do so. Effective treatment and preventive measures are available and the risk of spread of diseases caused by these pathogens is low.

Risk Group 3 (high individual risk, low community risk)

A pathogen that poses a high risk to the health of individuals or animals, and a low risk to public health. These pathogens are likely to cause serious disease in a human or animal. Effective treatment and preventive measures are usually available and the risk of spread of disease caused by these pathogens is low for the public. The risk of spread to the animal population, however, can range from low to high depending on the pathogen.

Risk Group 4 (high individual risk, high community risk)

A pathogen that poses a high risk to the health of individuals or animals and a high risk to public health. These pathogens are likely to cause serious disease in a human or animal which can often lead to death. Effective treatment and preventive measures are not usually available and the risk of spread of disease caused by these pathogens is high for the public. The risk of spread of disease to the animal population, however, ranges from low to high depending on the pathogen.

The Public Health Agency of Canada classifications also include pathogens that are capable of causing disease in humans or animals. The definition of “biohazardous

material” in this section does not apply to organisms capable of causing disease in animals, but does include toxins produced by organisms capable of causing human disease.

WHMIS 2015

Under WHMIS 2015, biohazardous infectious materials are classified under Biohazardous Infectious Materials (Category 1). These materials are defined as microorganisms, nucleic acids or proteins that cause or are a probable cause of infection, with or without toxicity, in humans or animals. Category 1 Biohazardous Infectious Materials include infectious materials that fall into Risk Group 2, Risk Group 3 or Risk Group 4, as defined in subsection 3(1) of the *Human Pathogens and Toxins Act*; or have been shown to be a cause or probable cause of infection or infection and toxicity in animals.

Figure 35.1 WHMIS symbol for Biohazardous Infectious Materials (Category 1)



Employer requirements for the training, handling and use of hazardous products are found under Part 29 of the *OHS Code*.

For more information

 *Canadian Biosafety Standard (CBS), Second Edition*

Sharps container design

A sharps container is a container into which sharps are placed for safe containment and disposal. Sharps containers are made from a variety of materials, including lined cardboard, metal and plastic. To be acceptable for use, the container must have the following characteristics:

- (1) *puncture resistant*—the container must be sturdy enough to prevent contained sharps from puncturing the container during normal conditions of use and handling, particularly when being disposed;
- (2) *fill line*—the container must have a fill line indicating the maximum level to which the container can safely be filled. For most containers, this should be no more than $\frac{3}{4}$ full;
- (3) *closable*—during normal handling and disposal, contained sharps must not be able to fall out;
- (4) *leakproof on the sides and bottom*—this prevents any accumulated fluids from leaking out of the container and posing a hazard to workers; and

- (5) *labelled or colour-coded*—the container must be clearly labelled as containing sharps or colour-coded according to the employer’s safe work practices. Acceptable labelling includes the universal “biohazard” symbol, the WHMIS biohazard symbol (Figure 35.1) or the word “SHARPS” appearing on the container. In all cases the label must be clearly visible.

Many types of sharps containers are commercially available. Containers emptied of their original contents are also acceptable for containing sharps as long as all of the above criteria are met. If using containers that are not originally designed as sharps containers, they must be clearly marked to indicate that they are storing sharps.

In terms of safe use practices, sharps containers should

- (a) not be filled to more than $\frac{3}{4}$ of their maximum capacity—this prevents injuries due to overfilling;
- (b) be upright during all times of use—to prevent spills and leaks;
- (c) not be emptied into another container and the original sharps reused—this exposes workers to an unacceptable hazard for injury; and
- (d) have their lids in place—this prevents spills and limits access to the collected materials. Immediately before a sharps container is removed or replaced, its lid must be secured in place to prevent the contents from spilling or sticking out during handling, storage, transport or shipping. Some lids may need to be securely taped in place.

The employer is responsible for providing sharps containers, making sure they are easily accessible, located as close as reasonably practicable to where sharps are used, and making sure that workers use the containers. Locating sharps containers close to the point of use encourages their immediate use and reduces or eliminates the need for workers to carry contaminated sharps. Sharps containers should be checked regularly, and securely disposed of when $\frac{3}{4}$ full.

Point of use placement also helps to reduce the likelihood of the contaminated sharp being placed into a pocket for later disposal, or left in bedding materials, only to be unexpectedly found later. It may be appropriate to place sharps containers in locations such as health care facility laundry areas where sharps can be reasonably expected to be found.

While the employer must provide sharps containers, workers must use them. Workers should plan ahead how they will safely handle their sharps, including disposal into a sharps container.

For more information



CSA Standard Z316.6-14, *Sharps Injury Protection - Requirements and Test Methods - Sharps Containers*



CSA Standard Z317.10-15, *Handling of Health Care Waste Materials*

Section 527 Recapping needles

Many injuries, known as needlesticks, occur when used or waste needles are recapped. Needlestick injuries can expose workers to a number of bloodborne pathogens that can cause serious or fatal infections. The pathogens posing the most serious health risks are

- (a) Hepatitis B virus (HBV);
- (b) Hepatitis C virus (HCV); and
- (c) Human immunodeficiency virus (HIV)—the virus that causes Acquired Immune Deficiency Syndrome (AIDS).

A waste needle is a needle that is no longer being used for clinical purposes, and one that can go directly into a sharps container for disposal. There may be situations in clinical practice where a needle may be used for multiple injections but is still in use in between injections, and not yet a waste syringe (e.g., giving local anesthetic, where an initial dose is given, and an additional dose may be needed if the patient is not completely anesthetized). While the syringe is in use, the general hazard assessment and control provisions in Part 2 of the *OHS Code* would apply, along with the requirement for an employer to establish policies and procedures for working with biohazardous materials under subsection 528(1) of the *OHS Code*.

Any person who comes in contact with a waste needle is at risk, including nursing staff, lab workers, emergency and public safety workers, doctors and housekeepers. The needles that usually cause needlestick injuries are hypodermic needles, blood collection needles, suture needles, dental needles and needles used in the delivery of intravenous (IV) fluids.

Waste needles must not be recapped and should be discarded immediately in an appropriate sharps container. It is not safe to carry an uncapped needle.

Employers can reduce needlestick injuries by prohibiting the recapping, bending, or cutting of needles. The employer is responsible for ensuring that waste needles are not recapped. Workers must not recap waste needles.

Section 527.1 Recapping needles at a farm or ranch

There are some situations where a farming and ranching operation needs to recap needles. For example, when reusable metal syringes or injection guns are used to vaccinate a herd of animals.

Section 527 does not apply to needles used at farming and ranching operations, providing the needles are designed by the manufacturer to be recapped.

Section 528 Policies and procedures

The employer must establish policies and procedures dealing with the storage, handling, use and disposal of biohazardous materials. As required by section 14 of the *OHS Act*, a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. The procedures in particular should take into account the educational level, literacy and language of the workers to whom the procedures apply.

Section 529 Limited exposure

The employer is required to keep worker exposure to biohazardous materials as low as reasonably practicable. The results of the employer's hazard assessment should provide direction as to where and how worker exposure can be minimized or eliminated.

Section 7 of the *OHS Code* requires an employer to assess a work site to identify existing or potential hazards before work begins. Where workers may be occupationally exposed to biohazardous materials, the assessment must include exposure to biohazardous materials as one of the assessed hazards. As required by Section 14 of the *OHS Act*, a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

The purpose of the hazard assessment is to determine the jobs, tasks and procedures for which exposure to a biohazardous material is possible and to evaluate the likelihood that such exposure will occur. The factors to be considered vary with the work site and the type of biohazardous material to which workers are potentially exposed. It is only necessary to assess work where there is potential for exposure.

When evaluating the potential for exposure, the following sources of information should be considered:

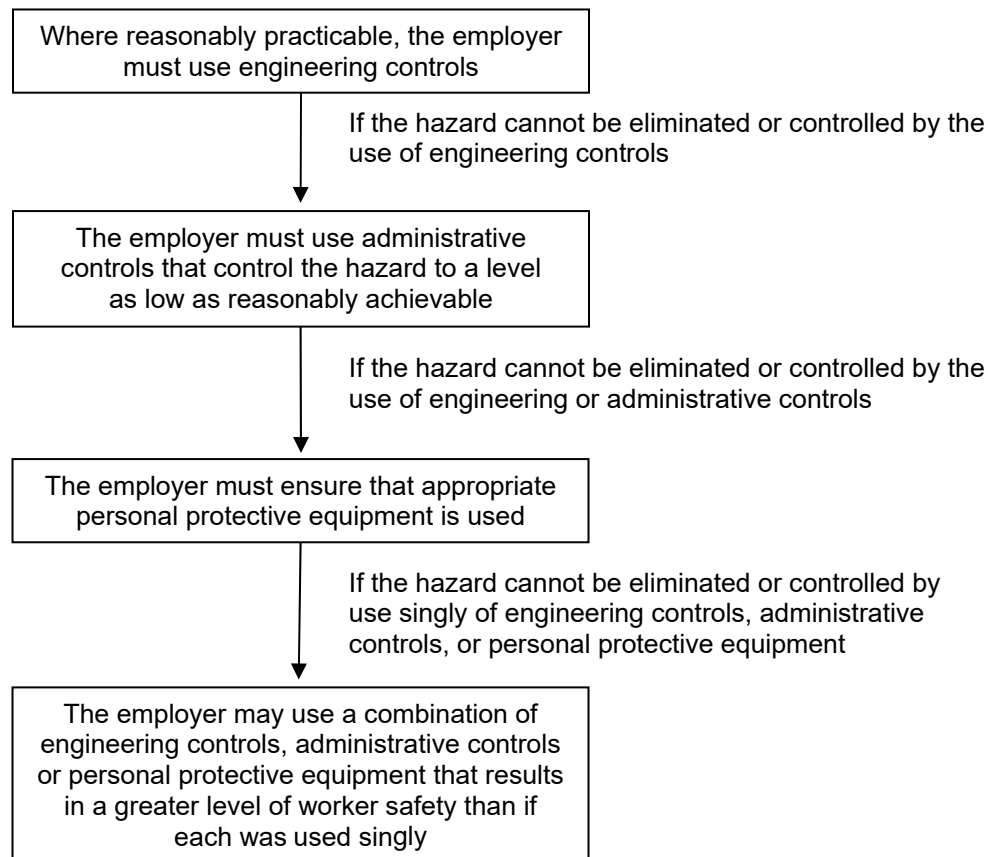
- (a) the employer's first aid records and incident or accident investigation reports—these may help to determine what type of injuries are occurring, where they are occurring, and perhaps the causes of those injuries;
- (b) WCB claims—these may help to determine what type of injuries are occurring, where they are occurring, and perhaps the causes of those injuries;
- (c) injury performance data for similar industries, injury performance of other employers in the same area, and industries dealing with the same client group; and
- (d) information available from agencies such as Alberta Health, Alberta Health Services, Health Canada, the Canadian Centre for Occupational Health and Safety (CCOHS), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. National Institute for Occupational Safety and Health (NIOSH).

Where a joint work site health and safety committee or health and safety representative exists, the employer must involve the committee or representative, as appropriate, in the performance of the hazard assessment and in the control or elimination of those hazards identified by the hazard assessment. The results of the hazard assessment must be communicated to those workers affected by its findings.

Section 9 of the *OHS Code* requires employers to take measures to eliminate the hazard or, where elimination is not reasonably practicable, control the hazard.

Figure 35.2 summarizes the hierarchy of control that must be followed.

Figure 35.2 Hazard elimination or control flowchart



Engineering Controls

Engineering controls reduce worker exposure to biohazardous materials by either removing or isolating the hazard, or isolating workers from exposure. Examples of engineering controls include

- (a) sharps containers;
- (b) safety-engineered medical sharps;
- (c) splatter guards;
- (d) mechanical waste compacting systems;

- (e) biological safety cabinets; or
- (f) mechanical pipetting systems in laboratories.

Administrative controls

Administrative controls reduce the likelihood of worker exposure to biohazardous materials by altering the way a task is performed. Examples of administrative controls include

- (a) hand washing immediately after removal of gloves and as soon as possible after skin contact with biohazardous materials;
- (b) disposing of contaminated sharps immediately after use in a readily available sharps container;
- (c) immediately cleaning up spills of biohazardous materials with equipment and supplies appropriate to the type and quantity of material spilled;
- (d) prohibiting the recapping of waste needles; or
- (e) preventing the storage of food and beverages in refrigerators or freezers where biohazardous materials are present.

Personal protective equipment

Personal protective equipment (PPE) should only be used once engineering and administrative controls, alone or in combination, have been unable to eliminate or control a particular hazard. PPE should always be thought of as the last line of defense, the “last resort.”

PPE should not be used as a substitute for engineering and/or administrative controls. PPE is designed to create a barrier against workplace hazards. Readers are referred to Part 18 of the *OHS Code* for information describing employer and worker duties involving PPE.

The *OHS Code* does not specify the type of PPE required for all work site circumstances. The choice of what type of PPE is required must be based on the specific exposure circumstances found at the work site. Examples of appropriate PPE may include gloves, gowns, puncture-proof footwear, laboratory coat, coveralls and booties, faceshield, splash goggles, resuscitation barrier, eye protection and respirator. For airborne or aerosolized exposure to biohazardous material, an approved and appropriately fitted particulate respirator may be required.

A worker must not fail to use PPE simply because

- (a) the patient is perceived to be “low risk”;
- (b) a respirator will frighten the patient;
- (c) exposure time will be “short”; or
- (d) the gloves provided are either too large, decrease the sensation of touch and/or hinder the ability to work. Under these circumstances, gloves appropriate to the worker and task have not been provided.

Section 530 Post-exposure management

Employers are required to have policies and procedures describing employer and worker responsibilities in the event that a worker is exposed to biohazardous material. As required by Section 14 of the *OHS Act*, a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

In case of an exposure, including needlesticks and other sharps-related injuries, the employer needs to ensure that first aid and medical attention are available to the worker. Details of the exposure need to be recorded, the significance of the exposure assessed, and timely follow-up medical care available to the worker. If the employer has WCB coverage, the policies and procedures should incorporate WCB reporting requirements.

For harmful exposures, follow-up actions may include making arrangements for confidential post-exposure counseling, medical evaluation, or medical intervention by a qualified person. It is important that workers have prompt access to medical evaluation, as some decisions about post-exposure management are time-sensitive.

Workers need to be aware of the procedures they must follow to obtain immediate first aid. Incidents of exposure to biohazardous materials must be reported as soon as possible to a supervisor and first aid attendant, and recorded in the first aid record. If a worker sustains an injury that meets the criteria in section 40(2) or 40(5) of the *OHS Act*, the employer or prime contractor must report the incident to a Director of Inspection.

Several Occupational Health and Safety publications provide more detailed information.

For more information



Immunizations for Worker Exposure, OHS Bulletin, Government of Alberta



Blood and Body Fluid Exposure (BBFE) Resources for Healthcare Professionals

Part 36 Mining

Highlights

- Section 546 requires the number of mine rescue teams to be related to the number of workers underground.
- According to section 573(1), an employer requires approval from the Director of Inspection with responsibility for mines when the gross vehicle weight (GVW) of a rubber-tired, self-propelled machine is more than 32,000 kilograms. However, the Director retains the right to request that an employer have tested and approved by the Director any rubber-tired, self-propelled machine at a mine site. Any machine approved under the *Traffic Safety Act* is approved for use in a mine.
- Section 573(3) allows rubber-tired, self-propelled machines to exceed their manufacturer-specified load weights if the listed conditions are met.
- Section 648 requires that machinery directly involved in loading an explosive is allowed to operate within 8 metres of a hole being loaded with explosive. The distance has been reduced from 15 metres.
- Section 692 requires underground storage of rescue breathing apparatus.
- Section 693 allows employers to search workers entering an underground mine for prohibited means of ignition, e.g., lighters, matches, etc.
- Section 731 lowers allowable flammable gas concentrations to 40 percent of their lower explosive limit (LEL) from 50 percent of their LEL.

Requirements

Section 531 Application

This Part of the *OHS Code* applies only to mines and mine sites. Special rules, not applicable elsewhere in the *OHS Code*, apply in this Part.

Section 532 Building safety

Employers must control the accumulation of dust in mine site buildings so that dust does not create a hazard to workers. Part 4 of the *OHS Code* covers concerns with exposure to coal dust in greater detail.

Dust itself is hazardous if it accumulates because it can create health problems for workers who inhale it. Fires and explosions can also result if an ignition source such as a

spark from a piece of equipment is introduced. There have been several examples of coal dust explosions in plant galleries containing conveyors. Depending on the dryness and temperature at which coal leaves the dryer, its dust can pose a real threat of creating an explosion.

The variables in a possible dust explosion generally include the concentration and explosivity of the dust, dryness, sources of ignition and the spontaneous combustion characteristics of the material. The cleaner a plant or facility is kept, the less likely dust will present a hazard to workers.

Section 533 Mine plans

The need for detailed, up-to-date work site plans has been established by experience. The availability of such information helps officers, mine managers and workers fulfill their respective roles and responsibilities. The importance of such information being readily available is particularly evident during an emergency. The information helps in

- (a) mounting an effective rescue operation, particularly underground;
- (b) decision making;
- (c) monitoring the operation;
- (d) having a better appreciation of the mineral deposit and related problems; and
- (e) identifying possible impacts of mine operations on pipeline or utility corridors.

It is important that mine plans be current, accurate and comprehensive. The requirements listed in this section represent the minimum and include both historic and current mine workings, geology, land ownership and other relevant activities affecting the mine.

Mine plans support effective safety planning so they must include major surface features such as bodies of water, unconsolidated deposits, transportation and utility corridors, etc. A specific feature that can threaten mine safety and therefore needs to be included is the presence of exploration holes drilled for any purpose in or through the deposits mined or to be mined. These could contain fluids which, if mined through, could unexpectedly flow into the mine workings. Disasters can be avoided by requiring that such hazards be clearly marked on mine plans. At Lake Peineur, Louisiana, U.S., in 1986, a salt mine was flooded when an unknown oil/gas exploration borehole drilled through the bottom of a lake.

An example of a detailed mine site plan is provided in Figures 36.1 and 36.2. Figure 36.1 shows the buildings and general working of the site; Figure 36.2 shows the direction and inclination of the strata being worked. When mining multiple seams or ore bodies, separate plans need to be kept for each one, together with one master plan showing how the different workings are related to each other, both vertically and horizontally.

Figure 36.1 General mine site plan

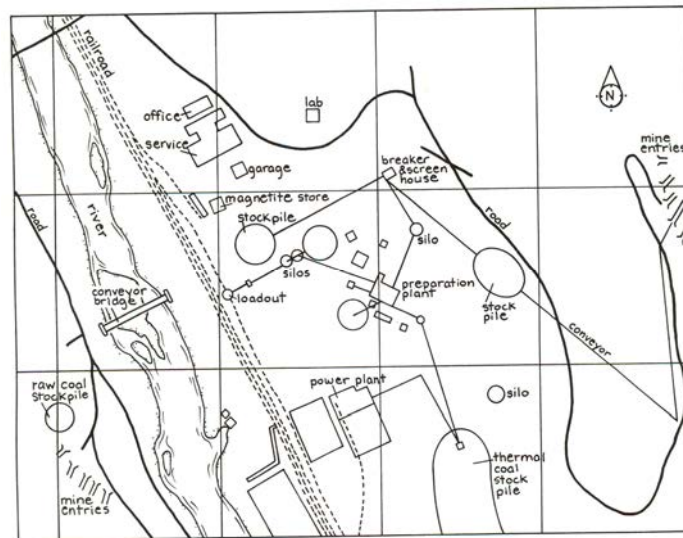
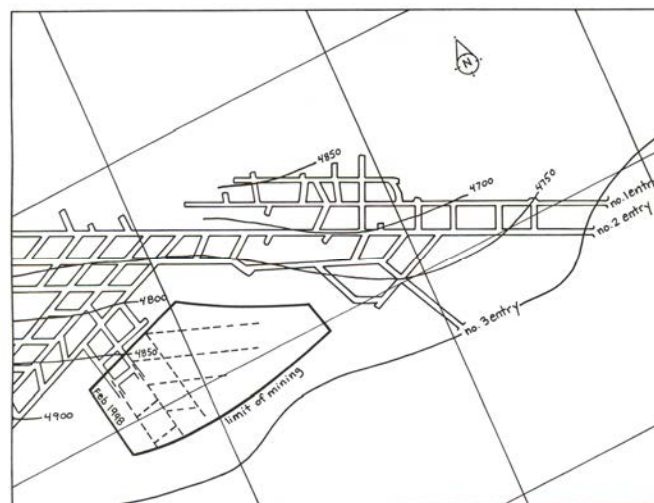


Figure 36.2 Operations plan



It is important to keep all mine plans up-to-date to support effective decision making.

No longer than three months can lapse between surveys of an active mining operation. This is a minimum requirement and, depending on the rate of mining, more frequent surveys may be appropriate to keep plans up-to-date. To help with updating plans, areas that have been mined within one month of the most recent survey may be sketched in to indicate the most recent changes.

Section 534 Record retention

Records of equipment inspections and incidents prove invaluable as one of the tools used in assessing the condition of equipment. Well-kept records can help prove that

equipment has been approved as capable of operating safely within the parameters for which it was designed.

In case of an incident or equipment failure, records can help pinpoint causes and trends. Repeat incidents or equipment problems can indicate design problems. Record keeping is useful in developing strategies and action plans for improving the overall safety and productivity of a mine.

Section 535 Excavation

Subsection 535(1)

Safe distances must be maintained while approaching any boundary of an operating property and other facility.

Subsection 535(2)

To meet the requirements of this subsection, designers of the walls of an excavation must consider both the eventual deterioration of the walls during the life of the mine as well as their final location when the mine is abandoned.

Section 536 Open stockpiles

Effective design and operation of open stockpiles relies on engineering principles that address the potential instability of the stockpile.

To ensure stability, stockpile design and construction should address the geotechnical behaviour and physical dimensions of the stockpile, chemical properties of the waste rock, location of the water table, and the permeability, size and strength of the rocks or other materials in the stockpile. Stockpile areas should be marked for hidden hazards, e.g., those associated with potential surface collapse into hidden cavities and voids that may be present close to the surface of the stockpile.

Section 537 Dust from drills

Subsection 537(1)

Dust generated by drilling operations must be controlled to minimize related health and safety risks. Control is generally done in two ways. The primary method is the use of a wetting agent right at the tip of the drilling bit. This conforms to the long held belief that the dust should be suppressed at its point of generation.

Dust control is also possible through mechanical means by routing dust-laden air through dust-collection equipment with filters and then releasing the filtered air.

Until recently, only water systems were approved for underground drilling operations. Now, with advances in filtering capability, some drills equipped with mechanical filtration and separation systems have been approved.

Drilling dust is normally controlled in open pit mines by one or more means that can include water, a mixture of water and methanol, bag filters, and cyclone filters.

Subsection 537(2)

Repealed

Section 538 Light metal alloys

The general expectation of this section is that the use of light metal alloys in underground coal mines is restricted. This reflects the hazard of light metal alloys becoming a source of potential ignition of gas or dust.

Subsection 538(1)

The term “light metals” refers to metals containing aluminum, magnesium and/or titanium, including aluminum paint and aluminum cans. Products containing these metals are generally not allowed in underground coal mines or other hazardous locations. Friction or sparking resulting from light metals striking or being struck by oxidized (rusty) ferrous metal is enough to ignite a mixture of methane and air.

The specific definition of the various light metals and their percentages in alloys is based on that of the former National Coal Board (NCB) of the United Kingdom (UK). Readers are referred to (i) NCB Spec No 481, CENELEC 1977 & (ii) *Light Alloys Fact Sheet*, on the Underground Coal Mining Safety Research Collaboration website). The use of aluminum was restricted, but not prohibited, in the UK following 12 international incidents that occurred between 1950 and 1955 and one in 1962. Ten of these incidents resulted from the use of aluminum face supports and one involved auxiliary fan blades.

Restrictions on the use of light metal alloys in underground coal mines and similar hazardous locations are intended to prevent light alloy metals from being struck by rusty iron or steel. For example, British Columbia restricts their use to the following:

- (a) electrical equipment within a flameproof enclosure;
 - (b) use in circumstances when there is no possibility of friction or impact;
 - (c) adequate coating with non-sparking material and immediately removed from service if the coating is damaged; and
 - (d) handheld tools which are placed in a non-sparking storage container following use.
- (See *Health, Safety and Reclamation Code for Mines in British Columbia, Prohibited Metals*)

Subsection 538(2)

It is impossible in some instances to prohibit the presence of all light metals. For example, many common fire extinguishers are made with light metals, but are required as fire protection underground. In these instances, equipment with aluminum components must be equipped with a protective canopy or other measure that serves to prevent friction or impact on the light metal.

Subsection 538(3)

The use of fan blades made of light metal alloy needs to be restricted in underground mine ventilation fans because light metal alloys can cause incendiary sparking when struck by oxidized ferrous metal (rusty iron). If a spark was created at a time when high explosive levels of methane gas were present, a catastrophic explosion could occur. Restrictions typically require protective coatings with a non-sparking material and periodic inspection to identify and repair damaged coatings. (*See Health, Safety and Reclamation Code for Mines in British Columbia*)

Subsection 538(4)

Potentially explosive atmospheres occur not only in underground mines but also at surface facilities where potentially explosive dusts are present. Therefore, light metal alloy restrictions apply there as well. Examples of such hazardous locations include coal preparation plants, coal silos or underground reclaim galleries beneath surface coal stockpiles and in small ventilation/cooling fans within some surface buildings.

Section 539 Haul roads

Subsection 539(1)

The major consideration in haul road design is safety. The design must anticipate the varying sizes, speeds, capabilities and loads of the vehicles and equipment that will travel on the road. Since most haul roads are built on pit walls and wind down to the bottom of the pit, a significant amount of capital is tied up in their development. Economic considerations tend to force an increase in the road gradient to shorten the haul road and a reduction in road width to minimize the required excavation of waste material. The employer must ensure the road is sufficient to handle emergencies.

Common factors considered in effective haul road design include:

- (a) width;
 - (b) gradient;
 - (c) radius of curvature;
 - (d) super elevation;
 - (e) rolling resistance;
 - (f) vehicle requirements;
 - (g) speed limits;
-

- (h) sight distance;
- (i) run-off lanes;
- (j) berm height; and
- (k) traffic control and signage.

Vehicles with the lowest performance capabilities in a fleet often dictate road design. Although some work can be done to improve a vehicle's performance, it is best to ensure that the road design accommodates the vehicle with the lowest performance capabilities.

Subsection 539(2)

Emergency escape roads are critical to safe haul road design. Many factors control the number and design of emergency escape roads. These include:

- (a) location of normal exit points;
- (b) potential entering speed;
- (c) vehicle gross weight;
- (d) location and available space;
- (e) maximum acceptable gradient; and
- (f) materials suitable for retarding a runaway vehicle.

Mine operators must assess the hazards of their particular mine environment and where a gradient of more than 5 percent is present, design suitable escape routes to minimize the exposure of mine workers to the hazard of an out-of-control or runaway vehicle.

Subsection 539(3)

Employers must consider berm height and drainage breaks to ensure that haul roads are sufficient to handle emergencies. Sufficient berm height ensures that vehicles do not simply ride over the berm. Drainage breaks in berms must be designed to be small enough to prevent a vehicle from going through them.

Section 540 Discard from mine

A variety of solid and liquid waste materials can be generated by a mining operation. Disposal of these materials must comply with accepted engineering principles to ensure the stability of the dump or impoundment. If failure of such a waste disposal structure could cause potential injury to a worker, or cause environmental contamination, design by a professional geotechnical engineer is the accepted standard.

Section 541 Mine walls

Subsection 541(1)

The proper design and control of pit walls significantly affects worker safety and the ability of workers to extract ore. Consequently, any design or related operating

procedure used to maintain pit walls must be certified by a professional engineer. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 541(2)

To minimize the risk of injury in a mine, the employer must ensure that:

- (a) undermining is prohibited since undermining of unconsolidated material can cause the material to collapse;
- (b) working faces receive a good cleaning before being left to stand. Bench heights are designed and excavated to be less than 1.5 metres above the maximum height the excavation equipment can reach. It becomes difficult above this height to clean loose materials that can contribute to an overhang;
- (c) the horizontal flat bench area within 2 metres of the working face crest must be kept clear of unconsolidated material. The height and stability of the bench above could dictate more than this specified 2-metre horizontal separation from the crest of the next lower working bench;
- (d) unconsolidated material lying more than 2 metres from the crest of the horizontal bench is stabilized to prevent it from falling onto workers below; and
- (e) safety berms are established at certain intervals along the height of the pit wall to catch rocks loosened from the face by weathering or vibration from blasting.

Section 542 Dumping block

Subsections 542(a) and 542(b)

Dumping blocks or a ridge of material such as a berm are required if equipment may back into an opening or over the edge of a dump. Dumping points may include hoppers, stock piles or waste dumps. Dumps can be very high and a flip-over or roll-over can cause serious injury. To reduce the risk to workers and their equipment, physical barriers are required to assist in stopping.

Subsection 542(c)

If physical barriers are not practicable, a designated signaller with a stop signal may be designated to direct equipment. All appropriate measures must be in place to address hazards involving the equipment and the designated signaller.

Section 543 Flammable gas monitors

Subsection 543(1)

This subsection requires the installation of gas monitors in any location that can be classified as a hazardous location according to section 18 of the *Canadian Electrical Code*.

In part, section 18-004 states:

“Hazardous locations shall be classified according to the nature of the hazards, as follows:

- (a) Class I locations are those in which flammable gases or vapours are or may be present in the air in quantities sufficient to produce explosive gas atmospheres;
- (b) Class II locations are those which are hazardous because of the presence of combustible or electrically conductive dusts;
- (c) Class III locations are those which are hazardous because of the presence of easily ignitable fibres or flyings, but in which such fibres or flyings are not likely to be in suspension in air in quantities sufficient to produce ignitable mixtures.”

In mining operations, a hazardous location can exist in an underground mine, conveyor gallery, reclaim tunnel, storage silo, drying plant, heating furnace, electrical room, battery charging room or other similar location.

Gas concentrations in hazardous locations can increase suddenly and trigger an alarm. Such an alarm is only effective if it prompts an immediate response. This may not occur if the monitoring device gives only a local alarm, but will occur if it is linked via a remote control and monitoring system to a permanently attended communication station. Such stations are typically found on the surface in the mine offices. They are computer controlled with comprehensive visual and audible alarm systems.

The general expectation under this subsection is that monitoring for flammable gases takes place at every location that is classified as a hazardous location as the result of a hazard assessment. It is further expected that a continuous monitoring system will be used, linked to a permanently attended communication station. Where necessary, the mine electrical inspector is available to provide guidance and interpretation of the *OHS Code* and the *Canadian Electrical Code*. Readers are referred to the explanation to section 165 of this explanation guide for additional information about hazardous locations.

Subsection 543(2)

The alarm given at a permanently attended communication station by flammable gas monitors can be visual, audible or both. Frequent calibration of these instruments is critical to assuring their proper function and accurate reading. Note the requirement that the alarm must sound when the gaseous content of the atmosphere exceeds 20 percent of the lower explosive limit of the gas being monitored. Since the lower explosive limit varies depending on the physical characteristics of the particular gas, the remote control

and monitoring system must be programmed accordingly. Workers must be trained to correctly use the related monitoring device.

Section 544 Reporting dangerous occurrences

Subsection 544(1)

Paragraphs 544(1)(a) to (g) list the incidents that require the Director to be notified about as soon as possible after the event. If requested by the Director, an investigation report may have to be submitted to the Director.

The reporting of dangerous occurrences is required for a variety of reasons:

- (a) monitoring safety and health conditions at individual mines and throughout the mining industry;
- (b) taking appropriate remedial actions if required;
- (c) informing other employers to take necessary precautions;
- (d) compiling statistics for evaluation and development of action plans;
- (e) ensuring the Director is kept informed; and
- (f) calling upon the resources of other companies to help resolve problems, if required.

The expectation of this section is that all dangerous occurrences will be reported. Several dangerous occurrences are listed and are typically self-explanatory. They include deterioration of underground conditions, ventilation and gases, equipment malfunction or failure, and circumstances requiring the withdrawal of workers from an area of the mine.

Subsection 544(2)

The failure of a containment dam or dike can seriously affect workers and mine facilities. At a minimum, a serious environmental situation will result from the uncontrolled spillage of liquid waste products. For this reason, the Director must be notified when any sign of dam or dike deterioration is identified.

Fire Prevention and Emergency Response

Section 545 Emergency response station

Subsection 545(1)

Each mine must maintain and operate an emergency response station and provide facilities from which rescue operations and emergency work can be conducted.

Subsection 545(2)

Emergency equipment must be chosen for its suitability to the work site and must be regularly maintained to ensure it is always ready for operation. A suitable number of trained emergency response personnel must be available to respond to an emergency.

There are many types of rescue equipment with equally diverse capabilities and performance characteristics. Some equipment has been found to perform poorly under extreme temperature conditions. Equipment capability plays an important role in effective emergency response plan design and implementation. The reliability and effectiveness of emergency equipment are vitally important to the confidence and success of emergency response teams.

Subsection 545(3)

Because of the specialized skills and training involved, an employer must ensure that a sufficient number of workers are trained and available to safely perform a rescue operation.

Section 546 Emergency response team

Subsection 546(1)

A well trained emergency response team is required by the *OHS Code*. The employer must appoint a competent worker as responsible for training the members of the emergency response team.

Subsection 546(2)

The medical fitness and competency of each member of an emergency response team is critical to the team's performance. In addition to holding a standard first aider certificate, each member must be suitably trained and be physically capable of carrying out very demanding tasks. Members may be required to carry and work with heavy loads, wear breathing apparatus and function effectively in hostile mine environments where visibility could be almost zero due to the presence of smoke or airborne dust.

Subsection 546(3)

Familiarity gained through regular emergency response practice sessions and worksite tours provides needed confidence among team members and reduces the time taken to rescue workers during a real emergency.

Practice training sessions must take place at least every two months.

Subsection 546(4)

For emergency response teams to be effective in underground coal mine emergencies, members must be trained and equipped appropriately and there must be a sufficient number of teams. Typically, in a mine rescue event at least three teams are required: one in action, one on standby and one resting. At small mines where it may not be practical to maintain three or more teams, it is important to have a minimum number of trained personnel on site. These personnel will provide a first response and assessment

capability. They can also guide and instruct other teams in local conditions when these teams arrive at the mine from elsewhere. (See *Health, Safety and Reclamation Code for Mines in British Columbia*, Section 3.7.)

Section 547 Firefighting training

Having firefighting equipment available is only one ingredient in successful firefighting. Training in effective firefighting for all workers employed underground is another essential ingredient. Every worker must be able to respond quickly and correctly to any type of fire that might develop. Training at the beginning of employment, with regular follow-up training at least every two years thereafter ensures workers can respond to fires as needed. Records of training help supervisors manage the training program.

Section 548 Fire precautions

Wherever possible, employers must reduce the potential for fire by reducing the quantity of flammable materials present and by using fire-resistant or non-flammable materials.

Combustible materials include items such as oily rags, plastic, paper, wood and coal dust. These materials can be easily ignited by an ignition source and can rapidly grow into an uncontrollable fire. Good housekeeping minimizes the potential for such a fire to occur.

This section lists several specific precautions appropriate for preventing fires and explosions in underground coal mines. However, this section does not imply that fire and explosion hazards are limited to the items in the list. Employers and workers are responsible for being constantly on the lookout for these and any other hazards.

One hazard specifically addressed in subsections (5) to (7) is that of flammable hydraulic fluids which can leak onto hot surfaces and ignite. This hazard can be mitigated by using fire resistant hydraulic fluids. However, the use of some of these requires qualification based on practical experience with their use in Alberta's harsh winter conditions. The use of fire resistant fluids (FRFs) in mobile diesel equipment underground has proven problematic in very cold weather and has led to many premature failures of hydraulic pumps on diesel vehicles. The temporary failure of steering, lifting and braking systems has been one result.

In the United States, other controls are used to mitigate this potential fire hazard, e.g., automatic fire suppression systems. The flash point of non FRF hydraulic fluids is typically 5 times higher than that of the diesel fuel carried on board the vehicle. In the *OHS Code*, subsections 548(5) through (7) allow alternatives to the use of non-fire resistant fluids by recognizing the use of fire suppression systems. Automatic fire suppression systems are standard on many items of mobile diesel equipment.

Section 549 Fireproofing of roadways

Use of combustible materials on roadway supports and linings must be minimized as much as possible. Any combustible materials used must be treated with a fire resistant coating.

Non-combustible or treated materials must be used at conveyor transfer and loading points and extend at least 5 metres on the air intake side and to not less than 10 metres on the return side. This minimizes the potential for a fire to spread and provides some protection to workers during firefighting activities.

Section 550 Conveyor clearance

Subsection 550(a)

Removal of dust and other combustible materials from beneath conveyors is important to preventing fires. Some materials can ignite by friction when they come into contact with moving parts, while coal dust accumulations can ignite spontaneously.

Subsection 550(b)

If pillars are used to provide clearance beneath conveyors to allow removal of debris, the pillars must be made of non-flammable material so that they do not become part of any fire.

Section 551 Fire detection systems

Subsection 551(1)

The ability to control and extinguish a fire is greatly improved with early detection of the fire. Detection devices used in mines must be continuously operational to be effective. They must also be capable of giving a warning signal if their ability to monitor for and detect fire is impaired. The employer can then immediately repair or replace non-functioning devices. The effectiveness of such equipment is greatest if automatically connected to an audible alarm in a permanently attended communication station or control room.

Subsection 551(2)

Specific locations where detection systems should be located are identified throughout this Part. If the Director thinks an additional device is needed at a particular location, this section authorizes the Director to order the installation of such a device.

Section 552 Emergency warning system

Subsection 552(a)

Workers must be made aware of fires or other emergencies as soon as they are detected. The emergency warning system in some mines consists of compressed air lines that release a distinctive smelling gas that workers are trained to recognize as an immediate order to evacuate. Faster and more sophisticated communication systems are used in other mines. The types and sophistication of emergency communication systems available vary significantly. The employer must use the one(s) most appropriate to the prevailing conditions. On becoming aware of the emergency warning, workers should know what to do and evacuate the area promptly and appropriately. If immediate first response is not appropriate, then the area should be evacuated in an orderly manner (see Section 553).

Subsection 552(b)

Testing the emergency warning system at least every 12 months ensures the system functions properly and workers recognize and respond appropriately to its warning signals. Testing also allows the employer to assess the overall effectiveness of the emergency warning and response systems and fine tune them as necessary. A record of such tests must be kept in a logbook or its electronic equivalent. Such records provide evidence of compliance and may help to better understand and optimize the operation of emergency warning systems.

Subsection 552(c)

Assessing emergency response evacuations and testing warning systems often means that actions can be taken to improve future performance. A record of these remedial actions must be kept in a log book or its electronic equivalent.

Section 553 Evacuation

Subsection 553(a)

To ensure an effective response, detailed and logical evacuation procedures must be prepared for fires, flooding, cave-ins, explosions and other life-threatening emergencies. How quickly the mine can be evacuated using the safest routes is one of the most important criteria in assessing the efficiency of evacuation procedures. To meet such criteria training instruction and worker familiarity with the evacuation procedures is essential [see Section 553(c)]. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 553(b)

Copies of the evacuation procedure must be posted in conspicuous places on the surface and underground to be readily available to all persons. Posted copies help to maintain worker familiarity with procedures to ensure that they evacuate in the right direction.

Subsection 553(c)

Site-specific training, familiarization with escape routes, and the ability to recognize warning signals and respond accordingly are all critical to successful evacuations. A successful execution of any emergency plan or procedure is the result of adequate planning, training, and provision of needed equipment and resources. Although emergency response procedures are rarely used in a well-managed mining operation, each mine's preparedness and ability to execute its plan with a high degree of efficiency and effectiveness helps ensure high morale and confidence among workers.

Subsection 553(d)

Classroom-based training and instruction in emergency evacuation procedures alone has been found to be inadequate. Experience in other jurisdictions with periodic physical mock evacuations show that, while being costly and time consuming, mock evacuations pay large dividends in terms of developing a practical, feasible, efficient and effective evacuation system.

A mock evacuation allows the evacuation plan and procedures to be demonstrated in the actual workplace and can provide valuable information to ensure the best results in the event of a real emergency. Mock evacuations can identify significant deficiencies like stretchers that may not fit in transport vehicles, insufficient or misplaced self-rescuer devices and defective lifelines. All such deficiencies can then be corrected to improve performance in any subsequent real emergency evacuation.

Section 554 Firefighting equipment

Subsection 554(1)

Firefighting equipment must be provided, readily available, maintained in working condition, and accessible without obstruction at any place where a fire hazard may exist in an underground coal mine.

Subsection 554(2)

Firefighting equipment should not be located in areas in which smoke will accumulate. It is therefore essential that the location of firefighting equipment take into consideration the direction of air flow from the mine ventilation system. Since the ventilation system could potentially be subjected to a change of air flow direction during an extreme

emergency, some contingency planning of additional firefighting equipment locations would be appropriate.

Subsection 554(3)

To ensure it operates properly, the firefighting equipment must be inspected once a month by a competent person. Except for fire extinguishers, this equipment must also be tested once every three months to ensure that it operates properly. The results of this inspection must be recorded in a logbook maintained for that purpose.

Section 555 Fire extinguishers

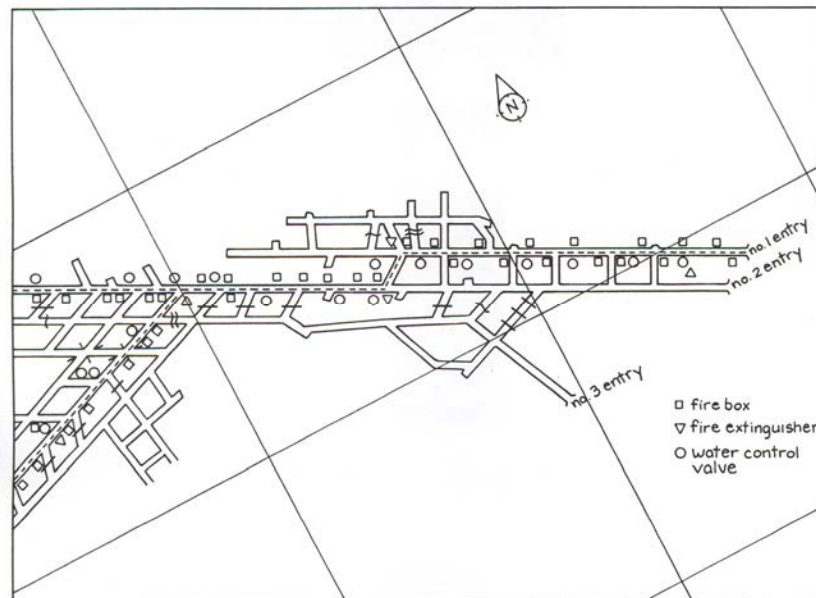
This minimum standard for the provision of two fire extinguishers at electric or diesel stationary motors, transformers and switch gear increases the potential that a minor fire can be extinguished before it gets out of control. Extinguishers should be classified for their intended service.

Section 556 Location of equipment

Up-to-date, detailed firefighting plans are particularly useful in training workers in firefighting response. Detailed information about the locations of firefighting equipment is also helpful as a reminder during emergency situations.

Figure 36.3 provides a sample plan showing the location of firefighting equipment. Note the requirement to review and update the plan at intervals not exceeding three months.

Figure 36.3 Sample fire protection plan



Section 557 Water supply

Minimum acceptable requirements respecting water supplies and pumping systems used to fight fires must be met.

Subsection 557(a)

A minimum volume of 100 cubic metres of water must be readily available. This is specified as a “minimum” dedicated water reserve. This supply must always be available for firefighting.

Subsection 557(b)

The firefighting water main must be able to distribute water to any part of a mine where a fire could be encountered. Water must be available at sufficient pressure and quantity to support firefighting. It must not be used for day-to-day operational requirements.

Subsection 557(c)

A standby pumping system must be available whose power supply is not dependent on the main electrical system for the mine. All pumps must be capable of delivering water at an adequate volume and pressure as specified in section 558.

Subsection 557(d)

The main firefighting water supply systems are not typically located in return airways. This ensures that emergency response personnel will not be exposed to smoke and fumes from fires or explosions. However, in some mines under very cold winter conditions, parts of the firefighting water main located in an intake can freeze. In circumstances where suitable thermal insulation cannot be provided, or where fan reversal in an emergency is possible, it is acceptable to place the firefighting water main in the return. At appropriate intervals, however, supply control valves in the main must be located in the intake airway.

Section 558 Water control valves

Subsection 558(1)

Water control valves must be strategically placed along potential fire ranges and in other critical areas to provide workers with adequate access to the emergency water supply. Availability, accessibility, standardization of materials and proximity of water control valves to a potential fire hazard are important considerations when designing and installing firefighting systems in underground mines. Since the mine continuously advances, adding or locating control valves close to any particular working face is an on-going activity.

Subsection 558(2)

Nozzles and hoses of the specified size and capacity must be available at each water control valve. In this case, it is specified that the water control valve must be capable of delivering not less than 4 litres per second of water flow.

Subsection 558(3)

The length of hoses and the size of nozzles are fixed by this subsection. Meeting these criteria ensures that the largest possible area can be reached by each hose to extinguish the fire, delivering the stated minimum volume of water per second.

Section 559 Refuge stations

In the event that exits are blocked or the ventilation system has been disrupted during or following an emergency, a refuge station must be available to underground mine workers as a safe place to wait until rescue teams arrive. Although miners carry self-rescuers, (a type of respiratory protective equipment), the air may be lacking in sufficient oxygen to support life. Additionally, the useable life of the self-rescuers may not be enough for workers to make it safely back to the surface. The size and number of refuge stations depends on the number of workers expected to use them and the distances workers must travel to reach them.

Refuge stations must have water, supplied air and a system that communicates effectively with the surface. Refuge stations may also contain dried foods and other survival supplies.

Electrical Systems

Section 560 Electrical standards

CSA Standard M421-00 (R2007), *Use of Electricity in Mines*, is adopted in its entirety. If CSA Standard M421-00 (R2007) does not address a particular electrical issue, CSA Standard C22.1-06, *Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations*, becomes the standard to be met.

Section 561 Notice to Director

Subsection 561(1)

Notification allows the Director to review the various requirements as a final check and ensure that all safety issues have been satisfactorily addressed. Similarly, it provides an incentive to the employer to review the work from all aspects before informing the Director and requesting permission to energize equipment.

Requirements for underground coal mines or hazardous locations at other mines are very rigorous. Accordingly, the employer is required to inform the Director and obtain permission on each and every electrical modification made. This provision exists because of the hazardous nature of underground coal mines and is similar to provisions in other jurisdictions.

An earlier requirement to notify the Director of power increases in excess of 500 kilovoltamperes has been repealed as outdated and unnecessary as other provisions of this section are considered to be adequate.

Subsection 561(2)

Approval from a Director ensures that safety requirements and concerns have been dealt with before electrical installations that are new or have undergone major modifications are energized.

Subsection 561(3)

Schematics that indicate where new electrical energy is to be transmitted and used help clarify the design and conditions of the mine.

The schematics should identify the main mine substation, the power line distribution system, the location of unit substations, major electrical equipment and the respective voltages of the distribution systems and operating equipment.

Section 562 Electrical installations

Subsection 562(1)

Electrical safety at mine sites relies primarily on the competency of authorized workers installing, repairing or modifying electrical installations. In Alberta, persons who work on electrical equipment must be certified as specified in section 21(3) of the *Apprenticeship and Industry Training Act*, which states:

- “A person shall not work in a compulsory certification trade unless that person
- (a) holds a trade certificate in that trade,
 - (b) has filed an application under this *Act* to participate in the apprenticeship program in that trade and that application is subsisting.”

Non-certified personnel can work on electrical equipment only by special approval under Section 23 of the *Apprenticeship and Industry Training Act* which states:

- “For the purposes of section 21(3)(f) and 22(3)(g), the Executive Director may, after notifying the Board and subject to the approval of the Minister, do the following:
- (a) authorize a person or a class of persons who are not permitted under section 21(3)(a) to (e) or 22(3)(a) to (f) to work in a designated trade, to work or to perform one or more tasks, activities or functions in that trade, or

- (b) authorize an employer or a class of employers to employ a person or a class of persons who are not permitted under section 21(3)(a) to (e) or 22(3)(a) to (f) to work in a designated trade, to work or to perform one or more tasks, activities or functions in that trade.”

Subsection 562(2)

Records of electrical installation and repair work are critical for troubleshooting and incident investigation purposes. Records must be kept at the mine for two years following the activity.

Section 563 Surface mine

Subsection 563(1)

The employer must assess the impact of electrical equipment and the surrounding environment on safety and then select equipment that fully meets applicable standards and adequately addresses local conditions. These conditions may include temperature, humidity, gases that may be flammable, corrosive or reactive, dusts such as coal dust, metallic powders and ammonium nitrate, fire and explosion hazards and so on.

For example, an electrical switch designed for use in hazardous locations at a gas plant may not be safe for use in a hazardous location in a surface plant at a coal mine. Coal dust poses an additional hazard for which the switch may not be designed.

Subsection 563(2)

An electrical spark can initiate an explosion of accumulated gases. This subsection requires that electrical repairs or adjustments that are done in a hazardous location only be done after

- (a) the equipment is de-energized; and
- (b) the worker doing the work has confirmed that no dangerous concentration of gas is present.

Section 564 Underground coal mine

Subsection 564(1)

A certified underground coal mine electrical superintendent must approve all electrical apparatus prior to its use underground. The electrical superintendent must be intimately involved in the specification, acceptance, installation, modification, maintenance and repair of underground electrical equipment.

Subsection 564(2)

On a day-to-day basis, the underground coal mine electrical superintendent must supervise and assume responsibility for all electrical work performed in the mine. Further, the electrical superintendent must ensure that underground electrical equipment remains in compliance with the requirements reflected in CSA Standard CAN/CSA—M421-00 (R2007), *Use of Electricity in Mines*.

Subsection 564(3)

Similar to the hazard posed by accumulated explosive gases in any other hazardous location, the concerns are the same in an underground coal mine. As a result, no electrical repairs or adjustments can be made unless the equipment is de-energized and the worker has confirmed that no dangerous accumulation of gas is present.

Section 565 Equipment supply systems

Subsection 565(1)

Ground fault protection is an essential safety feature on all mobile electrical equipment. To ensure this safety system is working properly, it must be tested before the equipment is put into service and at least annually thereafter.

Subsection 565(2)

Records related to ground fault system testing must be kept at the mine for two years after the test. The records should include information such as:

- (a) the date of testing;
- (b) the equipment tested with identification numbers where available;
- (c) the name of the person(s) conducting the test;
- (d) the test results; and
- (e) any repairs and re-testing, if applicable.

Records required by this subsection must be available for examination by an officer.

Section 566 Batteries

Subsection 566(1)(a)

Clause 5.5 of CSA Standard CAN/CSA-M421-00 (R2007), *Use of Electricity in Mines*, defines the safety requirements of surface storage battery rooms and battery changing stations.

“5.5.1 Location

Stationary-type storage batteries whose aggregate capacity is 5 kW at the 8 h discharge rate shall be located in storage-battery rooms or in areas with equivalent enclosures.”

Adequate ventilation is one of the most important requirements of the standard. Since charging operations generate hydrogen, which is highly flammable and explosive, the area must be continuously ventilated to be safe.

Subsection 566(1)(b)

For underground coal mine battery charging rooms, clause 6.10.4 of the CSA Standard applies and is closely followed by the Director.

“6.10.4 Storage Batteries

6.10.4.1

Storage batteries that are stationary when in use shall be located in storage-battery rooms or equivalent enclosures if the aggregate capacity at the 8 h discharge rate exceeds 5 kW, and the batteries are in unsealed jars or tanks.

6.10.4.2

Storage-battery rooms or other enclosures and battery-charging areas shall be provided with ventilation adequate to prevent the accumulation of an explosive mixture of battery gases.

6.10.4.3

Storage-battery rooms or other enclosures and battery-charging areas shall be in accordance with the applicable requirements of Clauses 6.10.4.4 to 6.10.4.14, and they shall be ventilated by an intake-air split adequate to ensure the diffusion of gases discharged into the return airway.

6.10.4.4

The location for battery-charging stations shall be designated as such and shall not be used for other purposes.

6.10.4.5

The construction of the battery-charging station shall be rendered fireproof.

6.10.4.6

An air vent shall be installed at the highest part of the structure to allow any gases generated to escape into the atmosphere.

6.10.4.7

All stations shall be equipped with adequate firefighting apparatus suitable for fighting Class C fires.

6.10.4.8

Heating, if required, shall be of the forced-air type, with the heating element located outside the charging station and arranged so that fresh air shall flow over the heating element when the element is operating.

6.10.4.9

The battery-charging station shall be adequately and continuously ventilated during battery-charging operations.

6.10.4.10

Material, other than standby batteries and material required for routine battery maintenance, shall not be stored in the battery-charging station.

6.10.4.11

Electrical equipment shall either be approved or be located so as to ensure that no possibility for the ignition of hydrogen exists.

6.10.4.12

Battery-charging equipment shall be located at or near floor level and shall be permanently connected to the main power supply.

6.10.4.13

Battery-charging cables installed after January 1, 2001, shall be contained within a protective jacket having an FT5 rating as specified in CSA Standard C22.2 No. 0.3.

6.10.4.14

Battery repairs shall be permitted only after precautions have been taken to ensure the dissipation of flammable gases. Battery-charging shall be discontinued for the duration of the time taken to effect the repair."

Air flowing into the storage room or battery charging station must come from an uncontaminated source that will not bring with it any additional flammable gases. The volume of air must be sufficient to dilute gases generated by the battery charging process. The flow of air must be directed into the return air flow so that the hydrogen gas does not flow into working areas of the mine.

An approval by the Director ensures that adequate consideration has been given to identified safety issues. The room design should include air quality monitoring and automatic power disconnects for situations where flammable gas accumulates above defined lower explosive limits.

Subsection 566(2)

Because of the potential for initiation of explosive gases, repairs to batteries must not be performed underground or in any hazardous location. A spark from a short circuited battery could be catastrophic.

Section 567 Overhead power lines

Cables between overhead power lines and moveable switch houses, or between an overhead power line and a substation, must be continuous, without couplers or junction boxes. In addition, the supply cable must not exceed a length of 25 metres unless the noted conditions are met.

At the overhead line end of the cable, a separate means of disconnection must be located on the power pole.

To minimize the risk of injury to workers, cable connections to moveable switch houses or substations must be directly through suitable cable glands.

Section 568 Ground fault protection

Because of the hazards associated with the arcing or short-circuiting of a power cable in an underground mine, any cable that exceeds 125 volts must include ground fault protection.

The intent is to provide automatic cut-off of the main power supply to ensure that arcing or sparking does not create the potential for fire or a methane gas or coal dust explosion.

Since re-setting the power supply could re-create the fault, the related ground fault protection system must be designed so that it is impossible to restore the power until the ground fault has been identified, repaired and tested to ensure the fault has been removed from the system.

Section 569 Switchgear

Subsection 569(1)

The ability to switch off the supply of electricity to an underground mine is important. In case of an electrical fire, power must be turned off if having the power on creates additional hazards.

Similarly, if an explosion damages electrical circuits and leaves parts of the system live, it may be necessary to isolate the damaged parts before they can be repaired.

At an underground mine, an authorized worker must be available to operate the switchgear whenever the circuits are energized. The availability of such an authorized worker could be essential to a rapid response in case of an underground emergency. It is simply not acceptable that underground workers be placed at additional risk while waiting for an authorized person to be “called-out” to the scene of an emergency.

Subsection 569(2)

Locating switchgear near a working face allows workers to operate and isolate electrical equipment and related circuits as needed. Switchgear can be hazardous if it is exposed to accumulations of flammable gas or if it catches fire. For these reasons it must not be located any closer to a working face than the last ventilated cross-cut. This minimizes the potential for exposure to flammable gases generated at the working face. If the switchgear itself catches fire, the last ventilated cross-cut location will ensure that toxic smoke and gases will not flow into the working face where workers may be endangered.

Section 570 Grounding

Subsection 570(1)

Continued integrity of the ground electrodes is essential to the safety of the electrical system and workers.

Inspection and testing of ground electrodes ensures that the system is properly maintained and operated. Ground resistance must be maintained at its lowest possible level. Normal oxidation or other causes may affect the measured resistance value. Electrical current leaks can occur as a result of deteriorating cable insulation or when an energized line comes into contact with another path to ground. Grounding prevents equipment and cables from becoming a serious threat to the safety of workers.

Subsection 570(2)

Records must be maintained and kept for two years. An officer may request the records to confirm compliance with this section.

Section 571 Electric welding

The return cable must be the same size as the welding cable and be connected to the work piece being welded. This avoids the possibility of the return current seeking other paths back to the welding machine, creating a secondary energized conductor and associated electrocution risk.

Section 572 Hand held electrical drills

Hand held electric drills must be equipped with a fail-safe mechanism that automatically cuts power to the drill. With this mechanism, the drill operates only when the power switch is depressed. The drill stops any time positive pressure on the switch is removed.

Rubber-Tired, Self-Propelled Machines

Section 573 Approval

Subsection 573(1)

The *OHS Code* is intended to prevent the introduction of sub-standard vehicles into mines. All new rubber-tired, self-propelled equipment that meets the size criteria must meet the requirements of the *OHS Code* and a representative unit must be approved by the Director before being put to use.

With the exception of section 574, the requirements of sections 573 to 596 are directed at large-sized mobile equipment that is self-powered and rubber-tired. Considering the gradient and condition of mine roads, the safety equipment provided on these vehicles has always been the focus of special attention. Although there have been few recent incidents in Alberta, statistics on brake failures, loss of steering, instability and road handling have not always been favourable. As the performance of safety components has improved over time, truck load factors and vehicle speeds have increased. As a result, the *OHS Code* requires correspondingly greater attention to these safety requirements.

Subsection 573(2)

The *OHS Code* does not apply to vehicles having a GVW of less than 32,000 kilograms unless specifically noted or specifically designated by the Director. This subsection provides the Director with the authority to request that any size or type of rubber-tired, self-propelled machine be tested and approved by the Director before being put into use. Such a request would be made after reported safety incidents, or upon the recommendation of OHS Officer.

Any machine that has already been approved for use on Alberta's highways under the *Traffic Safety Act* is exempt.

Subsection 573(3)

Instead of complying with the manufacturer's specifications requirements of section 12 of the *OHS Code*, rubber-tired, self-propelled machines that exceed their manufacturer-specified load weights can be operated if:

- (a) a written hazard assessment meeting the requirements of Part 2 has been completed; and
- (b) controls that ensure safe operation of the rubber-tired, self-propelled machine have been implemented.

The assessment and controls do not need to be reviewed by the Director prior to being implemented. If an officer inspects a work site and considers the assessment or controls insufficient, then the assessment and controls may need to be reviewed by the Director.

Section 574 Standards

The intent of this section is to ensure the safety of underground mine workers who often work in mines where road and ramp gradients are much steeper than those seen in surface operations.

Subsection 574(1)

CSA Standard CAN/CSA M424.3-M90 (R2007), *Braking Performance—Rubber-Tired, Self-Propelled Underground Mining Machines*, has been adopted in total despite the

specifications of section 573(1). The Standard applies to all underground mining machines with rated speeds of 32 kilometres or less and having a rated gross mass of 45,000 kilograms or less.

According to the Standard, such underground equipment requires:

“The test course for service, secondary and parking brake systems shall consist of a hard dry surface with a well-compacted base. The test surface shall

- (a) not exceed a 3 percent grade at right angles to the direction of travel, and
- (b) have a uniform down grade of 20 percent, plus or minus 1 percent.

The approach to the test course shall be of sufficient length, smoothness and uniformity of grade to ensure the required machine speed is reached before the brakes are applied.”

Subsection 574(2)

Repealed

Section 575 Prototype machines

Subsection 575(1)

This section applies only to those vehicles defined as self-propelled machines by ISO Standard 6165: 2006, *Earth-moving machinery – Basic Types – Vocabulary*. According to clause 3.1.1 of this standard, the family of machines covered includes:

- (a) backhoe loader;
- (b) dumper;
- (c) excavator;
- (d) grader;
- (e) land fill compactor;
- (f) loader;
- (g) pipelayer;
- (h) roller;
- (i) scraper;
- (j) tractor-dozers; and
- (k) trencher.

Subsection 575(2)

Prototype equipment in this section is interpreted to mean any new or used piece of rubber-tired, self-propelled mobile equipment that is brought into Alberta for the first time and intended for use in any Alberta mine.

Subsection 575(3)

Repealed

Subsection 575(4)

Repealed

Subsection 575(5)

No explanation required.

Subsection 575(6)

The required “Test Report” must include the following information taken from clause 8 of ISO Standard 3540: 1996, 8 Test report:

- (a) a reference to this International Standard;
- (b) type of machine;
- (c) make of machine;
- (d) model and serial number of the machine;
- (e) condition of the brake system, e.g., new, in operation for 1000 h, etc.;
- (f) mass and axle distribution of the machine as tested, in kilograms;
- (g) manufacturer’s approved maximum machine mass and maximum axle distribution, in kilograms;
- (h) tire size, ply rating, tread pattern and pressure, in megapascals;
- (i) description of the brakes, e.g., disc or drum, hand or foot control;
- (j) type of brake systems, e.g., mechanical or hydraulic;
- (k) which tests were carried out using a retarder and a description of the retarder, e.g., hydraulic or electric;
- (l) surface of the test course, e.g., asphalt, concrete or soil;
- (m) longitudinal and cross slope of the test course;
- (n) results of all stopping and holding tests;
- (o) percentage of the service brake system stored energy after the brake application test calculate from the following formula (see clause 7.2 of the Standard):

$$p = \frac{p_2}{p_1} \times 100$$

where

p is the residual pressure as a percentage,

p₁ is the brake application pressure during the first brake application,

p₂ is the lowest brake application pressure measured during subsequent brake applications;

- (p) force levels applied to the controls (see clause 7.1.1 of the Standard);
- (q) machine maximum level surface speed, in kilometres per hour;
- (r) secondary brake system capacity for stored energy system (see clause 7.3 of the Standard).

Section 576 Representative machines

Subsection 576(1)

For rubber-tired, self-propelled mobile equipment that exceeds 32,000 kilograms and that is not covered by ISO Standard 6165, the employer must provide brake performance test results as described in clause 7.6 of ISO Standard 3450: 1996.

If testing of a prototype unit has not been conducted by the manufacturer prior to delivery, the employer can elect to test a representative unit at the mine site. The unit to be tested must be equipped similarly to other units of the same fleet in order to be considered as truly “representative.” The related test course conditions are specified in clause 6.0 of the ISO Standard.

Although relevant excerpts from the Standard are provided below, readers are advised to consult the actual standard to confirm the detailed requirements. Note that additional information is provided in the Standard.

From ISO Standard 3450:

“6.2

The test course shall consist of a hard, dry surface with a well-compacted base. Ground moisture may be present to the extent that it does not adversely affect the braking test.

The course shall not have a slope of more than 3% at right angles to the direction of travel.

The approach to the test course shall be of sufficient length, smoothness and uniformity of slope to ensure the required machine speed is reached before the brakes are actuated.

6.3.1

The test mass of all machines, except dumpers and tractor-scraper, shall be as stated in 3.4 without a payload and at the manufacturer’s specified axle load distribution.

6.3.2

The test mass of dumpers and tractor-scrappers shall be as stated in 3.4 and include a payload.

7.6.1.1

Brake performance shall be tested from a machine speed, which is the greater of 80% of the maximum level surface machine speed or 32 km/h, it shall be tested at

maximum speed. The test speeds shall be within 3 km/h of the required target speeds.

7.6.1.3

The test course shall have no more than a 1% slope in the direction of travel.”

Subsection 576(2)

Test data required for certification of mobile equipment can be obtained from the equipment manufacturer or a professional engineer who can provide similar data by testing a representative unit as prescribed in clause 7.6 of ISO Standard 3450: 1996. The components of the representative unit’s braking system must be the same as those in the units intended for use.

The employer must maintain a copy of the brake certification, including the test report specified in clause 8 of ISO Standard 3450: 1996. One copy of the test report must be forwarded to the Director.

Section 577 Emergency energy

Braking systems using air or air-over-hydraulic mechanisms must have an emergency energy source to ensure service brakes can effectively stop the mobile equipment and hold it on any grade on which it operates. Spring coils are often used as a back-up if the hydraulic or compressed-air pressure drops drastically. Under normal conditions, hydraulic or pneumatic pressure keeps the springs compressed, releasing the wheels to move.

Section 578 Hydraulic brakes

In the event that 50 percent of this type of hydraulic braking system fails, the equipment can still be brought safely to rest on any grade on which it may operate.

The requirements for independently acting circuits provides a greater margin of safety. If one circuit fails, the other can do the job equally well. This is an example of a typical two-level safety provision, generally referred to as safety through redundancy.

The braking system must also meet the requirements of ISO Standard 3450: 1996.

Section 579 Dual brake systems

The visible or audible warning device on a divided or dual braking system is there to make the operator aware when part of the system fails. This warning is critical to the operator’s efforts to bring the equipment to a safe stop. The equipment should then be parked until the braking system problem is resolved.

Section 580 Emergency brakes

The air pressure exerted by the automatic emergency braking system on service brakes must not fall below 415 kilopascals (60 pounds per square inch). This pressure is considered sufficient to bring the vehicle to a stop and hold it there. System designs using other pressures should follow the manufacturer's recommendations.

Section 581 Air brakes

Basic design features and performance criteria have been set to achieve the degree of safety required in air and air-over-hydraulic braking systems.

Subsection 581(a)

In case of a sudden air pressure drop, this section requires that available air in the main braking reservoir be used only for braking and that it be protected from loss of pressure resulting from demand by auxiliary accessories. The auxiliary demand may be greater than the air system's ability to replenish itself.

Subsection 581(b)

The minimum volume of available air in the main circuit must be not less than 12 times the full volume displaced by the brake actuators. This allows reliable operation of the actuators and maintains a degree of uniformity in the volume and pressure of the air system for safe and effective brake operation.

Subsection 581(c)

The purpose of the water ejection or air-drying system is to remove moisture from the air. Moisture in the system can cause brakes to malfunction. Dry air helps prevent the problem of moisture freezing which could render the system inoperable.

Subsection 581(d)

The availability of visual indicators such as pressure gauges allows the operator to safely operate mining equipment. A decrease in air pressure warns the operator of a brake problem and allows the operator to take necessary safety measures.

Subsection 581(e)

An audible or visual alarm informs the operator when available air pressure falls below the permissible operational braking pressure range. The warning should provide the operator with enough time to safely stop the equipment.

Subsection 581(f)

The presence of check valves ensures reservoir air is not lost by leaking through a defective tube on the supply side. With the help of the air left in the reservoir, the operator can safely stop the equipment.

Section 582 Auxiliary air reservoirs

In the event of a failure in the main braking pressure supply circuit, there must be a sufficient energy reserve available in the auxiliary system to bring the equipment to a safe stop.

This minimum volume for auxiliary air reservoirs used for modulated emergency braking is six times the actuator's displacement capacity. This volume is considered sufficient for auxiliary brakes and is approximately half the requirement for normal service braking systems. This requirement allows for repeated pumping of the brake pedal which could be required to stop the machine in an emergency.

Section 583 Front wheel brake control

The ability to reduce the braking force of front wheels directly affects an operator's ability to maintain control of the vehicle. This is especially important in the case of slippery conditions. If the front brakes lock up, the operator may be unable to regain control.

Section 584 Parking brakes

Subsection 584(1)

This is a performance-based design parameter set for manufacturers. These minimum parking brake requirements address operations in which equipment is required to maneuver on a grade of up to 15 percent.

This requirement is consistent with clause 7.5 of ISO Standard 3450: 1996, *Earth-moving machinery — Braking systems of rubber-tired machines — Systems and performance requirements and test procedures*.

Subsection 584(2)

Parking brakes must be designed to remain fully operational and independent of fluctuations in air pressure within the system. Brake effectiveness must not be affected by the loss of apply pressure, temperature variations or dimensional changes of components due to expansion or contraction.

These fail-safe design requirements allow the vehicle to be parked safely while every other on-board system is shut off. Any modification to brake components must not compromise their effectiveness.

Section 585 Periodic service brake testing

Subsection 585(1)

The service brakes on specified units of rubber-tired, self-propelled mobile equipment that have a GVW of more than 32,000 kilograms and travel more than 10 kilometres per hour during normal operation must be periodically tested. The purpose of regular testing is to provide a measure of the effectiveness of the brake maintenance program. This periodic brake testing must not be confused with brake certification testing that is required to demonstrate the effectiveness of the original equipment design.

The periodic brake test provides:

- (a) a comparison of braking between machines;
- (b) a measure of braking improvement, deterioration or consistency over time;
- (c) workers with an opportunity to observe actual brake performance under simulated emergency conditions; and
- (d) information related to equipment maintenance program effectiveness.

Subsection 585(2)

This subsection gives the Director the authority to request that any piece of rubber-tired, self-propelled mobile equipment be tested. Such a request will not arbitrarily be made unless worker complaints, site inspections, equipment incidents or other information provides evidence that a braking problem may exist.

In all cases, the expectation is that the mining equipment will be maintained in accordance with the manufacturer's specifications.

Subsection 585(3)

Due to the increasing fleet size at some operations, the *OHS Code* has provided the employer with some discretion and flexibility with respect to periodic brake testing of the required units. A minimum of 30 percent of each fleet type of rubber-tired, self-propelled mobile equipment must be tested each year.

A "fleet" is defined by the individual model series or size of the respective units. For example, if a truck fleet consists of both Caterpillar and Komatsu 380 ton trucks, 30 percent of each type should be subjected to periodic brake testing.

If the fleet consists of a variety of truck sizes, e.g., 400 ton, 300 ton and 200 ton units, 30 percent of each size will be brake tested in a given year to ensure an adequate sampling.

Subsection 585(4)

Despite subsection 585(3), all individual rubber-tired, self-propelled machines must be brake tested within a given three-year period. For purposes of follow-up, records should be available to an OHS Officer to show that the brake tests have in fact been completed.

Subsection 585(5)

The expectation of this section is that the braking performance of any given machine will fall within the standard established by the manufacturer. Should periodic brake testing reveal that braking capability has been reduced below an acceptable level, the machine must be removed from service until repairs or adjustments are completed. After repairs or adjustments have been completed, a re-testing of the machine should be performed and documented.

Subsection 585(6)

This section provides the authority for an occupational health and safety officer to request that a given unit of rubber-tired, self-propelled equipment be brake tested. Again, this provision would normally be used only where information or evidence justifies the officer's request.

Section 586 Tests

Subsection 586(1)

Brake testing introduces an element of risk and as such must only be conducted under the supervision of a competent worker. That competent worker must ensure that the test site is suitable and the physical brake tests are conducted according to industry standards. Based on the test results, the competent worker must make decisions about continuing a test or removing a tested unit from service until repairs are made.

Subsection 586(2)

This subsection lists the conditions under which a loaded rubber-tired, self-propelled unit is to be brake tested. A straight, level road with a hard, dry surface is specified to minimize the risk of injury to workers involved in the process and to minimize the stress imposed on the mining equipment.

Subsection 586(3)(a)

For comparison purposes, the employer must ensure that the distance required to bring the unit to a complete stop is recorded during the brake test. This stopping distance must then be compared to the stopping distance determined during earlier brake tests, if the unit has previously been subjected to such tests. If available, the original brake certification test results may be relevant for comparative purposes.

If a unit is being subjected to a periodic brake test for the first time, it is recommended that the manufacturer's specifications or the original certification brake testing results be the basis for comparison.

Subsection 586(3)(b)

The actual speed of the unit prior to the service brake being applied is critical to the results of the stopping distance measurement and must therefore be recorded. In this case, the *OHS Code* is not specific and only requires the unit be operated at normal operating speed immediately before the brakes are applied.

It is recommended that where possible, all units of the same model and size be tested at the same "normal" operating speed during the test to allow the test results to be compared and interpreted.

Section 587 Maintenance records

Subsection 587(1)

Effective record keeping preserves a detailed history of vehicle problems, maintenance repairs and test records. This information is used to assess vehicle performance and the overall mechanical condition of the vehicle. It is also useful when planning annual production capability and when justifying equipment replacements. Maintenance history is also an important consideration during incident investigations.

The employer is required to maintain a maintenance record on each rubber-tired, self-propelled machine.

Subsection 587(2)

To ensure that relevant maintenance information is kept for a reasonable period of time, the *OHS Code* specifies that each record must be maintained for a period of three years from the date that a specific activity was performed. Since an occupational health and safety officer may request the maintenance records at any time, the employer must make such records available at the mine.

Section 588 Auxiliary steering

The mining environment can involve travel on busy access or haulage routes that are many kilometres in length and that are in some cases built with extended gradients of up to 10 percent. In such an environment, the loss of vehicle steering control could put mine workers at risk of serious injury. As a result, this subsection requires that any rubber-tired, self-propelled machine meeting the criteria specified in (a) and (b) must be equipped with an auxiliary power source that enables the operator to steer the machine to a safe stop.

This section provides an exemption to any machine that has its use restricted to underground operations and a maximum operating speed of 20 kilometres per hour.

Section 589 Auxiliary pump

An isolated or separate reservoir of emergency hydraulic fluid ensures that damage to any other hydraulic circuit will not affect the emergency steering system.

It is acceptable to have two reservoirs incorporated into a common container as long as the container separates the emergency steering fluid supply from other hydraulic fluid supplies.

Section 590 Auxiliary steering standards

Subsection 590(1)

SAE Standard J1511 FEB94/ISO 5010, *Steering for Off-Road, Rubber-Tired Machines*, has been adopted as the auxiliary steering standard for Alberta. The relevant parts of the Standard are reflected in subsection (2).

Subsection 590(2)

Given the steep gradients over which mine equipment can be used, automatic initiation of auxiliary steering is preferred, although a manual system is acceptable.

In any case of auxiliary steering activation, a warning device must also be activated to warn the operator that the emergency steering system is in use. This warning device is intended to minimize the potential that the auxiliary steering is being used without the operator's knowledge.

Section 591 Design safety factors

Subsection 591(1)

These design and operational requirements are intended to prevent worker injuries.

- (a) Without shock-absorbing seats, drivers could be subjected to chronic injuries from the whole-body vibration generated while travelling on rough mining roads.
- (b) Stop blocks, railings or a small ditch that will catch and hold the wheels of a vehicle can be used to prevent parked vehicles from rolling. The intention here, however, is to have a mechanical device or parking brake as the fail-safe means of preventing unintentional movement.
- (c) Starting an engine with the transmission engaged may cause the vehicle to jump or move unexpectedly. Any unexpected movement of the vehicle may threaten the safety of workers or nearby equipment.

Subsection 591(2)

Equipment stability can be a problem, especially when dump boxes have been altered or replaced to carry a larger volume of a lighter material. For example, replacement of a 100-ton truck dump box used to haul overburden that weighs 3,000 pounds per cubic yard with the dump box from a 150-ton truck used to haul coal weighting about 2,000 pounds per cubic yard can disrupt the vehicle's stability.

Although the GVW might remain within the equipment manufacturer's recommended load specifications, this alteration can adversely affect equipment steering and braking and shift the centre of gravity.

Subsection 591(3)

The intent here is that the vehicle remain stable with the front wheels on the ground. In rare instances, where a short-term operational condition might present a problem, alternate procedures are allowed. The expectation however is that a proper hazard assessment is completed, safe work procedures developed and workers advised and trained accordingly. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Section 592 Clearance lights

Subsection 592(1)

Clearance lights let other drivers know how much space a unit of equipment needs on the road. Clearance lights are particularly helpful at night and during times of poor visibility.

Subsection 592(2)

Clearance lights must be on when the machine's engine is on. Where practicable, the clearance lights should be interlocked with the engine so that they are automatically turned on when the engine is started and remain on while the vehicle is operating. If interlocking with the engine is not acceptable, defined operating procedures and worker training must be in place to comply with the *OHS Code*.

Subsection 592(3)

It is simply impractical to attach clearance lights to a blade or a bucket.

Section 593 Clear view

Most equipment is now designed to provide maximum visibility. However, some units may still require other devices to ensure good visibility. These devices may include mirrors, television cameras or other similar devices.

Section 594 Lights

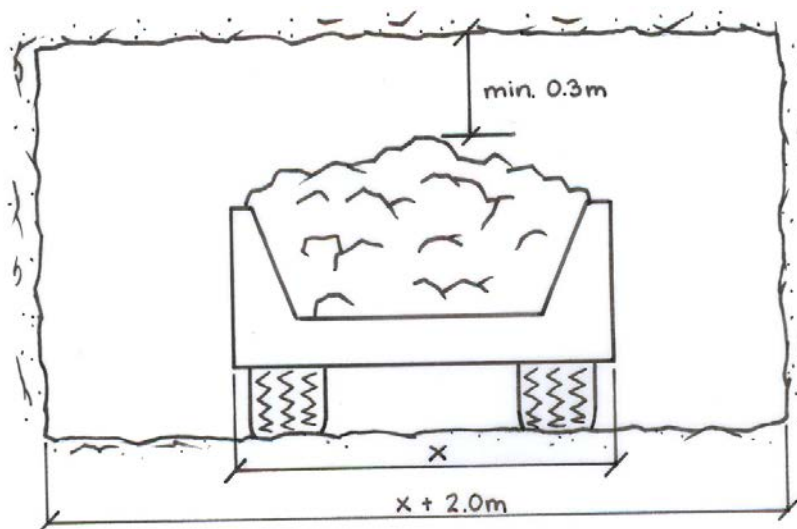
The lights listed in this section tell others in the area what the equipment is doing. Alignment, intensity and clarity are all important to the effectiveness of these lights.

Section 595 Clearances

Subsection 595(1)

Adequate clearance must be provided on each side of a rubber-tired self-propelled machine and above it as it travels underground. Both the required horizontal and vertical clearance distances are illustrated in Figure 36.4.

Figure 36.4 Vehicle clearances underground



Subsection 595(2)

Repealed

Section 596 Unattended machines

Subsection 596(1)

Due to the risk of fire and the very serious consequences of a fire in an underground mine, no rubber-tired, self-propelled machine can be left unattended unless the engine has been shut down and the unit has been secured from unintended movement according to subsection (2).

Subsection 596(2)

Workers must ensure unattended vehicles are properly parked so they do not move and create hazards for other workers. By parking on the level, or by ensuring the unit's wheels are turned or blocked appropriately, the potential for a runaway is minimized.

Diesel Power

Section 597 Diesel powered machine

Subsection 597(1)

CSA Standard CAN/CSA-M424.1-88 (R2007), *Flameproof Non-Rail-Bound, Diesel-Powered Machines for Use in Gassy Underground Coal Mines*, describes the technical requirements and procedures necessary for the design, performance and testing of new or unused flameproof, non-rail-bound diesel-powered, self-propelled machines for use in gassy underground mines. The working environment of such mines is characterized by the presence of methane gas and combustible dust.

The Standard applies to all machines of 45,000 kilograms (100,000 pounds) mass or less, which are designed to operate on level ground at a maximum speed of 32 kilometres per hour (20 miles per hour) or less on level ground.

Subsection 597(2)

This Standard describes the technical requirements and procedures necessary for the design, performance and testing of new or unused flameproof, non-rail-bound diesel-powered, self-propelled machines for use in non-gassy underground mines.

The Standard applies to all machines of 45,000 kilograms (100,000 pounds) mass or less, which are designed to operate on level ground at a maximum speed of 32 kilometres per hour (20 miles per hour) or less on level ground.

Conveyors

Section 598 Fire resistance

Conveyor belting and other conveyor components used in areas with high fire and explosion potential must be closely controlled. The standard referenced for additional information is CSA Standard CAN/CSA 422-M87 (R2007), *Fire-Performance and Anti-static Requirements for Conveyor Belting*.

The Standard addresses two categories of conveyor belts:

- (1) Types A1 and A2 intended for use in explosive atmospheres; and
- (2) Types B1-A, B1-B, B2 and C intended for use in non-explosive atmospheres.

The use of non-fire-resistant belting is allowed in a hazardous location provided the conveyor belt system is equipped with an effective fire suppression system approved by the Director.

Section 599 Stopping

Subsection 599(1)(a)

A pull cord that stops a conveyor in an emergency is a very important and reliable safety device. In almost all conveyor galleries, whether on the surface or underground, workers are required to travel beside the running conveyor either to supervise, maintain, monitor or clean.

When working around moving equipment associated with a conveyor, there is always the potential that a worker will fall into or find their clothing caught in the conveyor system. The conveyor must therefore be capable of being stopped immediately to prevent serious injury. Accessible pull cords make this possible.

To ensure it remains effective, the pull cord system must be tested frequently and adjusted as necessary.

Subsection 599(1)(b)

The requirement to manually reset and restart a stopped conveyor ensures the conveyor is not restarted until the area where the pull cord was tripped has been visually inspected and remedial actions taken.

Subsection 599(2)

In mines where material is conveyed on a series of conveyors, a sequential control is installed to stop all affected belts before their individual continuation could cause problems by dumping material and perhaps burying transfer points. This process is triggered by the use of sensor switches. A minimum of two are required:

- (i) Belt-slip switch—Friction caused by the slipping of a conveyor belt drive can generate heat that can contribute to fire and explosion hazards. This hazard is mitigated by application of a speed-sensitive “belt-slip” switch to shut down the conveyor when the belt suddenly slows to a predetermined speed.
- (ii) Blocked chute—In a series of conveyors the transfer chute directing mineral from one belt to the next can become blocked, spilling coal over the surrounding area, working areas and possibly onto personnel. This hazard is mitigated by using blocked chute switches which detect an accumulation of mineral in the chute and automatically stop the delivery conveyor.

Section 600 Travelling room

The minimum 1 metre of travelling room in an underground mine is considered sufficient to allow workers safe movement near the conveyor. If services such as electrical cable trays, water lines, communication cables and lighting systems are installed along the conveyors the required travel room must be maintained.

These travel areas may also be used as a return airway and require careful monitoring for dust, heat, methane and other gases. Since any travel way could be used as an emergency escape route, travel ways must be kept free of debris.

Section 601 Combustible dust

Subsection 601(1)

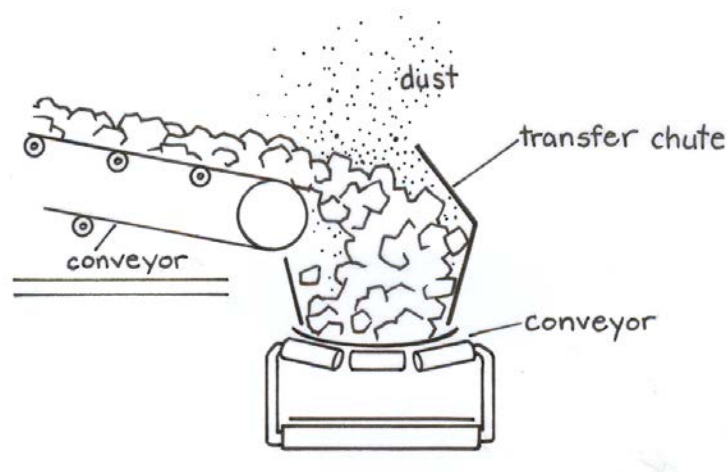
Dust generated by conveyors can be very fine and can easily become airborne. If not controlled as required by the *OHS Code*, much of it will eventually accumulate along the length of the conveyor, especially at the return end. Accumulations can also occur at the drive end due to spillage. If allowed to accumulate, dust can come into contact with moving parts and the resulting friction can create heat and fire leading to a possible explosion.

Belt cleaning devices should be located where the dust can be safely collected and disposed of at regular intervals.

Subsection 601(2)

The discharge of coal and similar materials generally produces dust that can be dangerous to workers' health. Dust can also create visibility problems when disturbed by air movement. Enclosed chutes and dust control measures at transfer and discharge points can help minimize the spread of dust. Figure 36.5 shows both a chute and a transfer point. Decreasing the fall distance for loose material reduces the generation of dust as does the use of water spray or dust suppression chemicals. Note that water is not very effective on coal dust.

Figure 36.5 Conveyor chute and transfer point



Section 602 Clearances

Subsection 602(1)

The minimum clearance for a rubber-tired vehicle to travel safely beside a conveyor has been set at 2 metres plus the vehicle's width. The total width required to accommodate the conveyor and a rubber-tired vehicle becomes 2 metres plus the sum of the vehicle's width, the room for the conveyor, and the clearance on the blind or non-travelling side of the conveyor. Figure 36.6 shows the arrangement and related distances.

For track-guided vehicles, the clearance is reduced to a minimum of 0.3 metres between the conveyor and the vehicle (see Figure 36.7). Since the vehicle is track guided, the likelihood of conveyor contact is much reduced.

The required clearance on the blind side of the conveyor is also 0.3 metres, mainly to provide room for cleaning accumulated dust.

Figure 36.6 Clearances for a conveyor and rubber-tired vehicle

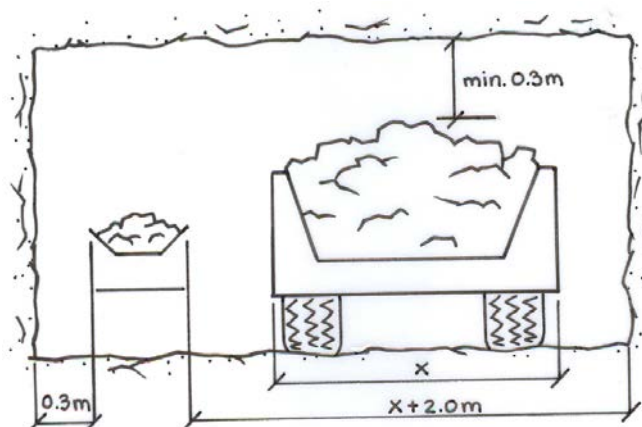
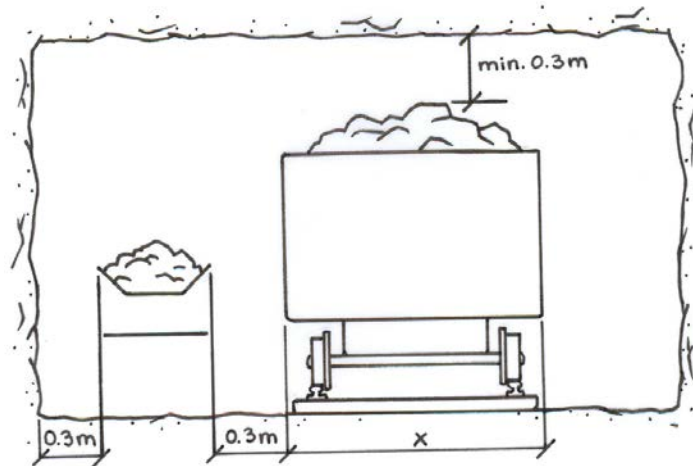


Figure 36.7 Clearance for a conveyor and track-guided vehicle



Subsection 602(2)

This minimum clearance of 0.3 metres between the roof supports and the top of the load on the conveyor provides adequate room for material movement.

Section 603 Riding conveyor belts

Subsection 603(1)

Working areas in underground coal mines are sometimes a great distance from the surface and walking conditions can be poor. In some underground mines, workers ride on specially designed conveyor belt systems to get to and from their respective work areas. In such cases, the entire system must be specifically designed and certified by a professional engineer.

This system includes provisions for getting on and off the moving conveyor and worker training to use the system. The system must also include various fail-safe protective measures to prevent incidents, e.g., if workers cannot get off the belt as anticipated, a method of stopping the belt before the worker is endangered must be incorporated.

Subsection 603(2)

This subsection provides basic design criteria for the professional engineer to use when designing the system. The success and safety of the system relies on proper design, protective features, safe operating procedures and training.

Subsection 603(2)(a)

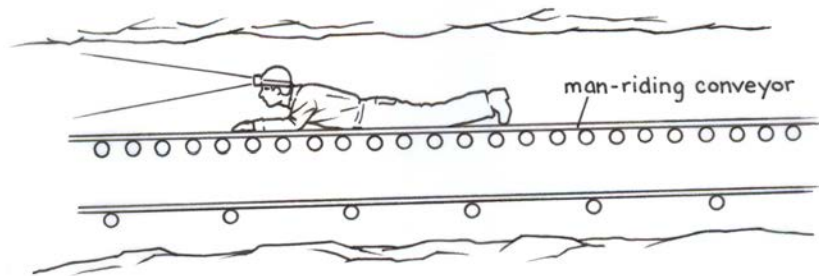
The gradient of conveyors used to transport workers is limited to a maximum of 15 degrees, while the maximum gradient for conveyors used to carry rock or coal is normally about 17 degrees.

Subsection 603(2)(b)

The head room clearance of 0.9 metres allows a worker to lie comfortably on the belt with head lifted to see disembarking signs ahead. Figure 36.8 illustrates this point. The clearance must also provide enough room for the worker to get on and off the conveyor.

The roof of a mine is generally rock bolted and may be equipped with other attachments to carry a variety of items. As a result, the required clearance must be measured between the belt and any protruding part of rock bolts or other attachments.

Figure 36.8 Head room clearance



Subsection 603(2)(c)

For the safety of workers who get on and get off a moving conveyor, the *OHS Code* limits the maximum belt speed to 2.65 metres per second (approximately 6 miles/hour). A faster speed could place workers at a greater risk of injury by over-balancing and falling over when mounting or dismounting the moving conveyor.

Subsection 603(2)(d)

A minimum belt width of 915 millimetres (36 inches) is specified to provide adequate space for a worker. This width is critical to a worker attempting to get on the conveyor. This width provides a reasonable safety factor in case of a trip or misstep when mounting or dismounting the moving belt.

Subsection 603(2)(e)

Non-slip surfaces ensure the safe mounting and dismounting of moving belts. Workers need a solid foothold from which to make the angular step necessary to get on the belt. The length of the non-slip surface must be sufficient to give workers enough time for mounting.

Subsection 603(2)(f)

Properly designed dismounting platforms are a critical safety component of any belt-riding system.

Since the conveyor belt is moving at a consistent speed of up to 2.65 metres per second (6 miles per hour), the dismounting platform must be large enough, at least 0.6 metres wide, and long enough, at least 15 metres in length, to accommodate the moving worker. To minimize the risk of injury, the platform surface must be treated or constructed of materials that provide a non-slip surface. A properly fitted handrail provides an additional means of protecting workers.

Recognizing the limitations of space in a typical underground mine, the *OHS Code* requires that adequate head room clearance be provided at a dismounting platform so that a worker can dismount in an upright position. With adequate overhead clearance, a worker need not be concerned with suspended or protruding objects at roof level. An upright body position provides the worker with a better chance of maintaining balance during dismounting, thus minimizing the potential of a trip or fall.

Subsection 603(2)(g)

Underground lighting is often limited, so proper illumination is critical at mounting and dismounting platforms. Without proper illumination, a worker will have difficulty seeing or judging distances at a mounting or dismounting location. Further, at an inadequately illuminated dismounting platform, the loss of a miner's lamp could be disastrous to any worker who was already riding the conveyor belt. As a result, the *OHS Code* requires that all conveyor mounting and dismounting platforms be electrically illuminated.

Subsection 603(2)(h)

Again, due to the limited availability of fixed lighting in an underground mine, it is important that workers be directed to mounting and dismounting platforms by the use of reflective signage. It is important for workers riding the conveyor belt that reflective signage is installed to indicate that they are approaching a dismounting platform. According to this subsection, those reflective signs must be installed at distances of 30 metres, 20 metres and 10 metres from any dismounting platform. Such advanced notice provides adequate time for a worker to get ready for a safe dismount.

Subsection 603(2)(i)

Since it is possible that a worker will miss the dismount platform or have difficulty in dismounting as planned, a belt-stopping safety device is required. This safety device must be installed in a location that will stop the belt prior to a worker being transported into a more dangerous situation such as into a chute or hopper.

Subsection 603(2)(j)

Any man-riding conveyor belt must be equipped with brakes that automatically apply to stop and hold the conveyor when a belt-stopping safety device is activated.

Subsection 603(2)(k)

A principal safety hazard with man-riding conveyors is the danger of stepping onto a torn or split belt. This could allow the human rider to contact the rotating rollers underneath, usually resulting in tragic consequences. This is typically addressed in the industry by use of “torn belt” sensors which are interlocked with the drive. Whenever a split in the belting is detected, the belt stops, allowing it to be repaired and preventing any subsequent accident.

Subsections 603(3) and 603(4)

Workers riding conveyor belts must be adequately trained and have access to detailed safe operating procedures for riding conveyor belts. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Procedures and precautions must be posted in a conspicuous place for easy reference and should include such things as

- (a) pre-use inspection of the belt;
- (b) prohibited materials that cannot be transported with a worker;
- (c) periodic testing of safety dismount devices; and
- (d) separation distance between riders on a belt.

Section 604 Examination

Proper care and maintenance of a conveyor system in any underground mine can significantly reduce the potential for fire. Given the combustible nature of coal and coal dust, the problems associated with a conveyor fire are increased many-fold. A competent worker must therefore frequently inspect the conveyor system and all its related components.

In an underground coal mine each conveyor system (belt line) must be inspected at least once each shift to check for hot spots caused by friction of the belt or other moving components such as belt-carrying-idlers.

Dangerous buildups of coal dust must not be allowed to accumulate beneath the moving belt, under pulleys, or around conveyor belt rollers. Friction could result in a fire or explosion.

Prior to resuming operations after an interruption in mining activity, the total conveyor system must be examined to ensure that it is safe to start up. Given the nature of the underground mining environment, any number of serious hazards could have developed since the last time the system was operated or inspected. For example, a fall of ground could have damaged the conveyor belt or blocked individual conveyor

components. As well, maintenance or operating materials could have been inadvertently left on the belt, or previously undetected electrical cable damage could now become evident. It is essential therefore that pre-use inspections be conducted to identify and correct any conveyor system hazards.

Section 605 Carbon monoxide monitors

Fire is a real threat associated with conveyor operations in a mine. In coal mines, the threat is increased due to the possibility of a methane gas/coal dust explosion. The presence of carbon monoxide indicates a heating process resulting from either spontaneous combustion or other heating process. Based on the content of carbon monoxide in the air, the state of the fire or heating can be predicted.

The location and frequency of monitoring installations depends on variables such as the length of the gallery, the nature and quality of the coal being mined, and the velocity of ventilation air.

Section 606 Conveyor roadways

Subsection 606(1)

All roadways in an underground mine may be used as escape routes by workers. As a result, such roadways must be kept clear of obstructions at all times.

Subsection 606(2)

The height of a conveyor roadway is dictated by the conveyor profile, the clearances required to move materials safely and the need to have the mine easily accessed by workers. The minimum requirement of 1.5 metres may be increased at the employer's discretion to accommodate variations in material heights and other conditions in the mine.

Subsection 606(3)

Because of the hazards associated with operating conveyors, all workers must travel only in the clear space on the conveyor roadway. As noted in subsection (1), these roadways must be kept clear of any obstructions that could impede the effective movement of any worker.

Division 2 Explosives

Section 607 Theft of explosives

Subsection 607(1)

Both federal and provincial authorities, including the RCMP, are to be informed of suspicious incidents involving explosives. Other mines may also need to be informed of such incidents to protect their own explosive supplies. A blaster must immediately inform the employer of any suspected attempt or known unlawful entry into a magazine or theft of an explosive product.

Subsection 607(2)

Upon becoming aware of a suspected attempt or known unlawful entry into a magazine or theft of explosive product from a mine site, an employer must immediately inform the Director. It is recommended that the employer also notify the RCMP.

Section 608 Non-sparking tools

Tools used for the handling of explosives must be made of non-sparking materials such as copper or brass to ensure they do not become a source of ignition. Both the employer and worker are responsible for ensuring that only non-sparking tools are used.

Section 609 Underground mine blaster

Subsection 609(1)

Responsibility for blasting and the related handling of explosives rests with the employer. At an underground mine, the employer must appoint a certified underground mine blaster to act on the employer's behalf. Once appointed by the employer, a certified underground mine blaster is responsible for the direction of explosive handling activities and for the safe execution of all blasting operations at the mine.

Only a certified underground mine blaster or another worker who works under the direct supervision of a certified underground mine blaster can handle an explosive product or blast a misfire.

Subsection 609(2)

Due to the knowledge required to properly handle explosives and the hazards related to improper use, non-certified underground mine workers must not handle explosives, except as noted in subsection (1).

The employer is responsible for ensuring that non-certified underground mine workers are trained to be aware of the hazards associated with explosive products. Those mine workers must also be trained in the company's blasting procedures.

Section 610 Surface mine blaster

Subsection 610(1)

Responsibility for blasting and the related handling of explosives rests with the employer. At a surface mine, the employer must appoint a certified surface mine blaster to act on the employer's behalf. Once appointed by the employer, a certified surface mine blaster is responsible for the direction of explosive handling activities and for the safe execution of all blasting operations at the mine.

Only a certified surface mine blaster or another worker who works under the direct supervision of a certified surface mine blaster can handle an explosive product or blast a misfire.

Subsection 610(2)

Due to the knowledge required to properly handle explosives and the hazards related to improper use, non-certified surface mine workers must not handle explosives, except as noted in subsection (1).

The employer is responsible for ensuring that non-certified surface mine workers are trained to be aware of the hazards associated with explosive products. These mine workers must also be trained in the company's blasting procedures.

Section 611 Magazines

This section applies to an explosive magazine intended for use in an underground mine. Magazines at a surface mine must be certified by federal authorities.

Explosives are classified as hazardous materials. Due to the confinement of an underground working environment, the effects of an unplanned explosion could be catastrophic to mine workers. Explosive products cannot be stored in an underground mine except in a magazine that meets very strict conditions.

According to the *OHS Code*, the minimum requirement for an underground explosive storage magazine is that the facility be designed and certified by a professional engineer. Further, the Director must also approve the magazine to ensure that an acceptable standard has been maintained.

Section 612 Illumination of magazines

Inappropriate portable lights may introduce fire or ignition hazards if brought into a magazine. Lights designed for use in hazardous locations provide safety measures against any such possibility through shielding, lower surface temperatures and proper air flow and are tested and certified for use in such hazardous locations.

Section 613 Stored explosives

Subsection 613(a)

Frequent examination is needed to ensure explosives are not deteriorating and becoming dangerous. For example, dynamite sticks “sweat” and produce nitroglycerine liquid. The liquid can be detonated with a fairly low-intensity vibration or impact. Similarly, ammonium nitrate blasting agent allows its diesel fuel to percolate down to the bottom, affecting the composition of the blasting agent and its performance when initiated. Regular examination and use of the explosives on the basis of first received, first used will avoid using explosives that have deteriorated due to an extended storage period.

Subsections 613(b) and 613(c)

Deteriorated explosives must be carefully removed and destroyed by a blaster according to the manufacturer’s specifications. Destruction must be carried out at a remote location to ensure the safety of anyone involved in or near the operation.

Section 614 Electric detonators

Leg wires must be shunted to avoid any possible initiation of the detonator from electrical sources such as static electricity, electrical storms, electrical wires/cables or similar energy sources. The wires are disconnected only before being connected to the blasting circuit. Leg wires must be kept coiled as they are more susceptible to electromagnetic fields if they are extended like an antenna.

Section 615 Access to explosives

Subsection 615(1)

The employer is responsible for controlling access to blasting magazines and their contents. Common practice is that the blaster-in-charge is provided with a set of magazine keys by the employer. Control of the magazine keys and related access to storage magazines and their contents is then the responsibility of the blaster while on the mine site. When a blaster is away from the site, the magazine keys are expected to be stored in a secure location under the control of the employer. If an additional

replacement blaster-in-charge has been appointed by the employer, the keys can be reassigned by the employer.

During routine loading and blasting activities, only the designated blaster or other workers under the direct supervision of the designated blaster can have access to a magazine and its contents.

Subsection 615(2)

The subsection reaffirms the employer's responsibility for ensuring that only the workers noted in subsection (1) have access to explosives. As a result, the employer must have control systems in place to ensure compliance with this section.

Accepted controls include defined policies and procedures that have been communicated to workers. These policies and procedures should be included in orientation packages, training and refresher training programs. The employer should keep on file all documentation to confirm the orientation and training.

Section 616 Removal from magazine

Subsection 616(1)

Detonators are very sensitive and as such must be kept separate from other explosive accessories like primers and detonating cord. The intention here is to minimize the potential that detonation of the more sensitive explosive could affect other nearby explosive products.

Subsection 616(2)

Non-conductive linings safeguard against electrical currents from static electricity, electrical storms or other similar energy sources. Theft, which sometimes occurs, is minimized by ensuring containers can only be opened by authorized personnel.

Subsection 616(3)

All practicable steps must be taken to prevent explosives from detonating prematurely. The employer must ensure that any explosives in a container are arranged and protected against contact with anything that could cause premature detonation.

Subsection 616(4)

Accidental initiation of electric detonators is a significant hazard prevented by shunting leg wires. Documented cases of accidental initiation and related worker fatalities are available from international explosives databases. The wires are to be kept shunted until the detonators are ready to be connected to the blasting circuit.

Section 617 Priority of use

Use of the oldest explosive first prevents deterioration from extended storage and ensures effective blasting. To simplify removal of explosives from storage magazines, supplies should be rotated so that older explosives are stacked in front of newer ones.

Section 618 Magazine record

Subsection 618(1)

Records indicating how explosives have been used are important for tracking performance, use and potential loss from theft. Both the public and workers are better protected when such controls and tracking methods are used.

Subsection 618(2)

The three-year retention period for records allows authorities to investigate any related incidents.

Section 619 Explosive location

Subsection 619(1)

A worker is prohibited from taking an explosive product into any mine building or similar facility other than a licensed magazine. The intent here is to avoid the risk of injury to other workers or site visitors due to a premature detonation. An additional benefit is that explosives are less likely to be lost, stolen or simply misplaced, thus providing an additional measure of control.

Subsection 619(2)

Explosives must be handled with care by persons trained and qualified to do so. If explosive products are discovered in a building, both the employer and workers must ensure that a certified mine blaster is called to remove the explosives.

Subsection 619(3)

All explosives must be used or returned to the licensed magazine by the end of any shift. Any worker who has explosives in his or her possession at the end of the shift must return the explosives to the magazine and record the details in the mandatory logbook. The requirement reduces the potential of theft, misplacement or premature detonation.

Transportation

Section 620 Removal and transfer

Subsection 620(1)

Proper transportation and handling of explosives by competent personnel ensures the safety of the work site. Limiting who transfers explosives reduces the number of workers at risk and reduces the potential for errors.

Subsection 620(2)

Explosives being transferred to a work site must be transported as quickly as possible to minimize the extent to which mine workers are exposed to a potential explosion hazard.

Section 621 Restriction on open flames

All potential sources of ignition must be controlled to ensure the safety of mine workers. Open flames and smouldering substances are prohibited from coming within 8 metres of a vehicle transporting explosives.

Although other ignition sources may be of concern, this section deals specifically with open flames and smouldering substances such as matches, cigarettes, cutting torches, etc.

Section 622 Vehicle requirements

Transporting explosives at a mine site introduces a number of hazards that must be controlled. The employer is responsible for ensuring that any explosive-carrying vehicle is properly maintained. Once appointed or designated by the employer, the mine blaster also takes on some responsibility under this section. In particular, under subsection 622(2), a vehicle used to transport explosives can only be operated by a mine blaster or a worker authorized by the mine blaster.

Subsection 622(1)

This subsection lists some of the characteristics that a vehicle transporting explosives must meet. In summary, the vehicle must be in reasonable operating condition and must be serviced and fully fuelled prior to being loaded with explosives. These precautions are intended to reduce the potential for premature initiation of the explosives as a result of equipment defects or a source of ignition provided by the servicing and fuelling activity, e.g., sparks, static electricity, fire resulting from hydrocarbon fumes, etc.

Design and construction of the vehicle's explosive-containing compartments must be such that detonators and other explosives can be kept separated from each other. Further, the on-board storage compartments must be constructed to ensure that the

explosives cannot inadvertently fall from the vehicle. Additional criteria related to storage compartment design are provided in subsection 625(1).

Subsection 622(2)

Only the mine blaster or a worker authorized by the mine blaster can operate a vehicle that is used to transport explosives. The intent here is to ensure that only a competent worker, familiar with the hazards of explosives, is allowed to operate the vehicle. Given the hazards associated with handling and transporting explosives, a well-intended, non-competent worker could inadvertently place himself or herself at risk without even realizing it.

Subsection 622(3)

Since fire is an ever-constant risk due to the presence of hydrocarbon fuels and the explosives, any vehicle that transports explosives must be equipped with at least two 9-kilogram ABC type fire extinguishers. By having the means to quickly respond to a fire, the vehicle operator can take immediate action to significantly reduce the potential for an accidental initiation of the explosives.

Subsection 622(4)

Highly visible signage is required on a vehicle transporting more than 25 kilograms of explosives to alert workers of the hazard. An orange-coloured, diamond-shaped placard containing lettering that is at least 150 millimetres (6 inches) high is the recommended standard. The placard must be clearly marked with the word "Explosives." Vehicles transporting a lesser quantity of explosives should also be placarded.

Section 623 Protection from weather

Rain and snow can damage and disable explosives and detonators. Wet explosives may not explode unless specifically designed for use in wet conditions.

Section 624 Original packaging

Explosives cannot be transported in anything but their original packaging. Repackaging is prohibited because of the potential for mislabelling and other errors. The true nature of the explosives must not be disguised by transfer to other packaging.

Section 625 Detonators

Subsection 625(1)

Maintaining a safe distance between detonators and other explosive accessories prevents them from coming in contact with one another. The material used to separate these items must have the same non-conductive properties as wood.

Subsection 625(2)

Radiofrequency energy from a radio transmitter has the potential to initiate a detonator if the leg wires are not shunted and the detonator is close to the transmitter. To reduce the likelihood of initiation, particularly during loading and unloading when the distance between the transmitter and detonators may be relatively little, the radio transmitter must be switched off.

Section 626 Vehicle breakdown

Subsection 626(1)

These requirements are intended to reduce the risk of explosives unintentionally exploding. Repairs that do not pose a risk are allowed. Since the vehicle operator is usually a blaster or other competent worker, the operator is best qualified to make such decisions.

Subsection 626(2)

Major repairs can include towing or hauling the vehicle, replacing major components, and storing or placing the vehicle in places not acceptable to this Code or other regulations, such as near welding operations or other potential sources of ignition.

Subsection 626(3)

If explosives must be removed from a vehicle so repairs can be made, the explosives must be either returned to a magazine or temporarily stored in an area that does not expose other workers or the public to undue risk. When stored temporarily under such circumstances, the explosives must be placed under proper security.

Operational Procedures

Section 627 Manufacturer's specifications

Explosive manufacturers base their specifications and procedures on extensive research and testing. Strict adherence to these specifications delivers the promised safety and performance results. Both the employer and worker are responsible for ensuring that the manufacturer's specifications are followed.

Section 628 Unsafe explosives

Responsibility for dealing with deteriorated, damaged, or otherwise unsafe explosives rests solely with the blaster. Once it has been determined that a particular explosive is unsafe, it must not be used. Unsafe explosives must be destroyed according to the manufacturer's specifications.

Section 629 Blast area control

Subsection 629(1)

Well-defined control and management of the blast area is critical to worker safety. A mine blaster must be designated to make decisions and be accountable for the work practices and safety at the work site.

Subsection 629(2)

To avoid problems related to blast site control and overall blast site responsibility, one blaster must be designated as the “blaster-in-charge.”

Section 630 Access to blast area

Workers are not permitted to enter the blast area without the blaster’s permission. Both the employer and workers are equally responsible for compliance.

Section 631 General duties

A blaster is appointed by the employer and assigned authority to control the blasting area. In taking charge of the area, the blaster must be prepared to direct and control the activities of everyone involved for the period required to complete the blast. The general duties of the blaster are described in subsections 631(1) through 631(6).

Depending on the complexity and size of the blasting operation, a blasting engineer may be involved in designing the loading, firing sequence and delay sequence used in the blast. Similarly, a blast involving a few hundred thousand kilograms of explosives will require a group of people to ensure that the job is done correctly. Loading of explosives, once drilling is complete, may itself take a few days or weeks to complete.

Section 632 Secondary blasting

Secondary blasting is always a dangerous undertaking since the explosive charge may be only minimally contained with stemming. Extreme fly rock should be expected and appropriate precautions taken to protect workers. As noted here, blockholes should be used if reasonably practicable.

Section 633 Mine blaster’s record

To ensure that the use of explosives is strictly monitored and controlled, the mine blaster is responsible for keeping a written log book in which all blast related details are recorded. The logbook must be filled out daily at the end of the mine blaster’s shift.

When combined with the explosive magazine record required by section 618, the mine blaster's logbook should provide a complete summary of the explosives used, explosives removed from or returned to the magazine, as well as the number of charges that remain unfired in the mine. Such information might be critical in case of an investigation related to magazine control or theft of explosives.

Section 634 Damaged blasting wires

A damaged wire may not activate the charge because current is unable to pass through the wire to the charge. The result could be a misfire. For this reason, any worker who inadvertently drives over or damages blasting lead wires must immediately report the occurrence to the blaster and the employer. Blast site control in such a case should also be reviewed.

Section 635 Blasting machine control

Assignment of the blasting machine to the blaster simply eliminates the possibility of unintended blast detonation by other persons.

Undetonated or Abandoned Explosives

Section 636 Unused explosives

Subsection 636(1)

The return of unused explosives allows the employer to track inventory and ensures no explosive material is left in or around the mine. Even boxes used to carry explosives are treated as though they contain explosive residues and are destroyed according to the manufacturer's specifications. Unused explosives must be returned to the magazine and the magazine record adjusted accordingly.

Subsection 636(2)

Even small quantities or portions of explosives that are blown out of a blasted hole can be a hazard. As such, they must be treated as a misfire and handled according to defined procedures.

Section 637 Misfire procedures

Subsection 637(1)

The presence of a misfire introduces a unique hazard to any operation since it is unplanned and unexpected. Only a worker holding a valid mine blaster certificate can be authorized to handle a misfire.

As noted in this section, a blaster must not abandon a misfire unless it cannot be safely detonated or removed from its hole. When such a situation occurs, it is recommended that the mine manager be included in the final decision process. Additional requirements for dealing with misfires are covered under sections 653, 672, 673 and 674 of the *OHS Code*.

Subsection 637(2)

As with any recognized hazardous activity, the employer is responsible for developing safe work procedures for handling misfires. Due to his or her training and expertise, it is recommended that the mine blaster be involved in that process. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Section 638 Abandoned explosive

Subsection 638(1)

If a worker finds an abandoned explosive or misfire, the worker must first advise others in the blast area of the danger and then inform the employer or mine blaster.

Subsection 638(2)

The employer's responsibility to protect workers from the danger of abandoned explosives or misfires includes ensuring the explosive or misfire is destroyed according to the manufacturer's specifications. The employer must also notify the Director when an abandoned explosive has been found.

Blasting Machines and Circuits

Section 639 Testing and initiation

Circuit testing devices are specifically designed for that purpose and must be used according to the manufacturer's specifications. The use of an inappropriate testing device could potentially result in a non-initiation event or an unnecessary misfire situation.

For hazardous sites and coal mines, explosive initiating and testing devices must be approved by CANMET or by the Director. Devices must be specifically designed and manufactured for use in flammable and explosive atmospheres.

Section 640 Blasting apparatus

Subsection 640(1)

The marking of the blasting machine's capacity lets the blaster know that the machine is able to initiate all the blasting detonators connected to it. The use of a blasting machine of incorrect capacity could lead to incomplete initiation and misfires.

Subsection 640(2)

Testing the blasting machine prior to any blast requiring its maximum current is essential to ensuring successful initiation of the detonator(s) connected to it. If the current is not sufficient, some detonators may not explode, creating production delays and a need to reblast.

Section 641 Circuit testing

Subsection 641(1)(a)

Workers must be removed from the blasting area before blasting circuits are tested in the event that an unintended detonation occurs.

Subsection 641(1)(b)

Testing ensures continuity of the circuit and provides confidence of a successful detonation.

Subsection 641(2)

The minimum 10-minute time period ensures that sufficient time is allowed for the delayed detonator to do its job. In case a detonator is defective, the extra time might be sufficient for it to explode. The waiting period also allows dust and smoke from the blast to clear.

Section 642 Circuit requirement

Subsection 642(1)

This section details specifications for the blasting machine, power circuits and lead wires. Any deviation will compromise efficiency and performance and may create safety problems. Most of these specifications are quite clear and self-explanatory. For ease of reference an excerpt from clause 3.7 of CSA Standard CAN/CSA M421-00 (R2007), *Use of Electricity in Mines*, is provided below. Readers should note that the Standard deals only with the case where electricity is supplied from the power distribution system.

3.7 Electric Blasting

3.7.1 General

3.7.1.1

Clause 3.7 applies to the use of electricity supplied from the power-distribution system for blasting. Where the power-distribution system is not used for blasting, the mine shall establish alternative procedures.

Note: See *Blaster's Handbook*

3.7.1.2

The mine shall have procedures to prevent inadvertent detonation of electric blasting caps in the presence of radio transmitters or other radio-frequency fields (cellular phones, GPS, portable hand-held radios, etc.).

3.7.1.3

Electric blasting circuits shall be tested for continuity before a blast is set off.

3.7.2 Supply Characteristics

An isolated, underground power source shall be used for electric blasting; it shall have adequate capacity for the number of caps involved, and it shall be used for blasting only.

3.7.3 Conductors

3.7.3.1

Acceptable blasting circuit conductors shall be:

- (a) not less than No. 12 AWG;
- (b) without splices, as far as practical; and
- (c) readily identifiable as being for blasting use, preferably red.

3.7.3.2

Where expendable connecting wires are used for the lead wires to the leg wires of the blasting caps, they shall be not less than No. 20 AWG.

3.7.4 Stray-Current Precautions

3.7.4.1

Blasting-circuit conductors shall be kept at least 150 mm away from power or lighting cables and, where possible, they shall be run on the side of the working opposite power and lighting circuits.

3.7.4.2

Where blasting lines are installed for a short time only, they may be fastened to sprags or sticks for adequate support during such temporary usage.

3.7.4.3

Blasting-circuit conductors shall not contact pipes, rails, or other electrically conductive materials that might be accidentally energized or be vulnerable to static charges.

3.7.5 Control

3.7.5.1

A fused service switch with provision for locking shall be installed between the source of power and the blasting switch.

3.7.5.2

In all cases where a blasting switch is used, a lightning gap of not less than 1.5 m shall be provided between the service switch and the blasting switch, and such gap shall be closed only at the time of blasting by means such as a twist-type locking device.

3.7.6 Blasting Switch

3.7.6.1

The blasting switch shall be constructed so that gravity tends to open the circuit and short the blasting leads. Where the power source exceeds 300 V, the blasting switch shall be electromagnetically operated.

3.7.6.2

The blasting switch shall be within a fixed, locked box and shall be accessible only to the authorized blaster.

3.7.7 Multiple Blasting

Where a single blasting switch is used for several blasting circuits, a three-way isolating switch that can be locked in either the shorted or closed position shall be installed in each circuit to provide for

- (a) shorting the circuit;
- (b) energizing the circuit; and
- (c) testing the circuit.

The isolating switches shall be located in a safe place.

3.7.8 Maintenance

Permanent blasting lines, blasting switches, and service switches shall be maintained by a qualified person.

3.7.9 Programmable Logic Control (PLC)

In addition to the requirements of Clauses 3.7.3.1 and 3.7.4.1, where a PLC or computer is used to control or initiate the blast, the system shall be approved by a professional engineer.

The detonation power source must provide sufficient current when the switch is closed. If the power circuit is also providing electricity to other equipment, the demand of this equipment may reduce the electricity available for blasting machines. This, in turn, may provide less than adequate power through the circuits resulting in misfires.

Subsection 642(2)

Lead wires for blasting are standard products supplied by an explosives accessories company and are readily identifiable. Despite standardization, the blaster is ultimately responsible for ensuring that the correct products are being used at a mine blast site. This subsection lists minimum specifications that must be confirmed by the blaster prior to putting the products to use. Key specifications are listed and include “AWG wire size,” “waterproof,” “readily identifiable for blasting use” and “used only for blasting.”

Additional safety requirements are listed and are meant to minimize the potential for premature detonation as a result of extraneous electrical current. This subsection specifies minimum distances that must be maintained between the lead wires and power or lighting cables, pipes, rails or other electrically conductive materials.

Subsection 642(3)

To ensure that enough current flows through the complete blasting circuit, the disposable connecting wire between the main lead wires and the detonator’s leg wires must be not less than No. 20 AWG in size.

Surface Mines

Section 643 Application

No explanation required.

Section 644 Signs

Subsection 644(1)

Any blast area must be clearly identified and access controlled. Detonating cord, non-electric tubing, detonating relays, fuses, and wires can easily be damaged by vehicles travelling over them. Depending on the status of blast preparation, there may also be a risk of premature detonation.

Subsection 644(2)

The presence of unauthorized manpower and equipment may introduce unintended hazards. As a result, the employer must train workers to ensure that they understand the hazards associated with a mine blast site. It must be clear to all personnel that the

blaster in charge is responsible for controlling access to the blast area by both personnel and vehicular traffic. The blaster's approval should be obtained before any non-blasting personnel or equipment approach the defined blasting area.

Section 645 Blast holes

Subsection 645(1)

Stemming is required for conventional blast holes to confine the pressure created by a blast and to concentrate it, as needed, to break the rock.

Subsection 645(2)

In controlled blasting, a decked blasting process can be used where the explosive is alternately layered with stemming or other non-explosive material. The tops of controlled blast holes are not stemmed to allow for rapid relief of released energy, which controls and minimizes fracturing of the surrounding rock mass.

Section 646 Electrical storm

The mine blaster must be aware of the presence of nearby electrical storms that could pose a risk to blasting operations. Although extraneous electrical current is considered a major risk to electrical blasting systems, recorded incidents provide sufficient evidence that non-electric blasting systems could also be at risk from direct lightning strike.

Although not specified in the *OHS Code*, it is highly recommended that the employer provide the mine blaster with lightning detection devices that will assist in related blast site decision making.

In locations where it may be necessary to halt blasting activities it is recommended that company procedures be clearly defined to assist the blaster in the decision making process. Explosive manufacturers should be consulted when these procedures are being prepared.

Paragraphs 646(b) and 646(c) are considered to apply to all mine workers who may be at risk of injury from the premature initiation of a loaded blast hole or blast pattern.

Section 647 Detonating cord

Subsection 647(1)

When priming drill holes using detonating cord and primers, care must be taken to ensure that down-lines are secured at the top of the hole with sufficient excess cord to allow for settling of the explosive column and stemming.

If insufficient cord is provided, the settling column could pull the cord down. This would require other risk increasing actions to assure initiation of the explosive column during subsequent blasting operations.

Subsection 647(2)

To minimize the potential for unplanned separation of the explosives column and only partial initiation, loading operations, from priming through to stemming should be as continuous as practicable.

Subsection 647(3)

The specific requirements noted are essential for ensuring safe and successful blasting operations.

Section 648 Ignition precautions

The 8-metre distance quoted is considered a minimum distance required to protect workers from any possible ignition source that might be created by machinery, smoking or an open flame. Responsibility for compliance has been assigned to both the employer and worker for their respective roles and scope of work.

Section 649 Safety fuses

Safety fuses must be of sufficient length to permit easy connection and allow enough time for the blaster to retreat to a safe location.

Section 650 Electrical cables and wires

Blasting cables must be carefully handled, connected and insulated to avoid grounding. If they are accidentally grounded, a current might pass through them and prematurely initiate a blast. A damaged wire could result in a misfire.

Section 651 Electric blasting

Subsection 651(1)

Electromagnetic radiation may introduce sufficient electrical current in an electrical blasting system to prematurely initiate detonation devices.

Subsection 651(2)

The build-up of electrical charges can produce sufficient electrical current to cause premature detonation and explosion.

Vibration from the blast or the shock wave produced by the blast can cause arcing and damage to electrical distribution systems.

Subsection 651(3)

Radio transmitters may induce electric current flow in susceptible electric detonators, causing explosion. Tables 1 and 2 of Schedule 11 specify minimum separation distances to be maintained to prevent such induction.

Subsection 651(4)

The same rationale applies as in subsection 651(3). The induction source in this instance is electrical trailing cable. As a current flows through a wire or cable, it creates electric and magnetic fields around it. Lead wires laid out parallel to trailing cables may have a current induced in them by the magnetic field produced by current flowing through the trailing cables.

Section 652 Burning explosives

Burning explosives may explode at any time. Burning also produces large quantities of extremely toxic oxides of nitrogen gas.

Section 653 Misfires

Subsection 653(1)

Exposing a misfire by digging is an extremely dangerous activity. It must be done very carefully under the direct supervision of a blaster or competent worker appointed by the employer. This person must ensure the excavator's bucket or other parts do not contact the explosive.

To be consistent with section 610 of the *OHS Code*, it is expected that while not being the designated blaster, the competent person would hold a valid mine blaster certificate.

Subsection 653(2)

Drilling near a misfire is very dangerous. The blaster or competent worker appointed by the employer will have to determine if the explosive has travelled from the hole into the surrounding ground being selected for drilling. If not done properly, the drilling operation could cause the remaining explosives to explode.

Section 654 Drilling near explosives

Subsection 654(1)

For the reasons explained in subsection 653(2), drilling near a charged blast hole is very dangerous. The minimum 5 metre distance from a charged blast hole must be maintained.

Although 5 metres is the minimum distance for surface blasting, care must be taken to ensure that cracks or fissures in the surrounding rocks do not contain explosives as well.

Subsection 654(2)

A cut-off hole is a charged blast hole in which detonation was not completed, i.e., cut-off, leaving behind live explosives. Prior to any drilling activity, the area must be examined by a mine blaster.

Section 655 Storage

Subsection 655(1)

This section deals with the control of explosives within the mine itself. It does not relate to the main explosive storage magazines. According to this subsection, a type 6 magazine or operational storage box can contain only a 24-hour supply of explosive products.

Subsection 655(2)

The minimum storage distance of 8 metres limits the likelihood that one box exploding will damage the other box.

Subsection 655(3)

These magazine standards are mandated by the federal *Explosives Act* (Canada) and together with requirements for handling, transport and storage, minimize the potential of worker injury.

Subsection 655(4)

Operation storage boxes are potentially a security risk. The employer must take steps to minimize the potential hazards of theft and their general use.

The boxes must be locked when not in use. This means that unless the blaster is removing or returning products, the lock must be in place and secured.

Since the risk of unplanned detonation is always present, operation storage boxes must be located away from the active blasting area, mine operating equipment, railway tracks,

travelled roadways and walkways. The storage boxes must also be placed away from electrical power cables.

As with any explosive magazine, the operation storage box must be appropriately identified by a sign indicating that it contains explosives.

Section 656 Blasting warnings

Subsection 656 (1)

Mobile radio transmitters must be turned off within 20 metres of an electric blasting system to prevent initiation of the blast by electromagnetic energy generated during transmission.

Subsections 656(2) and 656(3)

When blasting near public highways, the general public must be warned of the blasting hazard ahead. Drivers must be advised to turn off mobile transmitters, thereby minimizing the risk of prematurely detonating explosive charges.

Section 657 Charged holes

Before leaving a charged shot hole unattended, the detonator's lead wires must be shunted and a warning sign posted. These actions are intended to prevent unintended detonation and to warn workers of the potential hazard.

Underground Mines and Tunnels

Section 658 Application

No explanation required.

Section 659 Permitted explosives

Subsection 659(1)

Permitted explosives are designed specifically for use in coal mines where flammable gases may be present. These explosives are subjected to extensive testing by the Chief Inspector of Explosives, Natural Resources Canada.

Subsection 659(2)

The use of non-permitted explosives is allowed provided they meet other requirements of this section and the Director is satisfied with the safety measures certified by a professional engineer and has issued an Acceptance. Rock in which these explosives will

be used must not contain flammable hydrocarbon gases or coal. Many limestone formations lie near coal beds and carry flammable gases within them. The employer and the professional engineer must assess each formation before submitting an application to the Director.

Subsection 659(3)

The employer is responsible for ensuring that mine workers are appropriately trained and that controls are in place to ensure that workers do not take unauthorized explosives into an underground coal mine.

Section 660 Electric conveyance

Sparking or induction from electrical sources can cause explosives to detonate. Bumps, jerky movements and other impacts created by the conveyances can also cause detonation. Enclosing explosives in specially designed containers can provide protection against such hazards. However, the Director's permission must be obtained to use containers and the described conveyances.

Section 661 Mine shaft conveyance

The mine shaft is a major means of mine entry and exit. As well, the shaft cage is the main device used for transporting workers from the surface to underground and vice versa. Explosive products may not be transported on a shaft conveyance unless related safe work procedures have been developed, workers trained and the procedures implemented. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Section 662 Transport underground

This section is intended to provide strict specifications related to the transportation of explosives into an underground mine environment. Strict compliance and enforcement is expected from the employer in the interest of overall worker safety.

Subsection 662(1)

Detonators must be kept separate from explosives to avoid accidental unplanned detonation. The quantity of explosives that can be taken underground by a worker is limited to the quantity that can be used in one work shift. By limiting the quantity taken underground at one time by each worker, the *OHS Code* attempts to ensure that surplus supplies are not inadvertently left behind. Further, explosive inventories are easier to control.

Subsection 662(2)

Repealed

Subsection 662(3)

The purpose of this subsection is to control explosive product. A misplaced explosive could present a significant safety hazard. For that reason, the explosive-containing case or canister must be kept closed as much as possible.

Subsection 662(4)

Repealed

Subsection 662(5)

The underground mine blaster must ensure that when multiple cases or canisters are present at the working face, the cases or canisters are kept as far apart as reasonably practicable. Doing so limits the likelihood that one case or canister exploding will cause another one to explode or be damaged.

Subsection 662(6)

Because electric detonators can be very sensitive to extraneous electric current, a worker carrying electric detonators must not enter any room where cap lamps or related batteries are being charged.

Section 663 Drilling distances

Any hole previously in contact with explosives may still contain remnants of the original charge. As such, new holes must not be drilled within the specified distance. This prevents unintended and unexpected detonation of charge remnants.

Section 664 Underground mine blaster

Subsection 664(1)

The underground mine blaster is responsible for overall blast safety. Several safety precautions are listed and the blaster must ensure they are followed. If flammable gases or coal dust are present in higher concentrations than expected, a blast may trigger an explosion of the surrounding atmosphere which could travel through the entire mine.

Use of the correct explosive charge ensures the proper blasting of materials to be mined and minimizes damage to surrounding rock.

The defined precautions must also be taken to avoid premature initiation of charged holes.

Subsection 664(2)

If explosive gases are present, the blaster is responsible for ensuring that additional safety measures are taken. A blaster must not load or fire explosives if more than 1 percent of methane (or 20 percent of the lower explosive limit of a flammable gas) is present. Here the concern is that the blast might release additional quantities of methane that could accumulate to an explosive level during the blast itself.

Similar limitations are placed on the blaster to ensure that any coal dust is treated with non-combustible dust, or has been thoroughly wetted down to minimize the potential for a major gas or coal dust explosion.

Subsection 664(3)

If the atmosphere within 25 metres of a hole contains more than 1 percent of methane (or 20 percent of the lower explosive limit of a flammable gas), the blaster must ensure that loading or blasting is not performed. Any drilled hole must not be loaded and must be filled with stemming material.

Subsection 664(4)

This subsection is intended to protect workers from the effects of a blast. Blast guards are required to warn approaching workers. Blast guards must be stationed at a minimum distance of 75 metres from the blast area. The blaster is required to take refuge in a safe place before initiating the blast.

Subsection 664(5)

Although at least 10 minutes waiting time is mandatory, the underground blaster must ensure that this minimum requirement is consistent with the explosive manufacturer's specifications. If necessary, a longer period can be defined in the mine operating procedure.

Section 665 Blasting cable

Subsection 665(1)

The specified cable resistance ensures an adequate supply of current when using fixed voltage blasting machines.

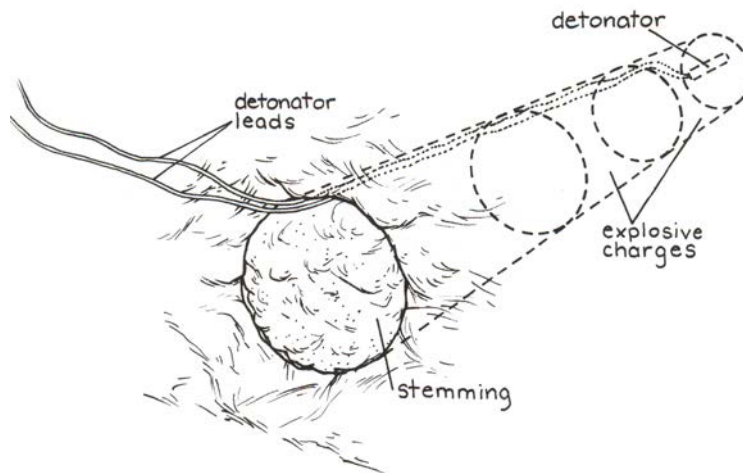
Subsection 665(2)

A cable used in blasting must be at least 75 metres long. It must reach from the blast area to a suitable refuge for the underground mine blaster.

Section 666 Delay detonator

This is a standard practice that has been legislated here to ensure blast holes are initiated from the bottom of the hole. This reduces the possibility of misfires and bootlegs. This inverse initiation is illustrated in Figure 36.9.

Figure 36.9 Inverse initiation



Section 667 Same manufacturer

This requirement prevents problems occurring due to differences in product and detonation characteristics.

Section 668 Series connection

This section requires the rounds in an underground coal mine blast to be connected in series. By using a series of tie-ins, vibration and other explosion effects are minimized. This reduces the potential damage to surrounding roof and rib formation, thus minimizing the potential for worker injury. This is not an issue in a shaft sinking (typically vertical) where all workers are removed from the shaft prior to the blast. In this specific application of blasting during shaft sinking, there is no hazard to workers so blasting during shaft sinking is exempt from this requirement.

Due to the nature of series blasting, material at the first hole to initiate has time to move, thus relieving the burden on the next hole in the series.

Section 669 Water

Water may render common explosives ineffective. Water resistant or sheathed explosives must be used in wet areas to prevent misfires and bootlegs.

Section 670 Stemming

Subsection 670(1)

Stemming prevents expanding gases created by blasting from escaping the hole. This focuses the blast energy where the rock needs to be broken. Non-flammable stemming materials are used to reduce the possibility of secondary coal dust and methane explosions.

Subsection 670(2)

Where water stemming is used, clay stemming is required to prevent the water from coming into contact with the explosive and rendering it ineffective. Two separate packings of water ensure at least one will work if the other leaks away.

Section 671 Firing in the same round

Only holes to be fired in the same round are to be loaded before the round is fired.

Section 672 Misfires

Subsection 672(1)

The handling of misfires is perhaps the most dangerous job in blasting and must be done under the direct supervision of an underground mine blaster.

Subsection 672(2)

These standard blasting practices have been legislated to stress their importance. The waiting period hopefully allows any defective detonator to detonate. It also provides time for the air to clear of fumes and smoke.

Disconnecting the blasting apparatus and short-circuiting the cable ends eliminates the possibility of an unintended detonation of the unblasted hole.

Once a parallel hole has been detonated, the blaster must search the broken rock pile for evidence that the misfire has detonated as well. If undetonated products are found, they must be carefully collected and then destroyed according to the manufacturer's specifications.

Subsection 672(3)

Water reduces the sensitivity of the explosive, thereby reducing the potential for detonation and explosion.

Subsection 672(4)

Friction along the lead wires as they dislodge from the end of the detonator could initiate the detonator.

Section 673 Misfire detonation

Subsection 673(1)

If a misfire has been identified and an effort will be made to detonate it (as compared to washing it out with water), the attempt to detonate the misfire must be done as a single hole blast. No other loaded holes or other misfires should be blasted at the same time.

The object of handling the misfire as a single hole blast is to minimize the potential for further blasting or possible dispersal of undetonated explosive products. An effort must be made to ensure the identified misfire has in fact detonated. This will reduce the hazard associated with inadvertent contact with undetonated explosive products.

Where more than one misfire is identified in the same area or blast pattern, each misfire must be handled independently.

Subsection 673(2)

If the detonation attempt is unsuccessful and the misfire clearly cannot be deactivated using a jet of water, this subsection recognizes another technique. This technique involves the drilling, charging and detonation of a parallel drill hole. Due to the extreme hazard associated with this operation, the minimum precautions that must be taken are specified. In particular, care must be taken to ensure that the drill bit does not encounter undetonated explosives in the hole. If evidence of undetonated explosives becomes apparent, all drilling activity should immediately stop and the operation should be reassessed.

Subsection 673(3)

Due to the sensitive nature of electric detonators in general, any faulty electric detonator must be handled with great care. To minimize the potential for detonation by sources of extraneous electricity, the leg wires of the faulty detonator must immediately be short-circuited. The detonator should then be handled and destroyed according to the manufacturer's specifications.

Section 674 Leaving a misfire

Subsection 674(1)

If the misfire cannot be handled and disposed of in one shift, either the subsequent shift will continue the work or the same blaster will continue the work the next day. Proper signage ensures that workers are informed that a misfire is present at that location.

Subsection 674(2)

The shift supervisor must be informed of any misfire that has not been deactivated. The supervisor must then inform any other mine workers who enter the mine.

Section 675 Compressed air

The procedure for such a coal breaking method must be developed by a professional engineer to ensure the safety and effectiveness of the process. This mode of coal breaking does not create the heat and flames that explosives do. Although it is a safe method for breaking coal, its scope is quite limited.

Section 676 Shock blasting

Subsection 676(1)

Shock blasting is generally used to relieve stresses and pressures developing for geotechnical reasons or because of gases trapped behind the face. Once stresses are released, the surrounding formations become more stable and easier to support with some degree of predictable behaviour.

A Director may allow shock blasting if the conditions of subsection 676(2) are met. An application for shock blasting must be submitted by the employer.

Subsection 676(2)

A professional engineer must prepare the procedures for performing shock blasting to ensure that related safety issues are adequately addressed.

Section 677 Surface shots

The absence of workers underground ensures no one is exposed to any hazardous condition during blasting.

Section 678 Permanent firing station

Subsection 678(1)

Firing from a permanent firing station underground is common practice. By posting blast guards and limiting the number of workers allowed in the area at the time of the blast, potential danger to the remaining workforce is eliminated.

Subsection 678(2)

Fumes and smoke created by a blast can be extremely hazardous. Since the ventilation system will carry such gases towards the return air system (downwind,) workers must be cleared to an appropriate fresh air location (upwind).

Section 679 Secondary blasting

Subsection 679(1)

These are standard procedures commonly used in coal mines. They are legislated to stress the importance and necessity of strict compliance.

For example, larger charges cause larger explosions and increase safety hazards. The limit of 0.5 kilograms of explosive and not more than two charges is designed to keep the blast to an acceptable size and limit safety hazards.

To minimize the potential for causing a catastrophic methane/coal dust explosion, the area surrounding the “top” charge must be cleared of coal dust and must be adequately rock dusted to within a 10-metre radius of the planned charge.

Subsection 679(2)

This subsection restricts secondary blasting if the methane content in the surrounding area is more than 0.3 percent (6 percent of methane’s lower explosive limit).

Subsection 679(3)

Since the hazards associated with secondary blasting, e.g., flyrock, vibration, etc., can be greater than in normal mine blasting, the place of refuge for the blaster must be at least 150 metres from the blast site. This compares to the 75 metres required for normal mine blasting.

Division 3 Underground Coal Mines

Section 680 Application

No explanation required.

Section 681 Annual plan

Annual mining plans provide the Director with general information related to planned mine development. They provide an opportunity to review and question planned development and to assess future worker risk and general management initiatives. In designing a mining plan, the professional engineer has many other considerations besides safety to take into account. These include production, economics, use of available resources and equipment, product quality, conservation and environmental impacts. The Director however, focuses only on worker safety. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Section 682 Underground coal mine surveyor

Subsection 682(1)

The *OHS Code* does not specify the qualifications and experience required for an underground coal mine surveyor. The employer is responsible for ensuring the mine surveyor is competent. The plans and records created by the surveyor are used to locate workers, trouble areas, facilities, rescue routes, ventilation systems and other materials during an emergency. To ensure successful emergency response, the surveyor's records must be accurate and up-to-date.

Subsection 682(2)

The availability and preparation of accurate and up-to-date survey information is vitally important for a successful and safe underground coal mine. Under the direction of the mine manager, the mine surveyor is assigned full responsibility for conducting surveys and developing plans required under this Part.

Subsection 682(3)

The employer must ensure that workers involved in surveying are competent and the employer must also be assured of the integrity of the final product. This is ensured by having all survey plans approved by a professional engineer.

Mine Workers

Section 683 Supervision

The underground coal mine employer is responsible for ensuring that underground coal mine workers are supervised by competent supervisors and managers. For supervisory and management candidates that meet a minimum standard of academic knowledge and experience, Alberta's Board of Examiners for mining issues a formal certificate.

According to this section, only persons holding a valid certificate may be appointed by the employer. Although the Board of Examiners assesses technical knowledge, the employer must ensure that a certified candidate has all of the other management skills necessary to successfully supervise or manage an underground coal mine.

Section 684 Required qualifications

Due to the critical contribution made by an underground coal mine foreman or manager or electrical superintendent, this section reiterates the fact that an employer must not appoint any person to these positions unless that person holds a valid certificate issued by the Board of Examiners for mining under sections 30, 31 and 32 of the *OHS Regulation*. Where a qualified and certified person is not immediately available, contracting or consulting services could be considered for short-term assistance.

Section 685 Mine Manager

Subsection 685(1)

The underground coal mine manager is the company representative who has the greatest opportunity to influence, and the greatest responsibility for, the health and safety of workers in an underground coal mine. It is the underground coal mine manager's position that is most often singled out in this Part when specific employer responsibilities are noted.

In Alberta, an underground coal mine manager must be appointed by the employer to supervise daily activities at the mine. Once the manager has been appointed, the Director must be notified without delay.

The Director confirms that the appointed mine manager is certified by Alberta's Board of Examiners for mining. This communication of appointment and the subsequent confirmation by the Director is intended to ensure the minimum qualifications established by the Board of Examiners are in fact maintained.

Subsection 685(2)

This subsection recognizes that qualified underground coal mine managers are becoming rare. This is due to the declining size of the underground coal mining industry and the fact that qualified candidates are leaving the industry.

While the appointed mine manager is temporarily away from the mine area, this section allows an employer to appoint an underground coal mine foreman to temporarily act in the mine manager's position. The foreman must hold an underground coal mine foreman's certificate. This approach is acceptable if not more than 30 workers in total work underground in the mining operation at any one time and the appointment is for not longer than seven days. The intent here is to provide the employer with some short-term flexibility while the appointed manager is temporarily away from the area.

Subsection 685(3)

An appointed underground coal mine manager is often required to be temporarily away from the mine site, possibly for several days. Such temporary absences must be recognized and accommodated appropriately. When an underground coal mine foreman is appointed as temporary underground coal mine manager, the appointed underground coal mine manager must, as far as practicable, remain in constant communication with his or her replacement. The common availability of cell phones, satellite phones and electronic communication make this possible.

Subsection 685(4)

If the appointed mine manager needs to be away from the mine area for more than seven days but less than 90 days, this section allows an employer to appoint an acting underground coal mine manager to act in the mine manager's position. The candidate must hold an underground coal mine manager's certificate. The intent here is to provide the employer with additional flexibility should the appointed manager be away from the mine area for up to 90 days.

Subsection 685(5)

If the appointed mine manager needs to be away from the mine area for more than 90 days, this section requires that the manager be replaced and a new manager be appointed. The candidate must hold an underground coal mine manager's certificate. The Director must be informed of the appointment as soon as possible.

Section 686 Combined operations

Subsection 686(1)

This section focuses on organizational and management aspects of combined operations and is important because of the impacts one operation can have on the other.

Any of the three parties listed in this section can declare a combined operation, but having made the declaration, this then binds all three parties to specific regulatory requirements for management structures.

Subsection 686(2)

If underground and surface mining operations are declared to be combined operations, the management structure at each mine and the shared management structure must be clearly defined and communicated to avoid any confusion.

The employer of the two operations must select a coordinator for the combined operation. This does not necessarily have to be one of the existing mine managers.

Subsection 686(3)

Each mine must still have its own manager. However, the requirements for a mine manager are extensive and may not leave adequate time for coordinating combined operations. A general manager or a vice-president may be a more appropriate choice for the role of coordinator.

Section 687 Working alone

Subsection 687(1)

Most production jobs in an underground coal mine are extremely dangerous. This subsection is intended to ensure that workers in such hazardous occupations do not work alone. This subsection specifically notes the activities that may be performed by a worker working alone at a working face. Workers performing the noted activities must be covered by the employer's working alone procedure.

Subsection 687(2)

The employer is responsible for ensuring that no worker works alone while producing coal at a working face. This limitation recognizes the extreme hazards associated with a dynamic coal mining face environment. The presence of two workers increases individual safety by having extra immediate help available in case of an emergency.

Section 688 Unsafe conditions

Subsection 688(1)

This subsection is based on the principle that team work and shared accountability ensure everyone's safety. Regardless of role or seniority, any worker finding a situation that might be hazardous to workers in an underground mine is responsible for alerting workers to the problem and notifying a mine official who must implement evacuation plans and take action to remedy the situation. Records of the event are used in subsequent review, addressing both the cause of the event and the effectiveness of monitoring and management systems.

Subsection 688(2)

The same responsibilities described in subsection 688(1) apply to workers at the surface of an underground mine.

Subsection 688(3)

Given that a specified hazardous situation has been reported to a mine official, this subsection compels the official to take immediate action by withdrawing workers from the area affected by the hazard if there is any potential of workers being exposed to the reported hazard. The emphasis here is on "immediate action" to minimize worker

exposure to possible injury. Such actions must be taken since the underground coal mining environment can rapidly change and a delay of decisions or action can result in serious consequences.

Subsection 688(4)

This subsection requires that a record of identified serious hazards be maintained and brought to the attention of mine workers. By recording identified hazards, workers can review the records as often as desired. Records allow developing trends to be analyzed and may assist both management and workers to identify needed remedial actions.

Section 689 Shift change

The mine foreman is responsible for underground safety. In particular, any area that is unsafe for mine workers must be isolated and access restricted.

Section 690 Shift report

Subsection 690(1)

To ensure the continuity of communication between shifts and shift foremen, an underground coal mine foreman must complete a shift report. Normally, for thoroughness, that report is finalized at the end of the shift. Any unusual safety hazards or issues must be highlighted in the shift report for the benefit of both the on-coming shift foreman and the employer.

Subsection 690(2)

Given that the shift report prepared by the previous foreman could contain essential information related to mine conditions or unusual hazards, the oncoming foreman must read and initial the report. Any unusual circumstances must be brought to the attention of on-coming workers.

Subsection 690(3)

To provide mine workers with the most current information related to mine conditions before work begins, the oncoming foreman must personally inspect the section of the mine where his or her workers will be assigned. This requirement is mandatory unless the assigned area has been inspected by another underground coal mine foreman in the preceding four hours. Of particular concern is the possibility of unstable ground, a build-up of explosive gases, an accumulation of water or other dangerous situation that could place oncoming workers at risk of injury.

Subsection 690(4)

If workers remain in the mine at the end of a shift to complete a critical task or for assigned overtime, the current shift foreman must post an inspection report that lists the

names and locations of the remaining workers. This posting of information is of benefit to the remaining workers and the oncoming workers since the actions of one group could be hazardous to the other.

Subsection 690(5)

To make sure that the report described in subsection (4) is visible and available to anyone who might need to see it, it must be posted in a designated location. During an emergency, the employer must be able to quickly determine how many workers are in the mine. This can be of particular assistance to mine rescue personnel if an emergency rescue is necessary.

Section 691 Record of workers

The employer is responsible for ensuring that every worker records when they enter and leave the mine as well as when they plan to stay beyond a regular shift change. In many mines, each worker hangs an identification tag on a board showing the location in the mine where they will be working. Upon leaving the mine, workers place their tags on the logout board.

Section 692 Self rescuers

A self-rescuer is a type of respiratory protective equipment that underground miners can put on quickly if the atmosphere becomes hazardous due to noxious gas concentrations or smoke. Self-rescuers are intended to give workers enough time to safely reach a refuge station or the surface, depending on how far away the worker is from either of these locations. Everyone who enters an underground mine must carry a self-rescuer and be trained to use it properly.

This section requires the use of self-contained self-rescuer devices. Such devices are self-contained because they generate oxygen and are also known as oxygen-generating self-rescuer devices. International experience in recent years has shown that carbon monoxide filter-type devices alone can be insufficient as workers have perished from oxygen deficiency. Industry has therefore adopted the more effective self-contained self-rescuer device because it generates oxygen to breathe and excludes any airborne contaminants. Such devices are now widely available and typically have a one-hour rating. This means that they provide a worker with oxygen for up to 60 minutes depending on the worker's physical condition, fitness and activity level.

Subsection 692(a)

Self-rescuers are intended to give workers breathable air for long enough to safely reach a refuge station or fresh air, depending on how far away the worker is from either of these locations. Self-rescuers must be available for all persons underground.

Two types of self-rescuers are commonly used in underground mines. The first is the filter type which is equipped with a filter that protects the wearer from as much as one percent carbon monoxide (CO) for one hour. In the presence of a high concentration of CO, the filter self-rescuer can become very hot. The filter type is designed only to deal with CO, a product of combustion and lethal at very small concentrations. Thus the worker is breathing in mine air but with the CO filtered out. If the oxygen content of the air is low, this type of self-rescuer cannot help and the worker is still at risk.

The second type, the oxygen generating self-rescue device, generates a supply of oxygen for the worker to breathe and is helpful in all hazardous atmospheres. In recent years, experience has shown that this second type of self-rescuer is more effective.

Subsection 692(b)

An employer must ensure that every person who enters an underground coal mine must be in possession at all times of an oxygen generating self-rescuer. This requirement does not necessarily imply that the unit must be worn on a belt. It does require that the unit be readily available at all times.

Subsections 692(c), 692(d) and 692(e)

Every person who enters an underground mine must be trained to use an oxygen generating self-rescuer properly. Typically, this involves an explanation and demonstration of the self-rescuer often followed by a hands-on exercise of actually putting on a training unit. The context of typical emergencies and escape routes should be explained. In mines in which the walking time from the furthest working section to fresh air is greater than the life of a single unit, additional units must be provided so that an exhausted unit may be replaced with a fresh one. In such mines, it is important that training include the procedure required to exchange a used unit for a fresh one without inhaling contaminated air.

Such training ensures that there is no uncertainty or hesitation in worker response when putting on or exchanging oxygen-generating self-rescuer units. Experience in incidents around the world has shown that workers have perished while trying to put on their self-rescuer unit, possibly due to inadequate or outdated training. Thus this section requires refresher training every three months.

Records of worker training in the use of self-rescuer devices must be maintained and kept at the mine. This confirms that training has taken place and helps with the scheduling of refresher training.

Subsection 692(f)

The employer is responsible for providing a sufficient number of self-rescuers to supply one unit to every person underground. This includes personnel not rostered to work every shift but who are required for other reasons, e.g., to make inspections or visitors.

The employer must also ensure that additional self-rescuers are stored and strategically located in caches along the emergency escape route(s). This allows any person to put on a fresh unit to ensure that they do not run out of oxygen when walking from the most distant working section to the defined emergency exit during a mine emergency.

Section 693 Means of ignition

Subsection 693(1)

Means of ignition are provided by any and all items that have the potential for causing a fire or explosion. Means of ignition are not limited to matches and lighters but can include non-permissible lighting, defective permissible lights, flame traps on equipment, foil wrapping on candy and other materials. All such items are commonly known as “contraband” and are prohibited in underground coal mines.

One means of enforcing this prohibition is to allow the employer to conduct periodic searches of workers and visitors prior to going underground to ensure that they are not in possession of contraband items.

Subsections 693(2) and 693(3)

Workers are also responsible for ensuring that contraband materials are not taken into underground mines. Employers must ensure workers are aware of this requirement through a system of checks and reminders as workers enter the mine. Employers must also clearly mark restricted areas where smoking materials and other sources of ignition are prohibited. Workers must comply with these requirements.

Subsection 693(4)

Despite the prohibitions noted in subsections (1) through (3), this Part does allow some limited means of controlled ignition to be brought into an underground coal mine. For example, subsection 659(1) allows permitted explosives in the mine.

Section 694 No smoking warnings

The employer must determine that tobacco, matches or other means of ignition are not allowed in designated or hazardous locations at the surface of an underground coal mine. Such locations must be appropriately signed and marked as “no smoking” areas.

Mine Equipment

Section 694.1 Equipment for use in underground coal mines

This section addresses a concern that the Code does not always acknowledge the validity of equipment certifications/approvals from other internationally well

recognized jurisdictions such as MSHA in the U.S. Underground coal mine operators are increasingly being forced to use equipment certified in other countries, especially the U.S. This section gives added flexibility to employers with no reduction to safety and health while maintaining compliance with the *OHS Code*.

Section 695 Propane installations

Subsection 695(1)

The manufacturer's specifications and the *Alberta Safety Codes Act* define the general safety precautions and the technical standards to be applied when installing and maintaining propane equipment. The employer is responsible for ensuring that propane installations at an underground coal mine site comply with the applicable requirements.

Subsection 695(2)

Due to the explosive nature of compressed gases, storage facilities must be protected from impact by moving vehicles. Even a minor impact could cause a propane leak or an explosion.

All propane installations should be protected by collision barriers to minimize the potential for contact by moving equipment.

Propane is heavier than air and accumulates in low-lying areas. Care must be taken to ensure that proper air flow or ventilation is provided in storage enclosures. Where appropriate, detection devices should also be installed to ensure that leaking gas does not enter the underground workings.

Subsection 695(3)

Inspections are intended to ensure that leaking propane does not present an additional hazard to workers underground or related mine facilities. Propane accumulates in low-lying areas and could conceivably find its way into the underground workings via rock fractures or even the mine ventilation system. For this reason, the location of propane installations must be carefully controlled and related propane facilities appropriately maintained.

Subsection 695(4)

This subsection outlines specific propane system components that must be checked at least every three months. The objective is to prevent propane leakage that could create an additional hazard to mine workers.

For ease of follow-up and investigation, it is recommended that all inspections be recorded in a maintenance logbook or computerized database maintained for that purpose.

Subsection 695(5)

Due to the hazard created by propane leakage and accumulation, this subsection requires that each underground coal mine be equipped with propane gas detectors. These detectors must be installed to detect propane leaking into the mine ventilation system and visibly or audibly warn workers of the leak.

Subsection 695(6)

Similar to propane space-heaters used in large surface buildings, mine heaters are used to heat cold incoming air in the winter. The warming of the intake air helps avoid freezing temperatures in the mine workings, especially those close to the surface.

Mine air heating systems could ignite a fire or explosion if not used correctly. Where such mine air heating systems are used, whatever fuel source they use, the employer must satisfy the Director of their safe application and use and have it approved by the Director.

Section 696 Bulk fuel storage

Subsections 696(1) and 696(2)

Designers of bulk fuel storage facilities must meet the requirements of this section to ensure that leaks do not occur. By locating bulk storage installations at a lower ground elevation than the entrance to the mine, leaks can be prevented from seeping into the mine.

Secondary containment structures and impermeable dikes also prevent leaking fuel from flowing into the mine by retaining gas or liquid and preventing seepage.

Section 697 Voice communication

An effective and reliable communication system is perhaps the most important instrument in maintaining safety and responding to emergencies. Worker confidence is also affected by the availability and quality of the communication system. Although a wide variety of sophisticated systems are available, the focus of this section is the minimum requirements that ensure safety.

Subsection 697(1)

An effective voice communication system is essential in an underground coal mine, both for mine efficiency and mine safety. The employer must ensure that an interconnected communication system is installed throughout the mine. Communication stations must be close to key production and high activity areas so that workers can call for assistance or rescue and pass on working instructions when required.

The use of “leaky feeder” systems throughout the underground coal mine makes the use of hand-held two-way radios an effective supplement to telephone systems. Despite this, hard-wiring of telephone stations is the expectation here.

Subsection 697(2)

Exploratory drivages up to 60 metres in length have been exempted because visual and voice communications are adequate in these smaller areas.

Subsection 697(3)

Because of the critical contribution that an electric communication system can make to worker safety, the employer must ensure that the system has a backup power supply. The backup power supply must be separate from the main power supply system and must remain operable if the main power system fails.

The focus here is on a secondary source of power such as an auxiliary generator.

Section 698 Location

Since rapid communication can minimize the potential for a major safety incident, this section specifies where some of the interconnected voice communication stations must be located. In general, the locations are where working activities are routinely undertaken and where workers are expected to be found.

The Director is authorized to order the installation of interconnected voice communications stations at any other location that the Director considers appropriate.

Section 699 Permanently attended stations

Subsection 699(1)

It is expected that an underground coal mine has at least one permanently attended voice communication station on the surface. A permanently attended station provides a critical link to workers underground and is used to pass on both routine operating and periodic emergency information.

This subsection requires that the permanently attended surface station be equipped with a telephone connection to the public telephone system. This ensures that additional emergency response assistance can be requested immediately.

Subsection 699(2)

For the primary purpose of alerting mine workers and emergency response personnel, the permanently attended surface communication station must be equipped with an audible alarm system. The alarm system must be installed and maintained so that it can be initiated from the permanently attended surface station in an emergency.

The alarm system must alarm on the surface and in the underground workings to initiate an evacuation of workers underground.

Section 700 Portal

Subsection 700(1)

In addition to protecting workers from falling or collapsing ground, portals ensure access to the mine during emergencies. Only non-flammable materials can be used for construction so that portal structures remain intact and operational during a fire.

Subsection 700(2)

A professional engineer must prepare and certify a design that adequately addresses all factors affecting the structure such as construction materials, position of the opening and stability of the formation around the opening.

Section 701 Mine outlets

Subsection 701(1)

The requirement for at least two outlets or emergency exits is the same for mines and many other workplaces. Underground mines are more restrictive and more prone to emergency situations than buildings.

These two outlets generally form part of the ventilation system in underground mines by providing fresh air to working areas through one outlet and returning used air through the other. The underground workings include cross cuts driven at certain intervals to provide alternate escape routes as well as pathways for ventilation tubing. One of the outlets often serves as a conveyor gallery for transporting coal out of the mine.

Subsection 701(2)

The availability of a voice communication system, in case of emergency, allows workers to communicate their presence directly to the command centre.

Subsection 701(2.1)

Mine outlets are typically either vertical shafts or inclined slopes. In an emergency such as a fire or explosion, two mine outlets located too close to one another may both be damaged, thus potentially trapping workers underground. A safe separation distance for mine outlets must be maintained for all foreseeable emergencies. The employer must ensure that the mine openings or outlets are at a safe distance from one another by ensuring the designs are certified by a professional engineer. In the event of an emergency, at least one opening will allow worker egress.

The safe separation distance will vary from mine site to mine site and will depend upon many factors, e.g., geology—the type of surrounding rock mass, its structure and properties geotechnology—the interrelationship and stability of rock mass and soils and engineered structures such as shafts, tunnels and ground slopes; and physical factors—such as the relative geometry, shape and size of the structures involved.

Subsection 701(3)

Exploration and early development work for a mine are exempt from the requirement of subsection 701(1) for practical reasons. However, the employer must ensure worker safety by conducting site hazard assessments as required by Part 2.

Subsection 701(4)

This subsection recognizes that under some circumstances, such as in the development of new areas, workers must work in a “single-entry” or blind heading, tunnel, roadway or shaft. In such circumstances, especially in the sinking or vertical shafts, working space is restricted and thus the number of workers allowed in the mine working must be limited. In such cases this limit is set at a maximum of nine at any one time.

It is also recognized that in an emergency, should there be nine persons already in the working area, it may be impossible for some of them to come out to allow emergency response and mine rescue personnel in. This subsection allows such emergency personnel to enter in sufficient numbers to safely conduct their work. In the absence of the extra outlet, monitoring and control take on higher priorities to maintain required safety levels.

Section 702 Escape ways

Subsection 702(1)

Good housekeeping is a recognized factor that contributes to reducing worker injuries. In the confines of an underground coal mine, housekeeping is even more critical since emergency evacuation could potentially occur in complete darkness. To maximize the potential for rapid worker evacuation or escape, all underground tunnel ways, shafts and related access facilities must be kept clear of all obstructions at all times. In particular, accumulations of ice must be routinely removed and all other obstructions addressed as appropriate.

Several requirements ensure that workers, in an emergency, can quickly determine the correct direction for escape. The first is signage to guide workers to each surface outlet. Both fluorescent/retroreflective and geometrically shaped signs are recommended so that workers can determine direction under conditions of limited visibility and lighting. The second is the provision of lifelines including directional indicators, which must be used. Lifeline continuity must be maintained in practical ways and special markers will

indicate the direction of exit and the location of caches of reserve oxygen generating self-rescuer units.

Subsection 702(2)

All emergency escape routes should be kept free of flowing water, i.e., whether from ground water, surface water or leaking pipes, etc., especially stairways and ladders. This helps prevent slippery and icy conditions or even ice-blockages, all of which could complicate, restrict or impede efficient emergency egress from the mine. All water must be directed away from stairways to minimize slipping hazards, especially during worker evacuation.

Subsection 702(3)

Escape ways inclined at more than 30 degrees from the horizontal must be equipped with devices that enable and do not hinder rapid worker escape in case of emergency. Walkways, stairs and ladders are mandatory and must be routinely inspected to ensure that they are maintained in a state of good repair.

Any shaft or tunnel way designated as an emergency escape way must allow a worker to leave the mine safely and by definition must lead to a surface outlet.

Subsection 702(4)

To ensure that escape under emergency conditions can be done as efficiently as possible, this subsection defines the minimum acceptable dimensions of an escape way. The 2-metre high and 2-metre wide dimensions allow a worker to move rapidly in an upright or semi-upright position when leaving the mine.

Section 703 Manholes

Subsection 703(1)

This subsection focuses on mine levels or tunnels in which haulage equipment and mine workers routinely travel at the same time. Facilities must be provided to give the worker an appropriate means of avoiding the moving equipment. In an underground mine that means of avoidance is provided by specially excavated “manholes” or places of refuge into which a worker can step.

Along underground haulage routes, this subsection requires that manholes be established at least every 20 metres (65 feet). Some exceptions to this requirement are provided in subsection 703(2).

Subsection 703(2)

Under certain conditions the employer is allowed to forego installing manholes. Unless a hazard assessment indicates that a manhole should still be installed, manholes are not

required if haulage equipment speed does not exceed 8 kilometres per hour (5 miles per hour). The physical dimensions of the travelway must also provide a clearance of at least 1 metre between the equipment and any worker.

Subsection 703(3)

To ensure that sufficient room is available for a mine worker to avoid contact with moving haulage equipment, this subsection specifies the minimum dimensions of a manhole or place of refuge. To ensure that the manhole can be used when needed, it cannot become a storage area for garbage or spare parts, etc. Manholes must be kept clear at all times.

Manholes must be clearly identified (usually with signage) and numbered. The signage and numbering ensure that assistance can be directed to the correct location as quickly as possible during an emergency.

Vehicles

Section 704 Underground fuel stations

Subsection 704(1)

Underground filling operations and fuel storage areas are managed with extreme care and discipline because of the ever-present potential for fire and explosion. Filling stations must be certified by a professional engineer.

Subsection 704(2)

The requirements stated in this section are the minimum required for controlling fire and explosion hazards and ensuring worker safety. Key features are systems to control or collect fuel seepage and the use of non-flammable construction materials. Outward opening fireproof doors are also mandatory.

Subsection 704(3)

Due to the ever present risk of fire, each fuel station must be equipped with suitable firefighting equipment that is readily available and easily accessible.

Section 705 Diesel fuel

Subsection 705(1)

The characteristics of commercial diesel fuel can vary significantly and emissions from some fuels can have a negative impact on worker health. This subsection specifies that only diesel fuel that at least meets CGSB Standard CAN/CGSB 3.16-99 AMEND, *Mining Diesel Fuel*, can be used in Alberta underground coal mines. The “Specified Limiting

Values” provided in the referenced standard are shown in Table 36.1. The Standard should be consulted for additional details.

To reduce the hazard associated with large volumes of stored fuel, the maximum quantity allowed to be stored underground is limited to that required for 24 hours of work unless permission to store more is given by the Director.

Subsection 705(2)

The employer must ensure that appropriate procedures have been developed and workers trained to minimize the spilling of diesel fuel during refuelling operations. Fuelling nozzles should be designed to allow only manual filling by a worker or attendant. Automatic tripping devices are discouraged due to the potential for malfunction, with resulting over-pressurization and/or spillage. Where some spillage is inevitable, drip pans or spill collection devices must be used to minimize the fire potential.

Subsection 705(3)

Since empty fuel containers still contain some residual fuel or related fuel fumes, they cannot be allowed to accumulate within the mine. If left to accumulate they could present an additional hazard during a fire emergency. All empty diesel containers must be removed from the mine daily.

Subsection 705(4)

As a precaution against fuel spill accumulation and potential fire, all spilled fuel and oil must be cleaned up immediately. For clean up purposes a supply of non-flammable absorbent material must be available in the fuelling station at all times.

Once used to clean up spills, the absorbent material must be disposed of in a flameproof receptacle. The material must be removed from the mine at intervals of not more than three days.

Subsection 705(5)

To reinforce the requirements of subsections (1) through (4), the employer must post a copy of the subsections in a conspicuous place at the underground fuel station. To ensure that workers comply with these requirements, it is highly recommended that refresher training take place on a periodic basis and that such training be documented. To ensure that the posted copy remains legible, clean copies should be re-posted as necessary.

Table 36.1 Specified limiting values		Min.	Max.	Test Method	
				ASTM	CGSB
6.4	Flash point, ¹ °C (par.9.1)	52.0	—	D 93 or D 3828	(Par. 6.16)
6.5	Kinematic viscosity ² at 40°C, mm ² /s (cST)	1.30	4.10	D 445	
6.6	Distillation 90% recovered, °C End point, °C	— —	325.0 355.0	D 86	(Par. 6.17)
6.7	Water and sediment, % by volume	—	0.05	D 1796	(Par. 6.18)
6.8	Acid number	—	0.10	D 974	
6.9	Sulphur, ³ % by mass (par 9.1) Special Special-LS	 — —	 0.25 0.25	D 1266 D 1552 D 2622 D 4294 D 5453	CAN/CGSB-3.0 No. 16.0 (Par. 6.19)
6.10	Copper strip corrosion, 3h at 50°C	—	No. 1	D 130	
6.11	Carbon residue on 10% bottoms, % by mass	—	0.10	D 4530	
6.12	Ash, % by mass	—	0.010	D 482	
6.13	Ignition quality, cetane number, ⁴ (par.9.1)	—	40.0	D 613	(Par. 6.21)
6.14	Electrical conductivity at point, time and temperature of delivery to purchaser, pS/m (par. 7.1)	25	—	D 2624	
6.15	Density, at 15°C, kg/m ³	—	850	D 1298 D 4052	(Par. 6.22)

1. A higher flash point may be specified in special applications
2. The SI unit for kinematic viscosity is the square meter per second. The preferred multiple for fluids in this viscosity range is the square millimeter per second which is equivalent to a centistoke (i.e., 1 mm²/s = 1cST).
3. The sulphur limit may be established by government regulations or as specified by contractual agreement.
4. Fuel having a higher cetane number may be necessary for some engines. Conditions of operation may also indicate the specification of a higher cetane number.

Section 706 Control levers

Subsection 706(1)

This section ensures mobile equipment is left with the operating lever in the neutral position so that the equipment will not move and create a danger. The lever must be designed to be removed only when the lever is in the neutral position. This prevents removal of the lever while engaged in the operating position, preventing continued unintended movement or equipment operation.

Subsection 706(2)

The use of remote controlled equipment is now common in underground coal mines. For example, in room and pillar mining where the distance from the cutting head to the driver's cab is 6 metres, the maximum depth of cut to prevent the operator from going under the unsupported roof is 6 metres. However, the conditions may allow an extended cut of 12 metres or even 18 metres to be made. In such circumstances, the use of a radio controlled remote unit allows the operator to remain under a supported roof and still control the continuous miner machine as it makes an extended cut.

Whenever such remote controlled equipment is used, the employer must ensure it is used in accordance with the manufacturer's specifications. These may include the following operational safeguards:

- (a) provision of a written procedure;
- (b) ensure that radio frequencies used underground are independent of one another so that a signal given to one machine will not somehow initiate an action on another separate machine;
- (c) allow selection of either manual or remote operation mode;
- (d) the operator must have sight of the equipment, either directly or via a camera and screen display;
- (e) clear signage of the area where remote controlled equipment is in use or may be in use;
- (f) only one authorized operator can operate remote controlled equipment at a given time;
- (g) a detailed log must be kept of remote controlled equipment use to provide a record of specific operational circumstances. This information may be useful in an incident investigation or for maintenance/operational trend analysis, etc.
- (h) ensure that remote controlled equipment is properly equipped and maintained to prevent unexpected/unauthorized use or interference with other operations that use radio frequencies, such as blasting; and
- (i) the radio frequency selection unit is sealed to prevent the operating frequency from being altered.

Roof and Side Support

Section 707 Support system

Subsection 707(1)

In designing entrances and roadways, the professional engineer must address the physical characteristics of the strata and structures, as well as stresses created by the mining sequence. Accurate evaluation of these factors must be contained in a geotechnical analysis.

Subsection 707(2)

Information collected from the geotechnical analysis is also used to determine appropriate support for the roof and sides of excavations. Safety factors addressed by the design of these support systems contribute to the stability and safety of the overall mining operation. All support systems and pillars must therefore be designed by a professional engineer.

Subsection 707(3)

To ensure a detailed geotechnical analysis is completed, this subsection specifies some of the factors that must be considered by the geotechnical engineer. Despite the requirements, other relevant factors can be included based on the engineer's professional judgment. These include the type and position of the seam and the rock layers above and below the seam, their strength, discontinuities, groundwater, geological structure, near-surface deposits, interaction of workings in more than one seam, mining sequence through time, stresses and strains, subsidence, the mine excavations and outbursts of rock, water or gas.

Subsection 707(4)

While geotechnical analysis and evaluation determine the minimum support required to provide relative stability and safety, additional support can improve workers' comfort level. Additional supports can be added at the worker's discretion to ensure safety.

Section 708 Extractions

Subsection 708(1)

A systematic and sequenced approach to the recovery of pillars is essential to ensure both the safety of workers involved in depillaring and the safety of others working in the immediate area. An uneven collapse line or roof fracture between the gob and mining area could create overhangs and cause an uneven distribution of stresses, making those areas unstable. Success in maintaining an even collapse line and

systematic collapse of roof materials into the gob allows the mining and recovery of coal resources without undue reserve losses or safety concerns.

Much of the success of a depillaring operation comes from the quality of the initial ground support program, an on-going maintenance program and the operation of a systematic sequence of pillar recovery.

Subsection 708(2)

Due to the safety hazards associated with extraction operations, a professional engineer must define and certify a safe method and sequence for those extraction operations.

Section 709 Operating procedures

Subsection 709(1)

A code of practice for support systems must clearly describe how roof supports are to be safely installed and withdrawn, and how roadways are to be repaired and restored following a roof collapse. In depillaring operations, safe operating procedures must focus on maintaining an even breakline. For roadway maintenance and repair, the procedures must detail the process and frequency of these activities and illustrate support locations. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 709(2)

The mine manager is responsible for posting a copy of the roof support code of practice.

Section 710 Removal of ground supports

Subsection 710(1)

Ground supports are installed to protect workers from roof or rib collapse and to maintain the structural integrity of underground openings. The installation of ground support systems is specified by a geotechnical engineer and installations are completed according to the mine manager's code of practice as noted in section 709. Due to the overall impact on mine stability and related worker safety, ground supports cannot be removed without the permission of a mine official. According to this Part, that mine official is either the underground coal mine manager or underground coal mine foreman.

Subsection 710(2)

Since removal of ground supports could lead to imminent ground collapse, the mine manager must ensure that workers are protected from falling ground by further ensuring that temporary supports are in place. Materials for such temporary supports must be readily available to the workers and installed prior to the designed supports being removed.

Subsection 710(3)

Worker safety is the ultimate concern. If a hazardous situation could quickly develop, despite subsection (2), other supports must not be used under the conditions specified unless related procedures have been certified by a professional engineer according to subsection (4).

Subsection 710(4)

The removal of supports from the area of the gob or from under an insecure roof could place a worker at significant risk of injury from falling ground. For this reason, it is mandatory that a professional engineer develop and certify the means and methodology to be used. By using certified safe work procedures, the related hazard to mine workers should be minimized.

Ventilation System

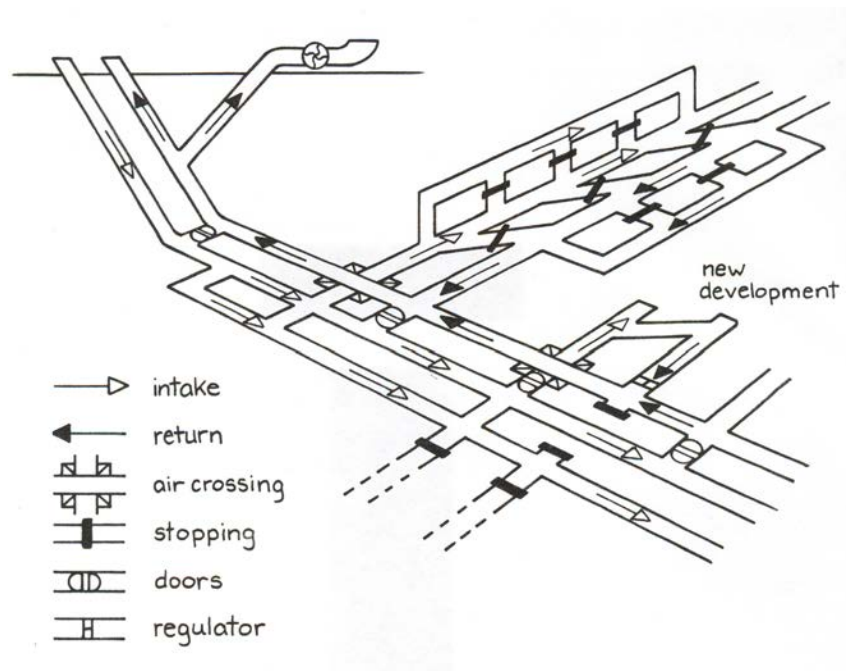
Section 711 Ventilation system

Subsection 711(1)

The professional engineer's design must ensure that air velocities are sufficient to create required turbulence without raising dust or stratifying the ventilation current. Locations of fans must prevent recirculation of contaminated air and stoppings must be provided to prevent leakage and short circuiting. Figure 36.10 illustrates a mine air distribution system.

Although the *OHS Code* sets specific standards for air content and quality, other considerations such as comfort level, drops in pressure and sudden emissions of methane may require higher standards.

Figure 36.10 Schematic mine air distribution system



Subsection 711(2)

Safe operating procedures are required to ensure ventilation problems are thoroughly and uniformly addressed. The safe operating procedures can also serve as a quick reference and training tool. The procedure must be certified by a professional engineer. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 711(3)

Unless an acceptance is provided by the Director, the use of compressed air for ventilation is prohibited. Its quality is largely unknown and once the air hits the ventilation system, it becomes breathing air for workers. It must therefore meet specific quality standards. It is also quite probable that ventilation using compressed air will not meet desired velocity and turbulence objectives, especially at working faces.

Section 712 Air velocity

Subsection 712(1)

The minimum air velocity allowed at a working face under normal working conditions is specified as 0.3 metres per second. This minimum velocity is mandated to ensure that methane gas levels and coal dust generation are maintained at acceptable levels in this

most hazardous location. Both methane gas and coal dust are liberated by the coal cutting activity.

Subsection 712(2)

Unused or intermittently used roadways can sometimes become pockets for methane accumulation. Minimum air velocity standards ensure that methane is adequately diluted and exhausted through the system. Methane is lighter than air and in low air velocities can accumulate in layers close to the roof. Such layers can, in certain circumstances, even move up gradient against the prevailing ventilation flow. Inadequate velocity and laminar flow in mine roadways can create conditions that lead to methane layering. Such layers can contain potentially explosive mixtures of methane in air which may go undetected. These layers can be removed by mixing the general air body by more turbulent airflow.

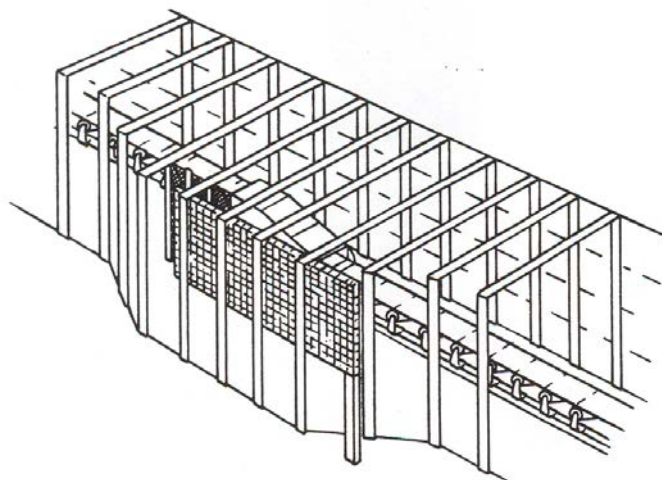
Subsection 712(3)

The maximum air velocity allowed in a coal mine must also be restricted in order to control dust. Higher velocities pick up coal particles in correspondingly larger quantities and create coal dust problems. When coal dust is combined with specific concentrations of oxygen, an explosive atmosphere can develop that can release more energy, if it explodes, than a methane atmosphere.

Apart from explosion hazards, coal dust impacts worker health, visibility, covers equipment, dulls lighting and creates a generally unhealthy atmosphere. As a countermeasure, coal dust in roadways must be removed and the areas dusted with stone dust to reduce any explosion potential and improve visibility.

To reduce dust problems at transfer points, roadways are sometimes widened to reduce air velocity. An illustration of this is provided in Figure 36.11.

Figure 36.11 Roadway enlargement



Subsection 712(4)

As indicated, the Director may issue an acceptance if an acceptable alternate has been certified by a professional engineer as providing a level of protection that is equal to or greater than the limits specified in subsections (2) and (3) for the actual mining conditions expected.

Section 713 Return airway

The air used to ventilate garages, bulk oil storage areas, filling stations and transformers rated at more than 1000 kilovoltamperes must not be reused for ventilating other areas. This air becomes contaminated with various hydrocarbon vapours and other emissions and is not fit for ventilating any other area. In coal mines, efforts are continually made to avoid the addition of any explosive gases to the already hazardous environment.

Section 714 Doors

Subsection 714(1)

Airlock doors prevent the uncontrolled leakage or loss of ventilation air from one roadway (intake air) into another roadway (return air). Airlock doors must be capable of withstanding the pressure differential between the two headings and allow workers, vehicles and materials to pass through. Generally, airlock doors are installed in tandem so that only one door is opened at a time, reducing loss and mixing of air.

Subsection 714(2)

Ventilation engineers design doors to direct or redirect air from one working area to another. Any tampering will cause serious problems with the quality and quantity of the ventilation. As a result, workers are not allowed to leave open any shut door unless properly authorized to do so. The same applies for closing any open door.

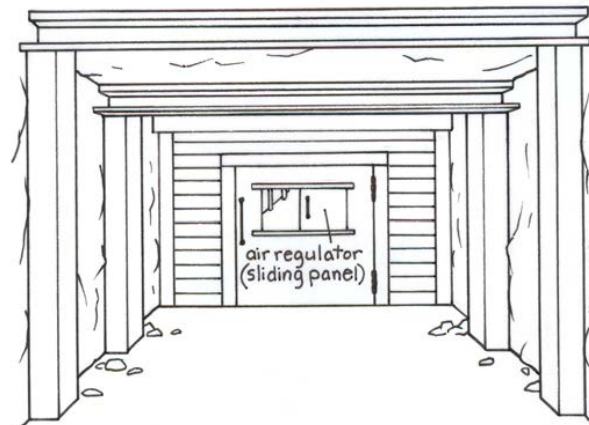
Subsection 714(3)

This safety measure of ensuring one door remains closed during an air reversal prevents uncontrolled air leakage and loss of ventilation efficiency.

Section 715 Stoppings

Stoppings are used as barriers in cross cuts between intake and return roadways. They are designed to prevent uncontrolled leakage resulting from the pressure differentials across the stoppings (see Figure 36.12).

Figure 36.12 Stopping for ventilation regulation



To ventilate a mine economically and effectively, areas not in use or not requiring any fresh air are sealed off with suitable stoppings. This prevents the loss and waste of ventilating air and prevents the potential of contaminated air in worked out areas from entering active working areas. Stoppings are also used to control the gob environment and ensure that the active working areas remain safe. If a hazardous condition develops behind stoppings, appropriate remedial measures must be taken. Ready access to the face of stoppings must be maintained at all times for monitoring, control and emergency activities.

In room and pillar mines it is important, as far as practicable, to isolate conveyor roadways. Conveyor systems are susceptible to fire. Using stoppings to isolate them minimizes the potential contamination of air in adjacent intakes or return airways. This provides the maximum opportunity for escape by mine workers.

Section 716 Seals

Subsection 716(1)

Worked out areas of a mine can still present a significant hazard to underground coal mine workers. Of particular concern is the potential for gases or water to accumulate or for the spontaneous combustion of coal or coal dust, resulting in fire and/or explosion. For this reason, worked out or inaccessible areas must be securely sealed off.

Subsection 716(1.1)

Seals required under subsection (1) must be built to withstand over pressure effects created by any subsequent explosion within the sealed areas. The minimum levels required are based on those recently introduced in the U.S. These minimum levels are an over pressure of 345 kPa (50 psi) for monitored seals. If such seals are designed to also contain a known or suspected fire under subsection (4), then minimum seal design requirements increase, for example, to a minimum over pressure of 800 kPa (120 psi) for

unmonitored seals, rising to an over pressure of 4.4 Mpa (640 psi) if an explosion pulse can be expected.

Subsection 716(2)

Since time is the critical factor in preventing the accumulation of dangerous gases or water or the generation of spontaneous combustion, this subsection requires that such abandoned areas be sealed off within three months of mining activities ceasing in those areas.

Subsection 716(3)

Although a properly designed seal minimizes potential hazards to mine workers, knowledge of what is happening behind a seal is also critical to worker safety. For this reason, the employer is responsible for ensuring that such behind-the-seal conditions are regularly monitored. Where warranted, the employer must also take actions to ensure that hazardous conditions are mitigated or eliminated. Where mitigating actions cannot be safely implemented, mine worker's health and safety must be the prime consideration when determining the next steps to be taken.

Subsection 716(4)

If a seal is being constructed to contain or isolate a fire or spontaneous heating, it is quite logical that it also be designed to withstand the effects of an explosion within the sealed area. Such seals are substantial structures and must be designed by a professional engineer guided by best industry practice considering the over pressure levels outlined in subsection (1.1). It must be also be possible to sample the atmosphere or drain accumulated water from behind a seal. Sampling can provide advance warning of gas buildup and provide a means of mitigating any problem related to water accumulation.

Section 717 Chutes

In mining an inclined seam, chutes, winces and raises are developed to transfer coal or other minerals from upper levels to lower levels or to an ore car. If the ventilating pressures at these levels are unequal, ventilating air could leak through uncovered or empty chutes. Also, the end assembly (bulkhead) of the chute, which generally has a gate and lever used in loading trucks, could be damaged if ore is dumped from an upper level to an empty chute. Some ore is usually left in the chute to act as a cushion and protect the end assembly. As well, an empty chute allows rock pieces to tumble freely, posing a hazard to workers below.

Section 718 Splits

An underground coal mine is divided into separate sections based on fresh air ventilation requirements. Accordingly, fresh air is split from the main air intake to

ventilate each area. Contaminated air from each station is directed directly into the main return airway.

Section 719 Fans

This Part sets minimum requirements for ventilating an underground coal mine and providing a safe environment. The required measurements of pressure provide invaluable information about conditions in the mine. A sudden increase in pressure may indicate a sudden release of methane from the coal face, a blast of air from the gob area due to roof breakage, or problems with control devices underground. Similarly, a decrease in pressure may indicate a substantial leak.

To ensure the integrity of the system and the health and safety of workers underground, redundancy of both the fan and its power supply is required. Keeping a record of ventilating pressures is mandatory.

Section 720 Reverse flows

Subsection 720(1)

Repealed

Subsection 720(2)

A coal mine ventilation system needs to be designed to meet the requirements of Part 2. If the design includes the ability in an emergency to reverse the main ventilation fan and thus reverse the main ventilation flow, then this section provides for its safe application.

Air flow reversal is normally only required in the event of a fire or explosion. Smoke and fumes need to be directed away from areas not yet evacuated, preventing contamination of areas under evacuation.

Air flow reversal must only be implemented with the underground coal mine manager's authorization. Air flow reversal can greatly affect worker health and safety so the decision is not made lightly.

Section 721 Surface fans

Subsection 721(1)

The main ventilation fan must be located to ensure used contaminated air is not recirculated back into the mine through an adjacent mine portal. The fan must also be protected from explosions and other air blasts. If a fan is damaged by an explosion, the entire ventilation system might fail, leaving trapped workers exposed to contaminated air. Placing the fan at least 5 metres away from the nearest side of the mine opening

ensures the fan is protected. The requirement for non-combustible air ducts increases the likelihood that they will survive a fire or explosion.

Subsection 721(2)

Explosion doors and or weak walls are required to provide protection for the main surface ventilating fans against air blast. The lives of mine workers could be at risk if the ventilation system failed. Air blasts can be generated by explosions or by a sudden unexpected large scale cave-in of roof rock in a mining section or sudden collapse of mine pillars. Some air blast protection is offered by the “off-set” requirement of subsection (1). Further protection must also be provided by using either explosion doors and/or weak walls located in direct line with possible explosive forces. Any such forces would thus preferentially open the explosion doors or destroy the weak wall and not pass through the main fan(s).

Subsection 721(3)

Despite the requirement of subsection (1), this subsection does allow the main ventilation fan to be located directly in front of or over a mine opening if certain criteria are met. The specified criteria limit the potential for damage of the main ventilation fan(s) in the event of an explosion or other air blast.

Section 722 Booster fans

This requirement ensures ventilation continues if the booster fan shuts down. However, if the main fan stops, the booster fan must also stop to ensure it does not create an air recirculation problem. In either case, continuous monitoring of run status and level provides timely notice of any adverse changes in operating status. Appropriate alarms in the permanently attended monitoring station should indicate problems with the booster fan.

Section 723 Auxiliary fans

Subsection 723(1)

Auxiliary fans must be electrically grounded. This is due to the fact that moving air can cause a build-up of static electricity on the fan and auxiliary fans tend to be independent systems. The grounding of auxiliary fans dissipates any statically induced charges.

Subsection 723(2)

If any single-entry heading or working area extends more than 10 metres from the nearest ventilation circuit, an auxiliary ventilation system is required to direct ventilation air toward the working face.

Such systems can use either auxiliary fan(s) and ducting or a curtain of brattice cloth or other ventilation materials that redirects air to the face. Auxiliary ducts are usually connected to a fan in the fresh air roadway.

Subsection 723(3)

The 10-metre distance specified in subsection 723(2) must be measured from a standard reference point, in this case the nearest rib.

Subsection 723(4)

Section 560 requires employers to meet the requirements of CSA Standard M421-00 (R2007), *Use of Electricity in Mines*. Clause 6.2.3 of the CSA standard requires provision of an interlock such that if an auxiliary fan shuts down automatically then so does other electrical equipment in that roadway. This subsection releases an employer from that requirement when a roadway under auxiliary ventilation is less than 200 metres long. This recognizes the difficulties in compliance in the early stages of roadway development and relies on manual rather than automatic shutdown of power to other equipment when a fan shuts down.

Section 724 Brattice, vent tubes

Subsection 724(1)

This subsection requires the end of the duct or brattice cloth at the working face to be as close to the face as possible to achieve the required amounts of air, turbulence and velocity along the working face.

Subsection 724(2)

The referenced CSA Standard ensures materials used in the manufacture of brattice and ducts do not add to the danger of fire and explosion. The survival of ventilating ducts and devices during an emergency can be essential to worker survival.

Section 725 Fan operating procedures

Subsection 725(1)

If a booster fan or auxiliary fan stops, workers must be evacuated to a place that is adequately ventilated. Since the loss of ventilation can result in a rapid deterioration of air quality, a competent worker must test the affected area before workers are allowed to return or enter the area. If air quality is below acceptable levels, workers must not return to this area until adequate ventilation has been re-established.

Subsection 725(2)

Areas affected by a stopped auxiliary fan require testing for flammable gases before they can be declared safe and the fan restarted. Testing an area for flammable gases and making the decision to restart an auxiliary fan must be done by a competent worker who is fully aware of the risks and importance of these activities. In addition to posting the declaration that it is safe to restart a fan, the supervisor must include it in his written shift report.

Subsection 725(3)

The code of practice for restarting both booster and auxiliary fans underground must be posted in a conspicuous location at the mine. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 725(4)

Repealed

Section 726 Stopping fan

Subsection 726(1)

Because the air ventilation system is the most critical component of the mine's safety system, it must not be modified in any manner without the consent of the senior mine official. This subsection specifically prohibits a worker from stopping any fan without that express consent.

Subsection 726(2)

Any significant change in ventilation or the stopping of a fan requires that workers be withdrawn to a location having adequate fresh air. The employer must ensure that procedures are in place and understood by all mine workers so that no worker returns to the affected area until the area is checked to confirm it is safe.

This subsection lists the conditions under which a worker can return to the affected area. Of particular note is the requirement that a mine official must examine the affected area and declare it safe by recording his or her findings and posting a notice in a conspicuous location that is used by the mine workers.

Subsection 726(3)

Since the mine official must perform the mandatory safety checks and examinations prior to allowing workers to return to the affected area, the conditions of subsection (2) do not apply to that mine official.

Section 727 Ventilation monitoring

Subsection 727(1)

This subsection addresses the measurement and recording of ventilating air quantities and qualities that must be taken, as a minimum, by an appointed competent worker. Readings include barometric pressure outside the mine and the velocity and quantity of air in airways and accessible old workings in the mine.

Barometric pressure has significant impact on fan performance as well as on the quantity of air circulated through the mine. A rapidly dropping barometric pressure releases flammable gases from exposed coal surfaces and sealed workings into the mine ventilation circuit. Thus measurements must be taken at seals along intake air courses where intake air passes by a seal to ventilate active working sections.

Subsection 727(2)

The places where measurements required in subsection (1) must be taken are clearly described as a minimum.

Subsection 727(3)

The appointed worker taking the measurements must promptly report abnormalities in pressure or air quantity to the underground coal mine manager.

Subsection 727(4)

The measurements required under subsection (1) must be taken at least once a week. This typically involves a complete survey of air quantities throughout the mine.

Subsection 727(5)

If measurements taken under the previous subsections indicate problems, they must be immediately reported to the mine manager for action. Surveys must be repeated if any significant alteration is made to the ventilation system.

Subsection 727(6)

Before any shift commences, atmospheric temperature and pressure measurements must be taken outside the mine.

Subsection 727(7)

All measurements required under this section must be recorded and kept for analysis and inspection by the employer and the Director. A copy of all survey results must be posted at the mine portal so that they are available to all mine workers.

Section 728 Cross cuts

Subsection 728(1)

Repealed

Subsection 728(2)

Requirements under this subsection are intended to ensure that an adequate quantity of air is delivered to working faces. As the distance from the last open cross cut increases, ventilation at the face becomes weaker. The requirement that stoppings be placed at all cross-cuts except the last one nearest the face maximizes air quantity at the last cross-cut.

Subsection 728(3)

Repealed

Section 729 Operating in split

The reason for having one machine in one split is to ensure that return air from one heading does not contaminate air in the other heading. However, the Director can issue an acceptance to allow two machines in one split if ventilation is properly designed.

Gas and Dust Control

Section 730 Gas inspections

Subsection 730(1)

All mine officials must carry approved gas detectors so that they can test for methane, carbon monoxide and oxygen at any time. This serves worker safety by ensuring that the impact of any change in circumstances on the level of these gases can be assessed promptly. This facilitates effective control of changing mine ventilation conditions. This subsection also ensures that working faces, roadways and all other parts of the mine to be used or worked on are examined for methane gas within four hours of any work taking place.

Subsection 730(2)

Gas measurements must be taken not only at working places but also in areas where gas is known to accumulate, such as at the edge of gobs and in roof cavities. The reliability of such measurements is critical because workers could unknowingly enter hazardous working places.

Subsection 730(3)

Readings must be correct, communicated to management, and properly recorded so that they can be effectively communicated to workers and used in investigations if an incident occurs. The mine official who inspects the area is fully accountable for the reliability of readings and the conclusions made.

Subsection 730(4)

So that underground workers are aware of mine conditions before entering the mine, a copy of the pre-shift inspection report must be posted at the portal or other designated location where it is accessible to workers.

Subsections 730(5)

The requirement for countersigning reports by the person in charge verifies the veracity of the report and signifies that the report has been completed.

Section 731 Flammable gas levels

Through the four subsections, safe working limits for atmospheres containing flammable gases are clearly described to ensure safe operation of the mine. The manager must take appropriate corrective actions once the related limits are exceeded. These actions are clearly described in this section and cannot be altered.

Subsection 731(1)

As gas levels rise there is a critical level at which workers must be evacuated from any area. This is set at a level where the concentration of flammable gas exceeds 40 percent of its lower explosive limit (LEL). This level is consistent with established practices in many jurisdictions around the world.

Subsection 731(2)

Automatic shutdown of electrical power is ensured on equipment where 25 percent of the LEL is exceeded. This level is consistent with established practices in many jurisdictions around the world.

Subsections 731(3) and 731(4)

These subsections prohibit blasting and the use of diesel equipment where gas concentrations exceed 20 percent of their LEL.

Subsection 731(5)

A properly designed gas bleeder system collects ventilation discharged from gobs, typically containing coal dust and methane gas. The level of gas in any bleeder roadway

must be controlled to be less than 40 percent of the LEL. The underground coal mine manager must ensure that appropriate corrective actions are taken if the related limits are exceeded.

Section 732 Diesel vehicle roads

Subsection 732(1)

The operation of a diesel vehicle in an underground mine introduces hazards that can negatively impact worker safety. Diesel engines produce noxious fumes such as carbon monoxide, carbon dioxide, carbon particulates, oxides of nitrogen, etc. Diesel engines can also introduce an additional source of ignition if explosive gases are present.

To minimize the hazard introduced by diesel equipment, this subsection requires that all underground roadways over which diesel units travel are tested for air flow and flammable gas on a scheduled basis at locations specified by the mine manager or the Director.

Subsection 732(2)

Repealed

Subsection 732(3)

Reduced air quantity can lead to insufficient dilution of noxious fumes or flammable gases, thus increasing worker exposure. The tests required under subsection (1) must therefore be done at least weekly and whenever an alteration is made in the air quantity flowing. The mine manager is responsible for making sure that workers meet these requirements.

Subsection 732(4)

If the level of flammable gas in the general body of air exceeds 15 percent (0.75 percent methane) of the LEL for methane gas (the LEL limit for methane is 5 percent), the employer must appoint a competent worker to take additional measurements. The objective here is to confirm the accuracy of earlier readings and to identify not only any trend in rising gas levels but also the source and distribution of flammable gas.

Once safe operating conditions or the consistency of measured flammable gas levels are confirmed, the competent worker must submit a written report to the mine manager. Depending on the results of the testing, the mine manager may order modifications to the ventilation system or reduced diesel equipment operations.

Subsection 732(5)

If the percentage of flammable gas continues to exceed 15 percent of the LEL, a continuous methane monitoring system must be installed. The continuous monitoring system must then remain in operation for the periods specified in this subsection.

Subsection 732(6)

The gas measurements required under subsection (4) must continue until either they have fallen below 15 percent of the LEL or a continuous monitoring system is installed.

Section 733 Degassing procedures

Subsection 733(1)

Due to the critical nature of degassing activities, safe operating procedures must be developed by a qualified professional engineer. Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subsection 733(2)

No explanation required.

Section 734 Gas removal

Due to the hazardous nature of a gassy environment, a responsible, knowledgeable mine official must directly supervise any gas removal activity.

Section 735 Unused areas

Subsection 735(1)

Because some areas of an underground coal mine can remain inactive for short periods of time, there is the potential that dangerous gases can accumulate in them. The employer is required to ensure that such inactive areas are kept free of gas accumulations so that a dangerous situation does not develop. Where gas accumulation cannot be controlled, the area must be sealed off according to section 736.

Subsection 735(2)

Repealed

Section 736 Sealed off areas

Subsection 736(1)

Accumulation of flammable gas in any part of a coal mine poses a significant risk to underground coal mine workers. For this reason, workers must be protected from the hazards by fencing off such areas.

Subsection 736(2)

If accumulations of gas in a part of a mine cannot be adequately removed then the area must be sealed off, isolating the area completely (see section 716).

Section 737 Specifications

This section ensures that combustible gas detectors and other devices used for testing and measuring air quality, velocity and volume in a mine in Alberta have gone through performance testing by an approved agency and meet criteria for certification.

Section 738 Combustible gas detector

Subsection 738(1)

This section deals primarily with the provision, installation and performance of combustible gas monitors used on coal cutting machines. Maintenance of monitoring devices is extremely important, as is regular testing of the accuracy of their readings. Coal cutting machines require a reliable, proven device to monitor the concentration of methane near the face.

For more information

See *Use of Combustible Gas Meters at the Work Site*, Workplace Health and Safety Bulletin CH038, July 2010.

Subsection 738(2)

The cutting operation generates significant quantities of coal dust and methane, and often produces sparks. Although water spray is used to control these hazards right where the cutting operation takes place, the situation remains challenging and dangerous. Continuous monitoring of methane near the cutting head is extremely important to worker safety and confidence. The worker operating a coal cutting machine must keep the combustible gas detector operating at all times.

Subsection 738(3)

The cutting head of a coal cutting machine, such as a continuous miner, is the point at which the coal is mined and then extracted. It is the mining process that liberates

methane gas that is normally contained within the coal seam. Because of the potential that the highest levels of methane gas will be present at this active mining location, this subsection requires that methane sensing devices be installed as close as reasonably practicable to the cutting head. Early detection of unusual gas levels at the cutting head will alert the operator to a potential problem, providing time for the operator to take action.

According to this subsection, the installed gas detector must be installed within 3 metres of the cutting head.

Subsection 738(4)

Repealed

Subsection 738(5)

Both visible and audible alarms must be provided to gain the operator's attention quickly. The percentage of the LEL is purposely kept low to provide an early warning for workers to withdraw to a safe location. For clarity, the LEL for a methane in air mixture is 5 percent methane. The values in this section are expressed as a percentage of the 5 percent limit. For example, 20 percent of the LEL translates to 1 percent methane content, e.g., 20 percent of 5 percent.

Subsection 738(6)

Since the methane detector must be interconnected with the machine control system, a methane gas excursion will trip out the cutting head. Such an occurrence would be the first warning that methane levels are rising above the levels specified in this section. Once the cutting head trips due to a high methane level, the worker must immediately back the machine away from the face and turn off electrical power to minimize the potential for initiating an explosion.

Section 739 Portable detector

Portable combustible gas detectors are extremely sensitive devices and as such must be calibrated and operated to defined standards.

Subsection 739(1)

Due to the training and technical knowledge required of all users, a worker must not use such a device until he or she is authorized to do so by the underground coal mine manager. By not complying with this section, a non-authorized worker could inadvertently expose all mine workers to a major hazard.

Subsection 739(2)

To maintain appropriate control over the use of portable gas detectors, this section specifies that only the underground coal mine manager can authorize a worker to use the devices. The mine manager must first ensure that the worker is “competent” according to the definition provided in Part 1.

Subsection 739(3)

This subsection requires a portable gas detector to be approved by an authorizing agency and meet criteria for certification for use in an underground coal mine.

Subsection 739(4)

Gas detectors can be misleading and pose a danger to workers if they are not regularly calibrated. This subsection requires calibration to the manufacturer’s specifications.

Section 740 Breakdown of detector

Subsection 740(1)

This subsection allows a coal cutting machine to continue to operate if its combustible gas detector fails to operate. This exception is available only for the shift during which the gas detector has failed and specifies that manual continuous monitoring must be performed during this period by a competent worker authorized by the underground coal mine manager. At no time during manual monitoring can the flammable gas reading in the operator’s cab exceed 15 percent of the LEL, equivalent to 0.75% methane. If so, the equipment must be shut down immediately and the area ventilation adjusted to remedy the problem.

Subsection 740(2)

A worker must ensure that a coal cutting machine is not operated on the shift following the shift on which a gas detector ceased to function. If discovered during the pre-shift inspection, the unit must not be operated until the detector is repaired or the requirements of subsection 740(1) are met.

Section 741 Roof bolting

Subsection 741(1)

Although roof bolting may not encounter as much flammable gas as coal cutting operations, the presence of flammable gas at the drilling location can be dangerous. As a result, monitoring for combustible gases such as methane by a competent person is equally important in this situation. Gas readings must be taken at roof level because

some combustible mine gases, like methane, are lighter than air and hence rise, so they will be present at higher concentrations near the roof than elsewhere.

Subsection 741(2)

If methane levels are measured at 25 percent of the lower explosive limit (1.25 percent of methane), all roof bolting activity must cease until ventilation is improved and methane levels are consistently measured below 25 percent of the LEL.

Subsection 741(3)

Many of the new bolters have methane monitors mounted on them, often with a continuous monitoring capability.

Section 742 Airborne dust

Subsection 742(1)

This subsection requires water spraying to keep coal dust from becoming airborne. Although this helps keep the dust down significantly, a good portion of coal dust remains airborne. Water does not adhere well to coal dust. In winter, some mines draw ventilation air from the outside without heating it. Since the resulting air in the mine is at a temperature much like that of the outside, an alternative to water is recommended to control dust if freezing is a problem.

Subsection 742(2)

Because underground mobile equipment cannot readily accommodate a supply of water for dust suppression purposes, this section exempts equipment such as shuttle cars from that requirement.

Subsection 742(3)

Since the movement of rubber-tired vehicles can generate large quantities of airborne dust when travelling on dry material, this subsection requires that related roadways are treated with dust suppression chemicals or wetted with water to minimize the creation of airborne dust.

Subsection 742(4)

This requirement for monitoring respirable dust concentrations reinforces the requirements specified by Part 4. The respirable portion of coal dust is a primary cause of pneumoconiosis among coal miners.

Subsection 742(5)

The Director may decide to use this authority to require the installation of dust collectors on exhaust fans if the exhaust air has the potential to become a visibility, fire, explosion or health hazard to workers.

Section 743 Incombustible dust

When coal dust is airborne it is potentially explosive. A coal dust explosion is often initiated by a methane explosion whereby its pressure wave raises any coal dust into the air and its flame front then ignites the cloud of coal dust, with devastating effect. The most recent example in Canada was at the Westray Mine in Nova Scotia in 1992. The coal dust hazard is typically mitigated by using inerting agents, usually water and/or incombustible dust consisting of finely ground limestone rock. The latter is usually referred to as stone dust or rock dust.

Subsection 743(1)

The mining area that falls within 10 metres of the active working face is generally considered to be constantly changing as mining excavation occurs. This section therefore does not apply to this area while coal cutting is in progress.

Subsection 743(1.1)

This subsection requires the employer to prevent accumulation of combustible dusts, typically coal dust. The Westray Inquiry into the coal dust explosion at the Westray Mine, Nova Scotia in 1992, highlighted, among other things, that an important first step in mitigating the hazard of combustible dust is to ensure that accumulations of coal dust do not build up anywhere. The exception to this is the immediate mining area [see subsection 743(1)]. Particular attention must be paid to conveyor systems which are well known for creating accumulations of coal dust. If unattended, these accumulations can build up around conveyor rollers. Should a roller fail and jam, the moving belt could generate enough heat to ignite the accumulation and cause a fire.

Subsection 743(1.2)

The employer must prepare a formal stone-dusting plan (which is in effect a coal dust inerting program) for filing with the Director. This plan demonstrates how the employer will achieve the minimum incombustible content of 80 percent [see section 743(3)]. The plan must include the approach, methods to be used, and testing procedure and frequency.

Subsection 743(2)

Incombustible dust is liberally applied in order to inert combustible dusts and minimize the potential for a coal dust explosion. All areas that are accessible to workers must be treated with the exception of the areas noted in subsection 743(1).

Subsection 743(3)

The quantity of incombustible dust applied to coal dust has been defined after extensive research. To effectively inert coal dust, post-dusting samples must consist of at least 80 percent incombustible dust.

Subsection 743(4)

The requirement for a minimum of 80 percent by weight of incombustible dust to coal dust is waived if the area under consideration contains at least 30 percent moisture. Such a high moisture content alone suppresses coal dust and its potential for explosion.

Subsection 743(5)

The requirement for 80 percent incombustible material must be increased by one percentage for every 0.1 percent of flammable gas in the ventilation current.

Subsection 743(6)

Repealed

Subsection 743(7)

The purpose of cleaning the roadway area is to remove coal dust or any other combustible matter so that stone dust or rock dust forms the base. The effectiveness of the stone dust is reduced when applied on top of thick layers of coal dust.

Section 744 Dust sampling

Sampling accumulated coal dust is the only means available to accurately assess the potential for coal dust explosions. It is important to prevent layering of coal dust on top of rock dust because explosions tend to lift only the top few millimetres of the coal dust/rock dust layer. During an explosion, the underlying rock dust may not be capable of quenching an explosion flame front. All sampling and subsequent test results must be recorded at the mine site.

Explosion Control

Section 745 Explosion barriers

Subsection 745(1)

Employers must develop an explosion prevention plan for every coal mine. The plan must be certified by a professional engineer and be acceptable to the Director. An important means for combating coal dust explosions involves explosion barriers. These are typically passive in nature. The pressure wave of a coal dust explosion creates a cloud of stone dust or water droplets which suppresses the flame front following behind the pressure wave. Explosion barriers can also be of an active type whereby pressure sensors detect an oncoming pressure wave and trigger the barrier to suppress the explosion's subsequent flame front.

Explosion barriers, if used, should be designed to stop explosions from travelling any further. Suitable explosion arresting materials and designs reduce the violent energy of explosions to almost zero as the explosion travels through the barrier. Barriers often use rock dust or water as the quenching material. The number of units comprising the barrier system and the speed at which they react to a passing shock wave are important variables to be considered in the design, as are the forces and energy associated with a potential explosion.

Any explosion barrier must be certified by a professional engineer. Explosion barriers are typically used at entrances to every production section, development district and ventilation split. Such locations are designed to confine explosions to the area in which they are most likely to occur, thus minimizing risk to other areas of the mine.

Subsection 745(2)

It is important in emergency response planning to know where explosion barriers are located. For this reason, the location of all explosion barriers must be shown on the mine ventilation and emergency response plans.

Section 746 Welding, cutting and soldering

Subsection 746(1)

This subsection prohibits any hot work that could serve as a potential source of a fire or an explosion.

Subsection 746(2)

Repealed

Subsection 746(2.1)

Repealed

Subsection 746(3)

Repealed

Section 747 Pillars

Subsection 747(1)

Underground mining activity in one property can inadvertently affect the safety of workers on an adjoining property. Consequently, both property owners or prime contractors, if prime contractors are designated, are required to communicate for purposes of maintaining a safety pillar between the two adjoining properties, commonly known as a barrier pillar. The required pillar separation must be sufficient to separate activities and prevent mine ventilation air, gas and water from one mine entering the other. The required pillar separation must be maintained on all working levels for all coal seams that are to be mined. To be equitable to both property owners or prime contractors, if prime contractors are designated, an appropriate portion of the required pillar must be left on each side of the common boundary.

Subsection 747(2)

Since portions of the remaining pillars will consist of material on each property, the respective owners or prime contractors, if prime contractors are designated, are held responsible for ensuring that the composite pillar size is sufficient to ensure the safety of workers in each mine.

Subsection 747(3)

The technical factors that can contribute to pillar capability and stability are such that a professional engineer must determine the safe width of the pillar.

Subsection 747(4)

To avoid the potential for inadvertent over-excavation into the intended pillar, both property owners are held responsible for ensuring that no mining activities are conducted within 100 metres (330 feet) of the property boundary line between the two properties unless a professional engineer has authorized a smaller distance under subsection (3).

Subsection 747(5)

After the pillar design has been determined by a professional engineer and the physical barrier pillar limits have been reached, the employer is responsible for ensuring that no mining is performed within the barrier pillar itself. Again, for worker safety reasons the barrier pillar must remain intact.

Subsection 747(6)

Since minor surveying differences can negatively impact the intended width of the barrier pillar, this subsection allows the designated surveyor from one property to enter the mine on the adjoining property for purposes of confirming the final pillar width. Ideally both surveyors will conduct these survey checks and subsequently cross-check results to minimize the potential for error.

Subsection 747(7)

The location of all final workings immediately adjacent to the defined barrier pillar must be surveyed within 60 days of completion. The resultant plans for each property must be immediately filed with the Director.

Section 748 Drill holes

Because of the hazards associated with unplanned hydrocarbon release into a mining area, the employer must ensure that mining does not occur within 100 metres of an existing oil or gas well drill hole or a hole that is being drilled.

Section 749 Water or gas

Accumulations of water and/or gas pose a major hazard to underground coal mine workers. These can occur either within the rock mass itself or in old, sometimes uncharted, abandoned workings, or as bodies of surface water and/or unconsolidated materials such as peat, lying in deep ravines, gullies or cracks in the bedrock surface. To minimize the potential for an inrush of water/gas into the workings, an employer must ensure that no working face approaches within 50 metres (150 feet) of the surface or within either 50 meters vertically or 100 meters (330 feet) in plan view of any area of potential or known water or gas accumulation.

These dimensions relate to the horizontal and vertical separation distances between active workings and possible areas of accumulation. The mandatory separation distances must be maintained until any inactive workings have been examined and the absence of water or gas accumulation confirmed.

Section 749.1 Shaft access and hoisting equipment

This section recognizes that as underground coal mines exploit deeper and deeper reserves a need often arises for vertical, sub-vertical or inclined shafts. In such cases, it is important that employers present comprehensive designs, plans and procedures certified by a professional engineer for the Director's approval. These designs, plans and procedures must include the number, type and purpose of shafts, their design, construction (shaft sinking), equipping and operation. In turn, the latter must include all shaft conveyances and mine hoisting plant.

Part 37 Oil and Gas Wells

Highlights

- Section 751 lists minimum competency requirements for supervisors of exploration, drilling, servicing, snubbing, testing and production operations.
- Section 759 allows service rig trucks to exceed their manufacturer-specified load weights if the listed conditions are met.
- Section 760 lists specific requirements for rigging up.
- Section 764 lists requirements for ground anchor pull-testing.
- Sections 779 and 780 present requirements that deal with fluid recovery during darkness.
- Section 837 presents requirements for securing pressurized piping.

Requirements

Section 750 Application

For the purposes of this Part, crude bitumen is considered to be any of the various mixtures of hydrocarbons present in their natural state and unaltered by processing.

Drilling a well is typically carried out by a “drilling contractor” under contract to a well-site owner, also known as the “operator.” The final step in drilling a new well is completion—when fluids start flowing to the surface.

Once a well is completed, the owner begins production, also known as operating, by bringing fluids to the surface and preparing them for delivery to a refinery.

A producing well may require servicing during its active life cycle. This includes routine maintenance activities, repair or replacement of equipment, and “workovers” which are activities intended to stimulate or enhance fluid flow.

This Part also applies to any process that supports and supplements drilling, operating or servicing activities.

Section 751 Competent supervisor

Subsection 751(1)

Work at a well site involves a wide variety of operations that often require a number of contractors, suppliers and technical service providers working together. These operations must be supervised by a qualified and competent person to ensure the safety of workers.

Subsection 751(2)

The operator, or prime contractor if there is one, has overall responsibility for safety at a well site. The on-site supervisor plays a key role in directing and coordinating implementation of the planned work program as well as ensuring that all safety requirements are met.

Each employer undertaking a particular job or function at a well site, is responsible for carrying out that job or function in a safe manner. This subsection describes the minimum safety knowledge required by each on-site supervisor within the scope of their job or function at a well site. For activities that are part of drilling, completion or workover, industry requirements are described in Industry Recommended Practice (IRP) No. 7, *Standards for Well Site Supervision of Drilling, Completion and Workovers*, published by Enform.

Section 752 Breathing equipment

Subsection 752(1)

Oil and gas exploration is considered high hazard work. The possibility of encountering flammable atmospheres, hydrocarbons, hydrogen sulphide, and immediately dangerous to life and health (IDLH) situations is present when work is done at the well site. Since well conditions can change rapidly, emergency self-contained breathing apparatus (SCBA) must be present when drilling, servicing, flushby, snubbing, swabbing, workover or other units are used at the well site.

The intent of this section is to ensure that there is enough breathing equipment available to workers at oil and gas well sites in an emergency and when a rescue operation needs to be performed. The number of breathing apparatus required must be linked to the number of workers that may potentially be affected. This should be determined by completing the hazard assessment required by Part 2, and meeting the requirements of Part 7 and section 244. As well, the employer must ensure that workers required to use this equipment are fit tested and have training to use it properly. Sections 244 to 254 of the *OHS Code* present the requirements that apply to the use of respiratory protective equipment at the work site.

Subsection 752(2)

In cases where there is only one worker at the work site, an employer may use alternate measures to protect the worker such as a remotely operated system. The alternate measure used must ensure that the worker is not exposed to a harmful substance (as defined in the *OHS Act*) in excess of its occupational exposure limit.

Section 753 Operating load of derrick or mast

Subsection 753(1)

Drillers must know the limitations of the derrick being used. Weights of objects being lifted must be known.

Exceeding the safe operating load, also known as “derrick lift capacity,” increases the possibility of equipment failure through overloading. The derrick or mast manufacturer should specify:

- (a) the maximum hook load;
- (b) the increased dead-load and wind induced load due to accumulation of ice and snow;
- (c) the maximum loading due to fastener pre-stress;
- (d) the maximum setback load such as amount of pipe the rig floor will hold; and
- (e) the maximum wind speed at which operations will be conducted.

Subsection 753(2)

Repairs must be made only with manufacturer approved and specified materials or as certified by a professional engineer.

Section 754 Derricks and masts

Prior to erecting or taking down a derrick or mast, a competent worker must inspect the derrick or mast and be in charge of, and present during, its erection or take down.

Section 755

Inspections and repairs must be recorded in a logbook issued by the Canadian Association of Oil Well Drilling Contractors (CAODC), or an equivalent logbook. Readers are referred to the CAODC website for copies of the organization’s logbook.

Section 756

No explanation required.

Section 757 Geophysical operations

For more information about geophysical operations, readers are referred to Alberta Workplace Health and Safety Bulletin IS004, *Safe Operating Procedures for Seismic Drilling*.

Section 758 Drilling rig, service rig, and snubbing unit inspections

Subsection 758(1)

Inspection procedures can be found in the following recommended practices developed by the Canadian Association of Oilwell Drilling Contractors (CAODC):

- (a) Recommended Practice 1.0, *Inspection and Certification of Masts (DR)*;
- (b) Recommended Practice 1.0A, *Inspection and Certification for Substructures (DR/SR)*;
- (c) Recommended Practice 2.0, *Inspection and Certification of Overhead Equipment (DR)*;
- (d) Recommended Practice 3.0, *Inspection and Certification of Masts (SR)*;
- (e) Recommended Practice 4.0, *Inspection and Certification of Overhead Equipment (SR)*;
and
- (f) Recommended Practice 5.0, *Inspection and Certification of Manual Rotary Tongs (DR/SR)*.

Subsection 758(2)

The following CAODC inspection report forms are available from CAODC:

- (a) Mast and Overhead Equipment Log Book;
- (b) Rig Inspection Checklist;
- (c) Rig Blowout Prevention/Equipment Checklist;
- (d) Rig Trailer Mounted Pre-Trip Inspection; and
- (e) Rig Trailer Mounted CVIP Inspection.

Section 759 Overloaded service rig trucks

Instead of complying with the manufacturer's specifications requirements of section 12 of the *OHS Code*, service rig trucks that exceed their manufacturer-specified load weights can be operated if:

- (a) a written hazard assessment meeting the requirements of Part 2 has been completed;
and
- (b) controls that ensure safe operation of the service rig truck have been implemented.

The assessment and controls do not need to be reviewed by a Director of Inspection prior to being implemented. If an officer inspects a work site and considers the assessment or controls insufficient, then the assessment and controls may need to be reviewed by a Director or Inspection.

Section 760 Safety check

Rigging up involves moving in and preparing the drilling rig for making the hole and installing tools and machinery before drilling is started. One way to ensure that the requirements of this section are followed is to incorporate them into a written safe work practice or safe work procedure.

Section 761 Exits from enclosures

Subsection 761(1)

If a rig floor is enclosed, an exit to ground level must be provided on at least two sides of the enclosure in addition to one from the doghouse.

If a rig floor is enclosed, the exit doors must open outwards in a direction away from the drill hole and must not be held closed with a lock or an outside latch while workers are on the rig floor.

Subsection 761(2)

The pump house must have two doors leading in two different directions to the outside, placed as far apart as practicable.

Subsection 761(3)

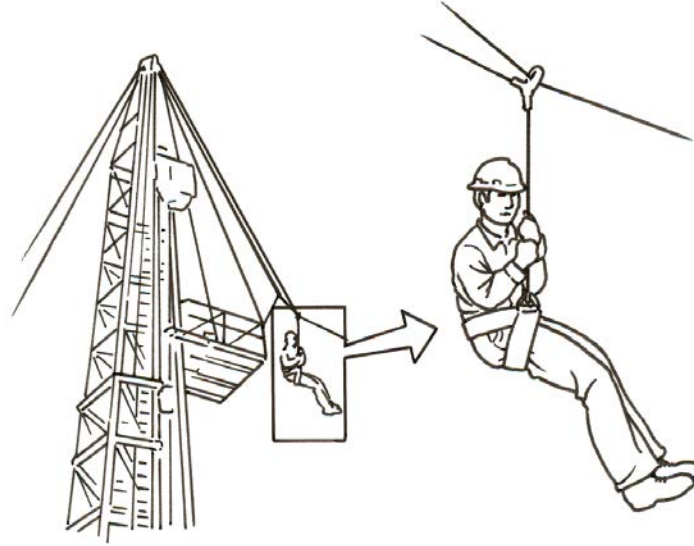
No explanation required.

Section 762 Emergency escape route

Subsection 762(1)

A vertical ladder is the usual means of access to the principal working platform above the rig floor, known as the “monkey board.” In the event of a blowout, wellhead fire, or other emergency situation, the ladder may become blocked or otherwise rendered unusable. In such a case, an emergency means of escape, typically an escape line with a slide of adequate strength, must be installed and maintained so that persons can safely descend to ground level (see Figure 37.1). Every part of the emergency escape device must be inspected at least once every week that the rig is in operation. A record of every inspection should be maintained.

Figure 37.1 Example of emergency escape safety buggy



Subsection 762(2)

Unless otherwise required by the manufacturer's specifications, the escape line should be securely fastened to the girt immediately above the monkey board. The line must be anchored to the ground at a distance specified in the manufacturer's specifications or the specifications certified by a professional engineer. This distance should be the greater of 45 metres from the derrick base or a distance equal to the height of the derrick. Tension on the escape line should be such that a 100-kilogram worker sliding down it will touch the ground at least 6 metres from the anchor.

Ground anchors must be subjected to a static pull test of 13.3 kilonewtons when installed.

Subsection 762(3)

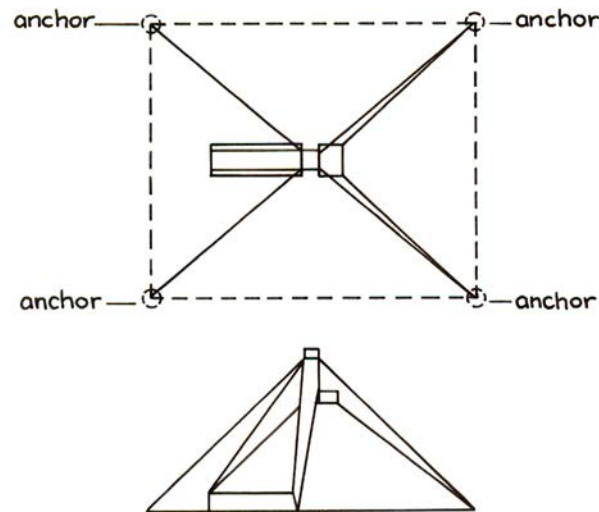
A safety buggy must be installed and maintained according to the manufacturer's specifications and should be checked by a competent worker along with the escape line. The buggy must be kept at the principal working platform when not in use so that it is ready when needed.

Section 763 Guy lines

Subsection 763(1)

All guy lines, as indicated by the manufacturer's diagram, must be in position and properly tensioned prior to commencing any work. In the absence of manufacturer's recommendations, or where the manufacturer's recommendations cannot be implemented, the diagram shown in Figure 37.2 may be used.

Figure 37.2 Example of anchor location diagram



Other guying patterns may be used if certified by a professional engineer. Guy lines should be 6x19 or 6x37 class, regular lay, made of improved plow steel (IPS), or better, with independent wire-rope core (IWRC) and not previously used for any other application. Double saddle clips should be used and wire rope should be installed in accordance with the manufacturer's recommendations.

Table 37.1 may be used as a guide to the pre-tensioning of guy lines. This method is commonly referred to as the Catenary Method or guy line sag method (see Figure 37.3).

Figure 37.3 Example of the Catenary Method

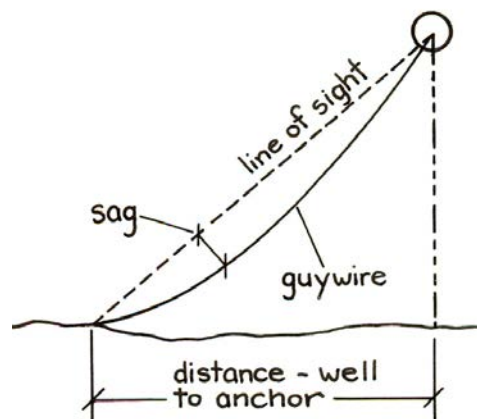


Table 37.1 Guide to pre-tensioning of guy wires

Guywire sag (millimetres)						
Distance well to anchor (metres)	Pole mast		Single mast		Double mast	
	Tubing board guy	Crown - ground guy	Tubing board guy	Crown-ground guy	Tubing board guy	Crown-ground guy
12	-	100	100	100	150	127
18	-	150	203	150	305	203
24	-	254	380	254	432	280
30	-	356	558	356	660	380
36	-	457	560	457	813	533
Pre-tension Kilonewtons (pound-force)	2225 (500 lbs-force)	4450 (1000 lbs-force)	2225 (500 lbs-force)	4450 (1000 lbs-force)	2225 (500 lbs-force)	4450 (1000 lbs-force)

Section 764 Ground anchors

Subsection 764(1)

Ground anchors must be pull-tested annually to ensure that they offer solid, stable securement for guy wires. The ground anchors must be tested according to:

- (a) API Recommended Practice RP 4G, *Recommended Practice for Maintenance and Use of Drilling and Well Servicing Structures* (2004);
- (b) the manufacturer's specifications; or
- (c) specifications certified by a professional engineer.

Subsection 764(2)

There are four basic types of manufactured anchors:

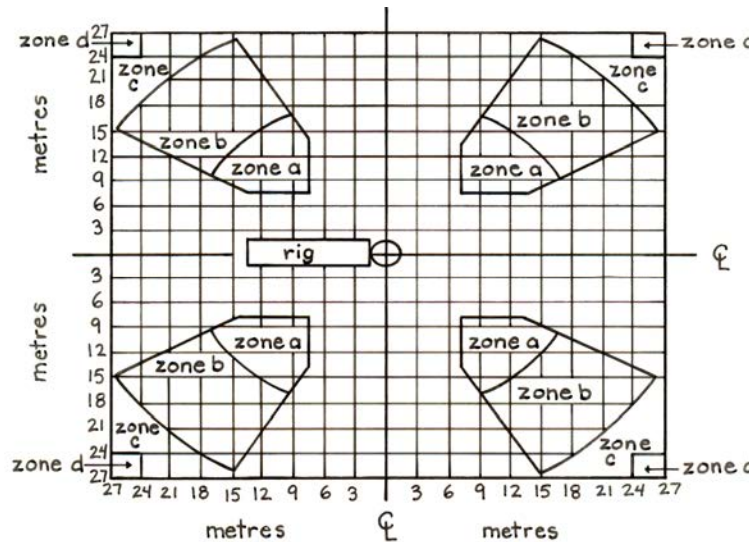
- (1) the screw or helix anchor;
- (2) the expanding plate anchor;
- (3) the flat plate anchor; and
- (4) the pivoting anchor.

Installing anchors according to the manufacturer's specifications satisfies the requirements for individual pull testing. Screw or helix type anchors have a direct correlation between anchor capacity and the torque required to install the anchor. Torquing according to the manufacturer's specifications is an acceptable non-pull test method of determining anchor capacity.

Fabricated anchors should be designed by a professional engineer. Written procedures for installation must be prepared and certified. These anchors should be proof tested for structural integrity and holding capacity. Individual pull testing is not required if anchors are installed in according to the written procedures. Proof of installation protocols and proof-tested holding capacities are required.

In the absence of manufacturer's specifications, the location diagram shown in Figure 37.4 may be used.

Figure 37.4 Example of anchor locations



Each zone requires an anchor of different holding capacity. If anchors are located in more than one zone, then all anchors should be of the capacity required for the greater capacity zone. See Table 37.2.

Table 37.2 Anchor capacity requirements for each zone

Anchor capacity (tonnes)			
Zone	Doubles mast	Singles mast	Post mast
A	14.2	6.4	6.4
B	10.5	4.6	4.6
C	8.2	4.6	4.6
D	6.7	4.6	4.6

Anchor capacities shown assume the following:

- adequate foundation support for mast and carrier
- adequate crown-to-carrier internal load guys
- maximum wind load—120 kilometres per hour

Section 765 Trailer pipe rack

Subsection 765(1)

Pipe racks must be designed to support any load placed on them. They should be set level on a stable foundation but may slope front to back to facilitate laying down or picking up pipe. Pipe, tubular material or other round material must be prevented from rolling off. No worker must go between pipe racks and a load of pipe during loading, unloading and transferring operations.

Pipe should be loaded and unloaded, layer by layer, with the bottom layer pinned or blocked securely at all four corners of the pipe rack and each successive layer effectively chocked or blocked. Spaces should be used and evenly spaced between the layers of pipe or material on the rack. When pipe is being moved or transferred between pipe racks, truck and trailer, the temporary supports for skidding or rolling should be constructed, placed and anchored to support the load placed on them.

Subsection 765(2)

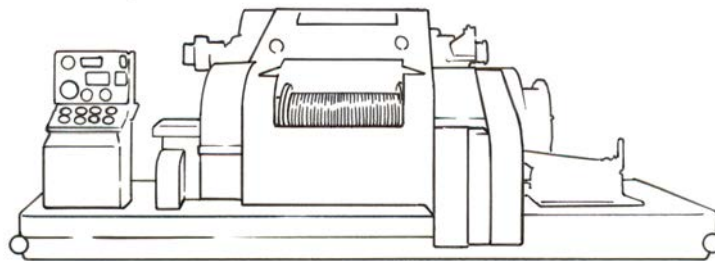
A catwalk is a footway giving access to the rig floor and should be at least 1.2 metres wide and cover the space between the pipe storage racks or trailers. It should be continuous from the derrick or from the lower end of the pipe ramp, connected to the derrick floor, to at least 2.4 metres beyond the outer end of the normal lengths of drill pipe to be handled on the catwalk.

Section 766 Drawworks

Subsection 766(1)

A drawworks on a drilling rig is an assembly of shafts, chains, pulleys, bells, clutches, catheads and/or other mechanical devices for hoisting, operating and handling the equipment used for drilling a well or servicing a producing well. The driller operates the drawworks at the driller's console, with controls for brakes, clutches and a transmission (see Figure 37.5). One set of brakes at each end of the drum holds it stationary and sustains the weight of the travelling block, rotating equipment and drill string.

Figure 37.5 An example of a driller's console



Subsection 766(2)

Workers must be constantly aware of rotating hazards. Work practices must be implemented to avoid contacting moving parts such as hoist cables and rotating drums.

Section 767 Brakes

Subsection 767(1)

Figure 37.6 shows an example of a hold-down mechanism. Figure 37.7 shows an example of a properly constructed chain anchor bracket that will prevent accidental disengagement of the chain.

Figure 37.6 Example of a hold-down mechanism

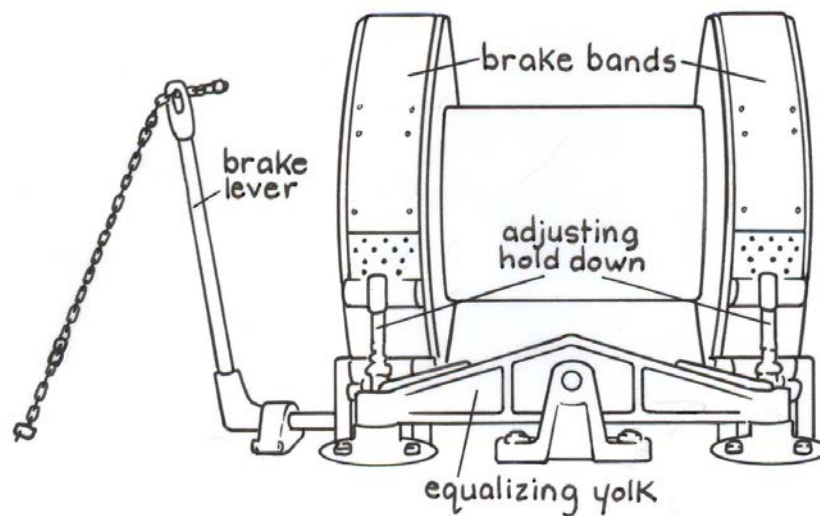
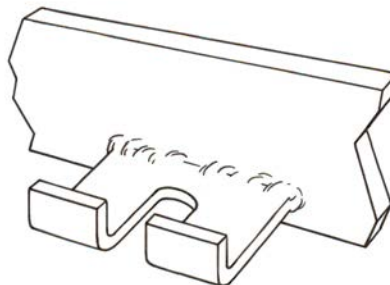


Figure 37.7 Example of a properly constructed chain anchor bracket that will prevent accidental disengagement of the chain



Subsection 767(2)

“Test” means to perform a procedure, including operating the equipment where appropriate, that determines whether the equipment is correctly assembled and functioning and is likely to continue to do so.

“Examine” means to verify by visual and manual examination, including dismantling or cleaning when appropriate, that the equipment is in a condition that will not compromise a worker’s safety.

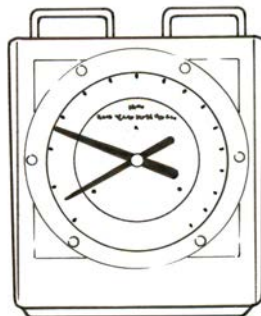
Subsections 767(3) and 767(4)

No explanation required.

Section 768 Weight indicators

A weight indicator is an instrument near the driller’s position that shows the weight of the drill stem that is hanging from the hook (see Figure 37.8). This is the hook load.

Figure 37.8 Example of a weight indicator

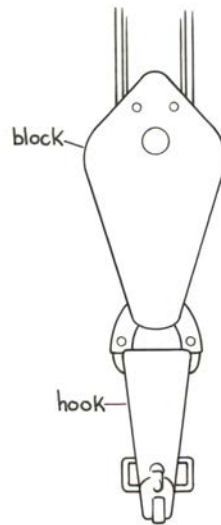


Section 769 Travelling blocks

Subsection 769(1)

The hook is attached, often permanently, to the bottom of the travelling block. It carries equipment, called elevators, for grasping and holding pipe while the pipe is being raised or lowered into the well bore. The hook also suspends the swivel and drill string while drilling (see Figure 37.9). It is rated by its load-carrying capacity. The hook latch must be designed to prevent release of the drill string when subjected to a sharp upward blow.

Figure 37.9 Example of a travelling block and hook



Subsection 769(2)

No explanation required.

Subsection 769(3)

An upward travel limiting device, often called a crown saver, prevents the travelling block from contacting the crown structure. Every drilling or service rig must have a crown saver.

Section 770 Tugger or travelling block

Lifting a worker by using the travelling block or a tugger is not permitted unless doing so is permitted in the manufacturer's specifications or in specifications certified by a professional engineer. Lowering is permitted during an emergency situation subject to the rotary table being stopped and a competent worker trained in emergency procedures operating the controls of the travelling block or tugger.

Section 771 Catheads

Catheads are recognized as a potential safety hazard. Many have been removed from rigs on a voluntary basis. The use of rope-operated friction catheads has not been allowed since January 1, 2005. Small air operated hoists, also known as "tuggers," are an acceptable alternative.

Section 772 Racking pipes

Subsection 772(1)

Most of the drilling fluid contained within a pipe stand is drained out through the mud-can when the pipe is tripped out. The drain rack should be connected to the mud flow-back line to capture any fluid that remains.

Subsection 772(2)

Pipe-racking support designed to prevent pipe from falling must be provided near the top of the stands of pipe. This support should be constructed so that it will, with the mast, completely surround the pipe.

Section 773 Rotary table danger zone

Subsection 773(1)

The extent of the danger zone will depend on the particular design of the rig. The limit of the danger zone can be marked by a line painted on the floor or some other equally effective means.

Subsection 773(2)

Loose materials can get caught in rotating equipment. Examples include tools, ropes, chains, clothing and fall protection lanyards.

Subsection 773(3)

Once a hazard assessment is completed as required by Part 2 of the *OHS Code*, a worker may be permitted within the rotary table danger zone, while the rotary table is in motion, only if it is done during a non-drilling operation, e.g., tripping pipe. In that case, the requirements of subsection 773(4) must be met.

Subsection 773(4)

If the requirements of subsection 773(3) are met, a worker may be permitted within the rotary table danger zone, while the rotary table is in motion, subject to the following conditions:

- (a) the table is turning at a slow rate of speed and the Driller is attending to the controls;
- (b) any equipment that may contact the rotating equipment, whether loose or suspended, is kept clear at all times while the rotary table is turning;
- (c) all workers who have positioned slips or tongs are clear of the rotating equipment,
- (d) all tong lines are placed outside of the line of rotating slips;
- (e) any clothing or personal protective equipment worn by the workers is such that there are no loose or trailing pieces that could become entangled in the rotating equipment; and

- (f) the worker does not wear any jewellery or similar adornments that could become entangled in the rotating equipment.

Subsection 773(5)

When drilling operations resume and the rotary table is to be returned to a high rate of speed, all workers and all equipment must be positioned outside of the rotary table danger zone.

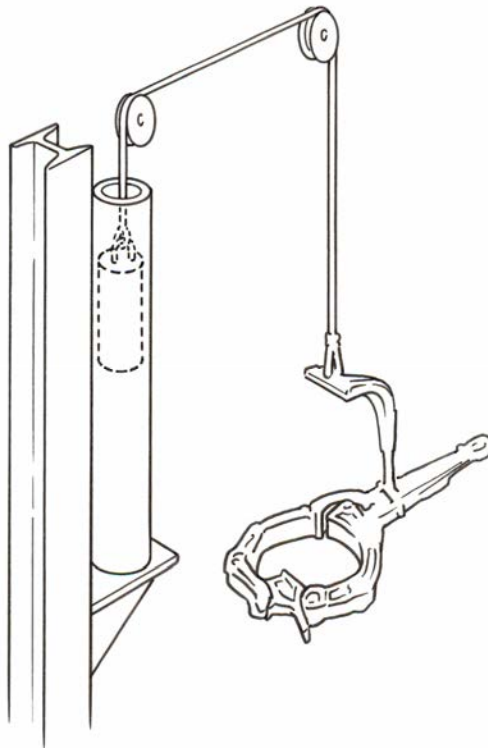
Section 774 Tong safety

Tong safety devices are typically two wire rope lines. Single stand rigs should use lines that are not less than 13 millimetres in diameter. Larger rigs should use lines that are not less than 16 millimetres in diameter.

Section 775 Counterweights

Figure 37.10 shows an example of a tong counterweight enclosure. The enclosure should extend from the working level to at least the midpoint of the counterweight when it is at its highest position. If not enclosed or in guides, the counterweight can be secured by chain or cable to prevent it from coming within 2.3 metres of the floor or working level. As added safety measures, work or pedestrian traffic can be prohibited in the area below the counterweight, or the area below the counterweight can be enclosed or barricaded.

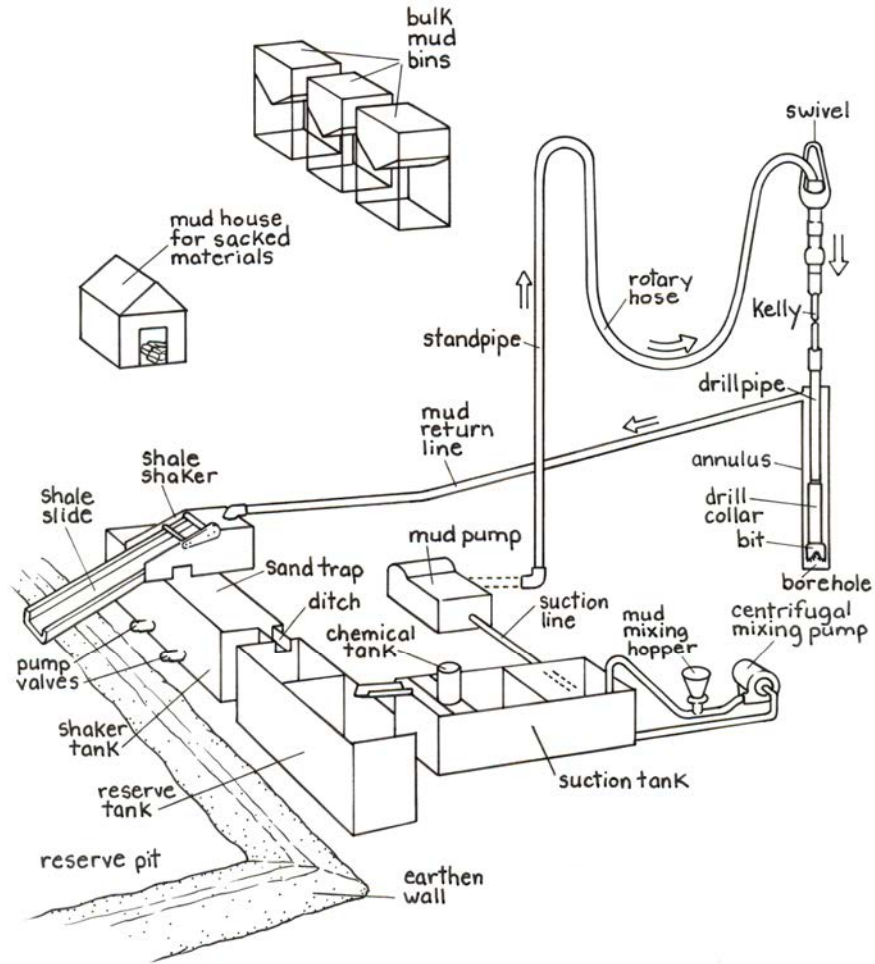
Figure 37.10 Example of a tong counterweight enclosure



Section 776 Drilling fluid

Figure 37.11 shows a typical drilling fluid or mud circulating system on a drilling rig.

Figure 37.11 Example of a typical mud circulating system on a drilling rig



Subsection 776(1)(a)

A system for pumping drilling mud typically operates at high pressure of up to 34,000 kilopascals (4,931 pounds/square inch). To ensure that a component of the system does not fail, all parts of the system must be rated at least equal to the maximum working pressure of the pump. This is also known as the “allowable rated working pressure.” Typically, this is shown on a metal plate affixed to the pump.

Before opening a pumping system or removing any cap, plug, plate or cover from a pump, the pressure within the pump should be bled off to atmospheric or as near atmospheric pressure as is practicable.

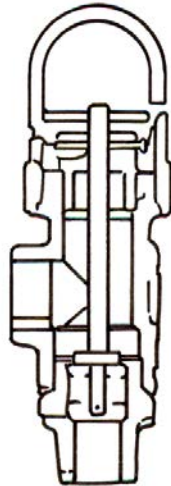
Subsection 776(1)(b)

The pump is the heart of the mud-delivery system and must be operational under all weather conditions.

Subsection 776(1)(c)

Figure 37.12 shows a typical pressure relief device.

Figure 37.12 Example of typical pressure relief device



Subsections 776(1)(d) and 776(1)(e)

No explanations required.

Subsection 776(1)(f)

Pressure relief devices are typically set to relieve at a pressure not in excess of 10 percent above the maximum working pressure of the pump.

Subsection 776(1)(g)

Every shear-pin-set relief device typically has a metal plate attached to it with holes drilled as a gauge for each size of shear pin to be used with the device and a table showing the pressure at which each size shear pin will shear. The shear pin must be of a design and strength specified in the manufacturer's specifications (see Figure 37.13).

Every shear-pin-set relief valve should have the valve stem and the shear pin enclosed in a manner that prevents contact with the valve stem and also prevents the shear pin from flying when sheared.

Figure 37.13 Example of shear pin sizing gauge

SHEAR RELIEF VALVE					
1 NAIL		NAIL SIZE		2 NAILS	
RELIEF PRESS.	2500 LB.		60 PENNY	5000 LB.	RELIEF PRESS.
	2250 LB.		50 PENNY	4500 LB.	
	1750 LB.		40 PENNY	3500 LB.	
	1500 LB.		30 PENNY	3000 LB.	
	1250 LB.		20 PENNY		
	1000 LB.		16 PENNY		

Subsection 776(1)(h)

Adequate drainage should be provided to prevent the accumulation of drilling fluids around pump bases.

Subsection 776(1)(i)

A reduction in piping size would impair the proper operation of the pressure relief device.

Subsection 776(1)(j)

The discharge of a pressure relief device is typically under high pressure. The sudden discharge of the device can result in wide movement of the piping if it is not secured.

Subsections 776(1)(k) and 776(1)(l)

No explanations required.

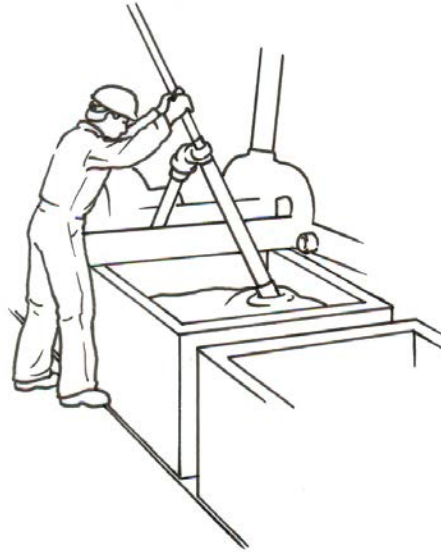
Subsection 776(2)

No explanation required.

Subsection 776(3)

A mud gun is typically used to mix the mud mixture in the rig tanks (see Figure 37.14). This is done to maintain a homogenous mix and ensure an even distribution of mud components. In carrying out this function, the outlet pressure can become high enough that the gun might become unmanageable by workers.

Figure 37.14 Example of a mud gun



Subsections 776(4) and 776(5)

A quick closing valve can produce momentary peak pressures that are beyond the capacity of a relief device to control.

Section 777 Rig tank or pit enclosures

Rig tanks or pits are used to store drilling fluid. Flammable gas might enter the mud from the well bore or a flammable substance might be added to the mud to enhance its drilling properties. This section addresses the handling of a flammable substance and the requirements of Part 10, *Fire and Explosion Hazards*, should be consulted.

Section 778 Prohibition on fuel storage

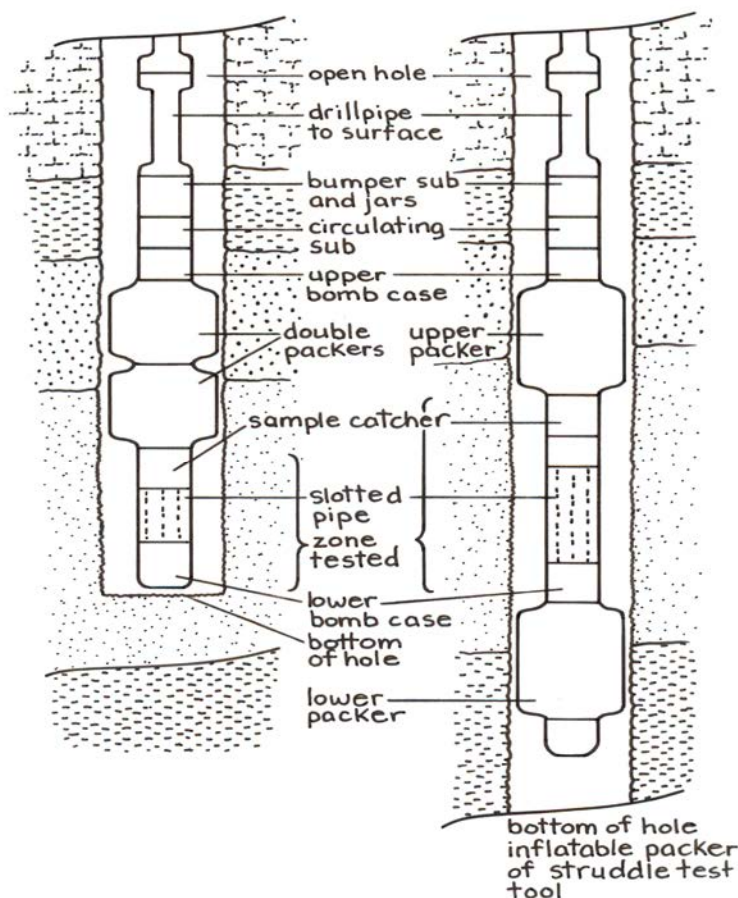
Except for diesel fuel used and stored as described in subsection 778(3), fuel must not be stored within 25 metres of a well.

Section 779 Drill stem testing

Subsection 779(1)

Drill stem testing (DST) is a method of determining the producing potential of a well. The formation fluids exert pressure that is controlled during drilling by using a dense drilling fluid, known as mud, which exerts its own pressure, i.e., hydrostatic head, in excess of the formation pressure (see Figure 37.15). DST is the removal of the drilling fluid so that the formation fluids can flow into the now empty drill string.

Figure 37.15 Example of drill stem testing



DST is one of the most hazardous operations within the industry, presenting a unique set of hazards since control is maintained by mechanical and human systems. Guidelines to minimize the probability of failure of either system during a test should be planned and reviewed before any test starts. This plan should include at least:

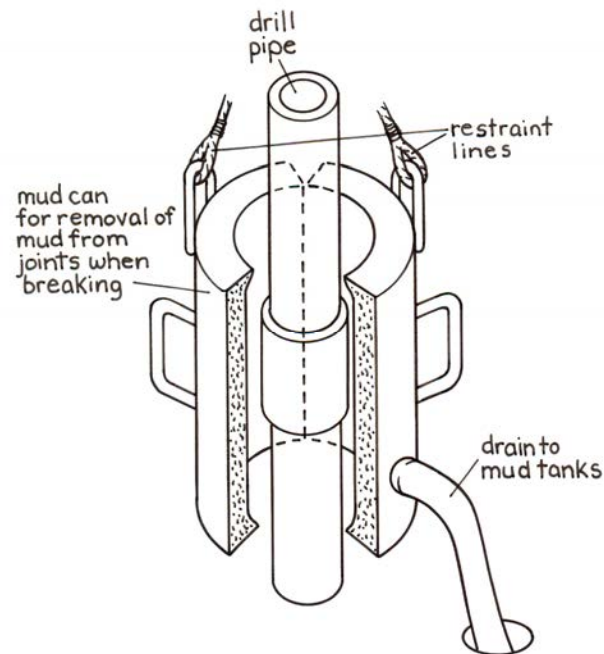
- (a) the zones to be tested;
- (b) the depths of tests;
- (c) the method of testing;
- (d) the type of equipment to be used;
- (e) the duration of the test; and
- (f) a reference to an emergency response plan where applicable.

The emergency response plan should be discussed with all employers and workers involved with the drill stem test. Detailed safe work procedures are described in the Industry Recommended Practice No. 4-2000, *Well-Testing and Fluid Handling*, published by the Canadian Petroleum Safety Council. In addition, the Petroleum Services Association of Canada (PSAC) has developed the *Drill Stem Testing Safety Guideline*, which is available on the PSAC website.

Subsection 779(2)

A “mud-can” is a device used to contain fluid and direct it away from the drill pipe when breaking connections (see Figure 37.16). A “test plug” is a valve attached to the top of each length of pipe being pulled from the hole to prevent flow up the drill pipe.

Figure 37.16 Example of a mud can



Subsection 779(3)

No explanation required.

Subsection 779(4)

Since DST has the potential to produce ignitable vapours, any potential sources of ignition must be removed. This can include any pumps, boilers and heaters not required for the operation. Locking out should be considered as an additional safety step.

Subsection 779(5)

Readers are referred to section 188 for information about restraining hoses and piping. Securing can include weights adequately installed to prevent pipe movement. Generally, there should be one weight for each pipe joint.

An alternative method of anchoring is to drill anchors near the pipe ends with a restraining cable running the length of the pipe. The cable system should be continuous and secured at both ends and all individual pressure components should be secured.

Restraining cables should not be less than 11 millimetres in diameter or chains of equal or greater strength should be used.

Subsection 779(6)

As long as there is adequate lighting, DST may be conducted during darkness until hydrocarbons appear at the surface. At this point the recovery must be reverse-circulated. Reverse circulation is the intentional pumping of fluids down the annulus, i.e., area of the well bore that is outside the drill pipe, and back up through the drill pipe. This is the opposite of the normal direction of fluid circulation in a well bore. A pump-out sub is typically in the test string in order to reverse.

Reverse circulation requires proper disposal of the contents of the drill string by pumping to a tank or a vacuum truck. The receiving vessel must be properly grounded and vented with any engines turned off. Extra care must be taken once the pump-out sub has reached the rig floor since hydrocarbons may be present below the pump-out sub.

Section 780 Well swabbing

Swabbing involves pulling a rubber-faced cylinder, i.e., a swab, up the well tubing which lifts the column of fluid above it to the surface. This reduces the pressure beneath the swab and sucks fluids out.

This swab is typically run through a pressurized lubricator connected to the top of the well Christmas tree. The process is called “swabbing.” This must be securely anchored to ensure that there is no break at the connection point.

Section 781 Well servicing

Subsection 781(1)

Well servicing includes all the maintenance procedures performed on an oil or gas well after the well has been completed and production has begun. Well service activities are generally conducted to maintain or enhance well productivity, although some applications are performed to assess or monitor the performance of the well. Slickline (wireline units other than for well logging), coiled tubing, snubbing, workover rigs, or rod units are used in well servicing activities.

Subsection 781(2)

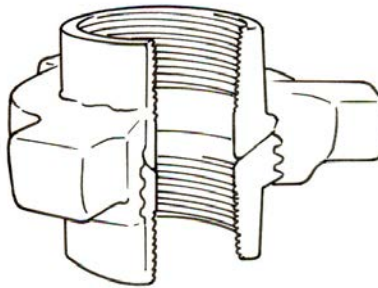
A well servicing activity can involve the circulation of hydrocarbon fluids and vapours which can create a fire or explosion hazard. To ensure that these vapours are not drawn into a pump motor or ignited by hot exhaust surfaces, the air intake and exhaust of the

pump motor must be at least 6 metres away from the rig tank into which the fluids are being circulated.

A tank truck supplying servicing fluid must run its engine to provide power to a pump for unloading or loading these fluids. To avoid the chance of igniting hydrocarbon vapours, the tank truck must be located at least 6 metres away from the rig tank into which the fluids are being circulated.

This subsection requires that the pressure lines supplying carbon dioxide be secured against dislodgment at the supply vehicle and at the pump. Fittings that have a mechanically-locking mechanism such as a hammer union (see Figure 37.17), bolt-up, or camlock with automatic locking arms, are preferable to fittings that must be strapped closed.

Figure 37.17 Cut-away view of a typical hammer union



Subsection 781(3)

The potential danger area is an area circumscribed by an arc the radius of which is equal to the length of the discharge pipeline and centered at either end of the line. Warning signs should also be placed along the perimeter of this area.

Subsections 781(4), 781(5) and 781(6)

No explanation required.

Section 782 Well stimulation

Subsections 782(1) and 782(2)

Stimulation is a treatment to restore or enhance the productivity of a well. Treatments are either hydraulic fracturing treatments or matrix treatments.

Fracturing involves pumping specially engineered fluids at high pressure and at a high rate into the formation, causing a fracture to open. Proppant, such as grains of sand, is mixed with the treatment fluid to keep the fracture open.

Matrix stimulation includes acid, solvent or other chemical treatments to improve or restore the permeability of the formation.

Remedial cementing is performed to repair primary-cementing problems or to treat conditions arising after the well bore has been constructed. This process is carried out at the time of well completion.

Subsection 782(3)

Even if the piping system is restrained in accordance with section 188, no worker is permitted in the danger area unless the pump pressurizing the system is disengaged.

Subsection 782(4)

If liquid carbon dioxide or liquid hydrogen escapes into the atmosphere, it rapidly vapourizes creating a low-temperature hazard and an oxygen-displacement hazard. This subsection addresses that hazard by requiring pump operators to be on the side of the pumping unit away from the discharge line.

Should pressure be lost in the piping system, a check valve near the well head would act to prevent the return of fluids from the well head which could contain hydrocarbon vapours.

In addition to providing fire protection equipment, the following preventive measures should be considered:

- (a) all blending equipment be grounded;
- (b) all equipment unloading sand be bonded to the blending equipment;
- (c) pressurized suction lines be covered so as to deflect fluids in case of leaks;
- (d) lines not be laid under vehicles;
- (e) any flammable fluids spilled be cleaned up before pumping begins; and
- (f) all sources of ignition not necessary for the job be shut down.

The hosing used for a mud line is typically not rated for pressure service and therefore, should not be used.

Section 783 Well site piping system

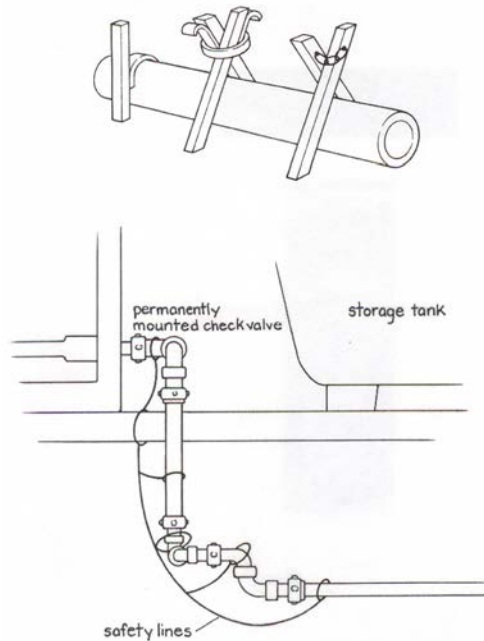
Subsection 783(1)

The manufacturer's specifications or the certified specifications of a professional engineer must be followed.

For threaded connections, the dimensions and gauging of pipe threads must meet the appropriate requirements of ANSI/ASME Standard B1.20.1-1983 (R2006), *Pipe Threads, General Purpose (Inch)*.

Figure 37.18 shows examples of how piping systems can be anchored and restrained.

Figure 37.18 Examples of piping systems being anchored and restrained



Section 784 Gas sample containers

Gas samples are used to determine the physical properties of the gas from a specific well. Because each well has its own unique characteristics, sampling procedures vary from well to well. There are manual methods such as purging at reduced pressure, fluid displacement, air displacement, floating pistons and vacuums and automatic sampling devices that allow gas to flow into a container over a certain period of time at a constant rate.

Regardless of the method, gas sampling involves handling a flammable product under pressure. Consequently, the sampling equipment, which typically consists of a probe inserted into a pipe, must be leak free and able to withstand all expected pressures. The containers must be contaminant free and purged of all other gases and vapours.

Part 38 Residential Roofing

This Part of the *OHS Code* expired on October 31, 2007, following a six-month extension issued by the Minister.

Part 39 Tree Care Operations

Highlights

This Part applies to arboriculture activities that involve pruning, repairing, maintaining or removing trees or cutting brush if a worker works at height and depends on the tree for support.

- Section 793 requires employers to develop and implement safe work practices and procedures (Section 14 of the *OHS Act* requires that a report, plan or procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one).
- Section 794 allows workers to use a work positioning system when it is not reasonably practicable to comply with the fall protection requirements of section 139.
- Section 795 requires, at a minimum, that workers using a work-positioning system use a sit harness approved to one of the listed sit harness standards. “approved to” means that the harness meets one of the listed standards and bears the approval or certification mark of a nationally accredited third-party testing organization. A manufacturer’s self-declaration of compliance *is not* acceptable. A full body harness approved to one of the other listed standards *is* acceptable.
- Section 796 allows employers and workers to use knots in place of rope grabs.

Requirements

Section 792 Application

This Part applies to arboriculture activities that involve pruning, repairing, maintaining or removing trees or cutting brush if a worker works at height and depends on the tree for support. For consistency with the fall protection limits of Part 9, *Fall Protection*, “work at height” means that:

- (a) a worker may fall 3 metres or more; or
- (b) a worker falling a lesser distance is subject to an unusual risk of injury.

Situations involving an “unusual risk of injury” may include work performed above moving water, operating machinery, retaining walls, objects onto which a worker could be impaled, etc. The resulting injury may be worse than an injury from landing on a solid, flat surface.

These criteria and this Part only applies to situations in which the worker depends on the tree for support. This typically involves the use of ropes, connecting hardware,

harnesses, and accessories. For workers performing tree care activities out of an elevated work platform or similar equipment, the requirements of Part 9 must be met.

Readers must keep in mind that other requirements of the *OHS Code* apply to tree care operations, not just this Part. For example:

- (1) connecting components such as carabiners must meet the requirements of subsection 143 and life safety rope must meet the requirements of section 147. The nature of tree care work—seamlessly and constantly switching from work positioning to fall protection to work positioning—requires a high level of safety. These requirements therefore apply even though the worker’s rigging is used as a fall protection system for only brief periods of time during work at height;
- (2) sections 225 through 227 deal with work in and around overhead power lines. The stated safe limit of approach distances must be respected;
- (3) section 234 states requirements for protective headwear. Because of the nature of the work, tree care workers will almost always require headwear that incorporates lateral impact protection. Readers are referred to the explanation to section 234 for a discussion of headwear protection; and
- (4) section 242 deals with the need for employers to ensure that where there is a possibility of injury, a worker wears appropriate hand, arm, leg or body protective equipment. In the case of tree care activities, chain saws are used widely and therefore appropriate chain saw pants need to be worn.

Many other requirements throughout the *OHS Code* similarly apply to tree care operations.

Section 793 Safe work practices

Subsection 793(1)

An employer is required to develop and implement safe work practices and procedures. Section 14 of the *OHS Act* requires that the procedures be in writing and available to workers. More specifically, the safe work practices and procedures must include the following:

- (a) *an assessment of hazards at the work site*—this hazard assessment is key to performing work safely and is a mandatory requirement of the *OHS Code*. Employers must assess hazards and then eliminate and control them as required by Part 2. Readers are referred to the explanation of Part 2 for a thorough discussion of what is expected of employers and workers.

Hazards specific to tree care operations that need to be considered in the hazard assessment include the following:

- (i) condition of the root zone, e.g., cracks, lack of root flare, soil mounding;
- (ii) condition of the tree trunk, e.g., cracks, loose bark, swellings or depressions;


- (iii) condition of the tree crown, e.g., lodged branches, dead branches, stinging insects, electrical conductors;
 - (iv) weather-related hazards, e.g., ice, snow or wet limbs; and
 - (v) climbing and work site hazards, e.g., nearby structures, vehicles and their access to the work area, presence of lawn furniture, bird feeders, satellite dishes and antennas, electrical hazards, poisonous plants, extreme slopes, people in the area.
- (b) *worker training, including hazard recognition*—section 15 of the *OHS Regulation* requires that workers be trained in the safe operation of the equipment they are required to operate. This training must include the following:
- (i) the selection of appropriate equipment;
 - (ii) the limitations of the equipment
 - (iii) an operator's pre-use inspection;
 - (iv) the use of the equipment;
 - (v) the operator skills required by the manufacturer's specifications for the equipment;
 - (vi) the basic mechanical and maintenance requirements of the equipment;
 - (vii) loading and unloading the equipment if doing so is a job requirement; and
 - (viii) the hazards specific to the operation of the equipment at the work site.


Workers must participate in the training and apply it when working. Workers must also be trained to recognize hazards and know what to do about them;

- (c) *work positioning and fall protection*—workers must understand the difference between these two safety systems and the equipment each requires. Work positioning systems support a worker so that the worker's hands are free when he or she reaches the work position. Fall protection systems either "catch" a worker in mid-air, preventing the worker from contacting a lower surface (fall arrest system), or prevent a worker from reaching an edge from which he or she could fall (travel restraint system); and
- (d) *emergency rescue*—the employer must develop rescue procedures to be used if a worker falls, is suspended by a work positioning system or fall arrest system and needs to be rescued. Readers are referred to the explanation of section 140 for information about emergency rescue, as well as the explanation of Part 7, *Emergency Preparedness and Response*.

For additional information directly related to safe work procedures, readers are directed to section 9, Work Procedures, of ANSI Standard Z133.1-2006, *American National Standard for Arboricultural Operations—Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush—Safety Requirements*. The remainder of the requirements of the Standard are already addressed in the *OHS Code*, legislation that takes precedence over the ANSI Standard.

For more information

 ANSI Standard Z133.1-2006, *American National Standard for Arboricultural Operations—Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush—Safety Requirements*.

 Jepson J. *The Tree Climber's Companion—A Reference and Training Manual for Professional Tree Climbers*, 2nd edition. Beaver Tree Publishing, Minnesota; 2000.

Subsection 793(2)

The purpose of this requirement is to involve those persons most knowledgeable about the work or processes being assessed, and who will be most affected by whatever actions are taken as a result of the assessment. Directly affected workers often have more insight into a job or task than persons who only observe the completed work.

Involving workers can:

- (a) increase the number of persons available to perform assessments, spreading out the work into manageable pieces;
- (b) teach them how to recognize hazards, increasing the likelihood that the hazards will be quickly corrected; and
- (c) increase their awareness of, and involvement in, health and safety issues at the work site.

Workers affected by the hazards identified in the hazard assessment need to know about those hazards and the methods that will be used to control or eliminate the hazards. They are the persons with the greatest potential to be affected by the hazards and they need to know if corrective measures will require them to do something.

Section 794 Fall protection and work positioning

In instances where a worker must climb into a tree to perform work, it may not be reasonably practicable to comply with the fall protection requirements of section 139. If this is the case, the employer must ensure that a worker uses a work positioning system. Work positioning systems support a worker so that the worker's hands are free when he or she reaches the work position. Fall protection systems either "catch" a worker in mid-air, preventing the worker from contacting a lower surface (fall arrest system), or prevent a worker from reaching an edge from which he or she could fall (travel restraint system).

Work in trees is a strenuous, dynamic activity that involves the worker seamlessly and constantly switching from work positioning to fall protection to work positioning. Most often the worker is using his or her equipment as a work positioning system, with ropes, lanyards and lifelines in tension, limiting fall distances to a minimum.

Section 795 Harness standards

Sit harness

Historically, the tree care industry has relied upon the sit harness or “climbing saddle” as it is known within the industry, as the piece of safety equipment that supports a worker while he or she works at height. A saddle consists of a waist belt with two wide leg loops, and sometimes a support strap that passes under the buttocks. Unlike a full body harness, a saddle does not have any shoulder straps.

Virtually all saddles in North America have been built to the requirements of ANSI Standard A10.14-1991, *Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use*. Although the Standard has been withdrawn by ANSI, its use has set the precedent of what is acceptable for worker protection in work positioning systems during tree care activities. The Standard has also set the basic design requirements of the safety harnesses. Based on this precedent, the *OHS Code* allows the use of sit harnesses or saddles in work positioning systems during tree care activities for which it is not reasonably practicable to use traditional fall protection equipment. To be acceptable, the sit harness or saddle must be approved to one of the standards listed in subsection 795(1).

Full body harness

In some cases, workers may choose to use a full body harness rather than a sit harness. Many models of full body harness have the waist belt and leg straps of a sit harness, plus shoulder and chest straps. As a result, a full body harness provides protection that is equal to and often better than that offered by a sit harness or saddle. While the minimum requirement is for an approved sit harness, a worker can use a full body harness and is encouraged to do so. To be acceptable, the full body harness must be approved to one of the listed standards for full body harnesses.

Experience in the province of Quebec suggests that full body harnesses with the appropriate design features can be used during tree care activities. Alberta Labour will monitor the Quebec program and initiatives elsewhere in North America that would eventually result in the tree care industry moving towards full body harnesses for all tree climbing activities.

Approval

Only sit harnesses and full body harnesses approved to one of the listed standards are acceptable. For compliance purposes, the harness must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the harness meets the requirements of the listed standard. Without this mark or label, the harness is unacceptable even if the manufacturer’s label and product literature states that the harness complies with one of the referenced standards.

Subsection 795(1)(a)

NFPA Standard 1983, *Standard on Fire Service Life Safety Rope and System Components*, 2006 edition, specifies minimum design, performance, testing, and certification requirements for new life safety rope and new system components including escape rope, water rescue throwlines, life safety harnesses, belts, and auxiliary equipment used for rescue and training by the fire service or similar emergency service organizations.

The Standard defines a Class II life safety harness as a harness that fastens around the waist and around the thighs or under the buttocks and is designed for rescue with a design load of 2.67 kilonewtons (600 pounds-force). This is a sit harness or saddle.

A Class III life safety harness fastens around the waist, around the thighs or under the buttocks, and over the shoulders. The harness is designed for rescue with a design load of 2.67 kilonewtons (600 pounds-force). This is a full body harness.

Subsection 795(1)(b)

EN Standard 813: 1997, *Personal protective equipment for prevention of falls from a height — Sit harnesses*, specifies requirements, testing, marking and instructions for use of sit harnesses for use in work positioning and restraint systems where a low point of attachment is required. The Standard states that sit harnesses are not suitable for fall arrest purposes.

A sit harness is defined as an arrangement of straps, fittings and buckles or other elements in the form of a waist belt with a low attachment element and connecting support encircling each leg suitably arranged to support the body of a conscious person in a sitting position. Sit harnesses may be fitted with shoulder straps and/or may be incorporated into a garment.

Subsection 795(1)(c)

CSA Standard CAN/CSA-Z259.10-06, *Full Body Harnesses*, covers full body harnesses for use as body supports in personal fall arrest systems and in other work situations that involve the risk of falling. The Standard does not stipulate designs for full body harnesses, except insofar as design limitations are necessary to help ensure safe and durable service. The Standard does not include harnesses for use by firefighters or for use in recreational situations such as mountaineering.

Subsection 795(1)(d)

ANSI Standard Z359.1-2007, *Safety requirements for personal fall arrest systems, subsystems and components*, specifies requirements for the performance, design, marking, qualifications, instructions, training, inspection, use, maintenance and removal from service of connectors, full body harnesses, lanyards, energy absorbers, anchorage connectors, fall arresters, vertical lifelines, and self-retracting lanyards comprising

personal fall arrest systems for users within the capacity range of 59 to 140 kilograms (130 to 310 pounds). In terms of harness types, the Standard only specifies requirements for full body harnesses.

Subsection 795(1)(e)

EN Standard 361: 2007, *Personal protective equipment against falls from a height—Full body harnesses*, specifies the requirements, test methods, marking, information supplied by the manufacturer and packaging for full body harnesses. Other types of body support, specified in other European Standards, e.g., EN358, EN813 or EN1497, may be incorporated into the full body harness.

The full body harness may comprise straps, fittings, buckles or other elements, suitably arranged and assembled to support the whole body of a person and to restrain the wearer during a fall and after the arrest of a fall.

Subsection 795(2)

The requirement that a harness be approved to one of the listed standards does not apply to sit harnesses and full body harnesses in use in tree care activities prior to April 30, 2004, the effective date of the first edition of the *OHS Code*.

Section 796 Knot exemption

Almost every aspect of tree climbing and tree work involves the use of a rope. To use the rope properly and safely, workers must know how to tie and set a variety of knots and sliding hitches. Sliding or friction hitches are used by workers to ascend and descend trees, and as a belay device. Sliding hitches act as a type of rope grab, sliding along a rope. Commonly used sliding hitches include Blake's Hitch, the Taughtline Hitch, and a Prusik knot used with a Prusik sling.

Section 150.3 restricts the use of Prusik and similar sliding hitch knots to competent rescue or emergency services personnel, or in an emergency to a worker trained in its use and limitations. Reflecting the extent to which tree care activities rely on knots and ropes, and the fact that tree care workers are competent in the use of these knots, section 150.3 does not apply to tree care operations.

Part 40 Utility Workers—Electrical

Section 797 Application

The requirements of this Part may conflict with requirements appearing elsewhere in the *OHS Code*. This section clarifies that the requirements of this Part take precedence.

Section 798 Application

If a particular term is defined in both the *OHS Code* and the *Alberta Electrical and Communication Utility Code* (ECUC), the definition appearing in the ECUC, Second Edition, 2002, takes precedence. This eliminates any potential conflicts should identical terms be defined differently in both publications.

Section 799 Protective devices or equipment

Subsection 799(1) Standards

To ensure the safety of protective devices and protective equipment used by workers, employers must ensure that the devices and equipment meet the requirements of the listed standards. The devices and equipment need not be approved by an independent third-party organization such as CSA, ULC, UL, or SEI as complying with the standards. A manufacturer's self-declaration of compliance is satisfactory.

North American manufacturers presently make products that meet the requirements of the listed standards.

ULC Standards

CAN/ULC-60832-99, *Insulating Poles (Insulating Sticks) and Universal Tool Attachments ((Fittings) for Live Working*, is an adoption, without modification, of IEC standard 60832. The Standard specifies performance characteristics for insulating poles and accessory attachments.

CAN/ULC-D60855-00, *Live Working—Insulating Foam-Filled Tubes and Solid Rods for Live Working*, is an adoption, with Canadian deviations, of IEC standard 60855. The Standard applies to insulating foam-filled tubes and solid rods made of synthetic materials and intended for tools and equipment for live work on systems operating at voltages above 1 kV. Separate special technical standards give details of tests for fittings and attachments to these poles and rods, adaptable tools and complete tools.

CAN/ULC-60895-04, *Live Working—Conductive Clothing for Use at Nominal Voltage Up to 800 kV A.C. and +/- 600 kV D.C.*, is an adoption, without modification, of IEC standard 60895. The Standard applies to conductive clothing, either assembled from component

parts or forming a single complete clothing element, worn by electrically skilled persons during live work, especially bare-hand work, at a nominal power system voltage up to 800 kV a.c. and 600 kV d.c. It is applicable to conductive jackets, trousers, coveralls, gloves or mitts, hoods, shoes, overshoe socks and socks.

CAN/UCL-60900-99, *Hand Tools for Live Working up to 1000 V a.c. and 1500 V d.c.*, is an adoption, without modification, of IEC standard 60900. The Standard applies to insulated and insulating hand tools used for working live or close to live parts at nominal voltages up to 1000 V a.c. and 1500 V d.c. Not included are tools, equipment and material supplied from an external energy source, and insulating rods and poles used for working at distances which are covered by IEC Standard 855.

CAN/ULC-60903-04, *Live Working—Gloves of Insulating Materials*, is an adoption, without modification, of IEC standard 60903. The Standard applies to:

- (a) insulating gloves and mitts which should normally be used in conjunction with leather protector gloves worn over the insulating gloves to provide mechanical protection; and
- (b) insulating gloves and mitts useable without over-gloves for mechanical protection.

Unless otherwise stated in the Standard, the use of the term “glove” includes both gloves and mitts. The use of the term “insulating gloves” designates gloves providing electrical protection only. The use of the term “composite gloves” designates gloves providing electrical and mechanical protection.

CAN/ULC-D60984-00, *Sleeves of Insulating Material for Live Working*, is an adoption, with Canadian deviations, of IEC standard 60984. The Standard applies to insulating sleeves for the protection of workers from accidental contact with live electrical conductors, apparatus or circuits.

CAN/UCL-D61112-01, *Blankets of Insulating Material for Electrical Purposes*, is an adoption, with Canadian deviations, of IEC standard 61112. The Standard applies to insulating blankets for the protection of workers from accidental contact with live or earthed electrical conductors, apparatus or circuits and avoidance of short circuits on a.c. and d.c. installations.

CAN/ULC-D61229-00, *Rigid Protective Covers for Live Working on a.c. Installations*, is an adoption, with Canadian deviations, of IEC standard 61229. The Standard applies to rigid insulating covers for live working on a.c. installations, including those described in IEC Standard 743.

CAN/ULC-61236-99, *Saddles, Pole Clamps (Stick Clamps) and Accessories for Live Working*, is an adoption, without modification, of IEC standard 61236. The Standard applies to saddles and pole clamps (stick clamps) used for live working, and to their accessories. The standard specifies the dimensional and mechanical characteristics to be given by the

manufacturer for each tool, the corresponding mechanical tests, and the other points to be checked (visual, functional, marking, etc.).

CSA Standard

CSA Standard, CAN/CSA-C225-00, *Vehicle-Mounted Aerial Devices*, sets criteria for the design, manufacture, testing, inspection, installation, maintenance, use and operation of vehicle-mounted aerial devices. These devices are installed on a chassis, are primarily used to position workers for work purposes, and are used for operator training. The vehicle may be a truck, trailer or all-terrain vehicle. The design and manufacturing requirements of the Standard apply to those devices manufactured after the date of publication of the Standard.

The Standard recognizes both insulated and non-insulated aerial devices. Insulated aerial devices are classified into three categories based on the degree of electrical protection they provide and the type of work being performed.

Subsection 799(2) Effective date

No explanation required.

Subsection 799(3) Laboratories performing electrical testing

Because electrical utility workers rely on high voltage protective devices and equipment such as voltage detectors, insulating sleeves, protective covers and insulating blankets for their protection, laboratories testing this equipment must ensure that testing is performed properly. Laboratories performing this work must meet the requirements of ASTM Standard D2865-06, *Standard Practice for Calibration of Standards and Equipment for Electrical Insulating Materials Testing*.

Compliance with the standard requires an employer to establish and maintain calibration procedures for measuring and test equipment used for testing electrical insulating materials. This ensures the accuracy and precision of any measurements. The Standard also presents requirements applicable to the calibration of reference standards and test and measuring equipment, and personnel training.

Section 800 Safe work practices for electric utilities and rural electrification associations

Subsection 800(1) Rules in the ECUC that apply

The *OHS Act* is the enabling legislation governing worker safety in Alberta. It is under the authority of the *OHS Act* that the *OHS Regulation* and *OHS Code* have been created. However, a number of worker safety rules have also historically appeared in the *Alberta Electrical and Communication Utility Code (ECUC)*, under the authority of the *Safety Codes Act*. The ECUC, Second Edition, 2002, published by the Safety Codes Council,

establishes minimum safety standards for the installation and maintenance of electrical and communication utility systems in Alberta.

When worker safety requirements are developed and administered outside of occupational health and safety legislation, confusion is created about which requirements apply and who is responsible for enforcement. Furthermore, workers become accustomed to referencing a particular regulation and are often unaware of rules in other regulations, rules that may be very important to their safety and well-being.

To end this potential confusion, the worker safety rules present in the ECUC have been transferred to the *OHS Code*. However, rather than reproduce the ECUC safety rules in the *OHS Code*, section 800 references the appropriate rules of the ECUC directly. Presented after the explanation to section 10 are the explanations of the referenced ECUC rules, which are now under the authority of the *OHS Act* and part of the *OHS Code*.

Subsection 800(2) Rules in the ECUC that do not apply

This subsection lists rules in section 4 of the ECUC that do not apply. Some of these rules are not relevant or have been replaced by requirements appearing in the *OHS Code*.

Section 801 Safe work practices for industrial power producers

No explanation required.

Section 802 Coordinated work

This section applies to situations where two or more sets of workers perform potentially dangerous work requiring coordination such as isolating equipment, energizing equipment, switching, and tagging. It is vital that all workers involved in the work follow the same safe work procedures.

When such coordinated work takes place, the employers involved, i.e., electrical utility, industrial power producer, or rural electrification association, must jointly develop and follow one agreed upon set of safe work procedures for isolating electrical equipment and lines or blocking reclosing devices.

Section 803 Communication lines, cables

Paragraphs (a) and (b) are intended to eliminate the possibility of communication lines or cables contacting energized electrical equipment or lines.

Paragraphs (c) and (d) require that safe procedures and work methods be followed to ensure that the work is done safely. The work method must be acceptable to the owner/operator of the electric utility.

Section 804 Work on energized electrical equipment or lines (above 750 volts)

Subsection 804(1)

Rule 4-160 of the 2002 edition of the ECUC, with minor changes, now appears as section 804. Live line work must be performed by a 3-person crew consisting of a minimum of two qualified utility employees to perform the work and one utility employee at ground level. If an aerial device is used while performing the work, the aerial device must be equipped with both upper and lower controls. This ensures that the aerial device bucket can be returned to the ground by an appropriately trained utility employee should the worker or workers in the bucket be unable to do so.

Subsection 804(2)

Rule 4-162 of the 2002 edition of the ECUC now appears as section 805. As with the rule it replaces, section 805 exempts a utility worker from the requirement to have a minimum 3-person crew when performing live line work if certain conditions are met.

Subsection 804(2) now also exempts a utility from having to have a third worker on the ground when certain work is performed. If the employer's hazard assessment (required by Part 2 of the *OHS Code*) indicates that the work can be done safely and a professional engineer certifies that an alternative live line work procedure provides adequate utility employee protection, then a crew of two qualified utility employees can perform the live line work. One of the two qualified utility employees must be at the work site at ground level.

Rule 4-162 required the utility to get "special permission" if a work procedure other than that described by rule 4-160 was to be followed. In preparing clause 805(a), the term "special permission" was removed to eliminate the need for a utility to apply for an acceptance every time an alternative live line work practice is required. The authority to alter work practices should remain with the utility but for safety and accountability reasons, a professional engineer needs to certify the alternative procedure as providing an adequate level of worker protection.

Subsection 804(3)

Rule 4-164 of the 2002 edition of the ECUC, revised to include additional low risk activities, appears as section 806. Switching or fuse replacement work for example, involves the use of rated live line tools. This is a low risk activity because the tools are designed for this activity and there is minimal or no opportunity to violate the limits of approach during this activity. The other activities listed are also considered to be low risk activities.

Subsections 804(1) and 804(2) do not apply under the circumstances described.

Explanation of Rules Referenced from the ECUC, Second Edition

Rule 4-000 Scope

While this rule defines the scope of what is covered, it is important to note that work involving telecommunications work activities are regulated federally under the *Canada Labour Code*, Part II. For more information about which workers are covered by Alberta's *OHS Act* and which are not, readers are referred to the explanation for the word "worker" appearing in Part 1 Definitions of this OHS Code Explanation Guide.

Rule 4-002 Duties

Subrule 4-002(1) Competency

As required elsewhere in the OHS Code, the employer is responsible for determining worker competency. For more information about competency, readers are referred to the definition of the term "competent" appearing in Section 1 of the *OHS Act*. In the subsections that follow, the term "worker" is used in its broadest sense to refer to any worker, whether a utility, its contractors, or subcontractors employ the person. Similarly, the term "employer" refers to any employer, whether it be a utility, its contractor, or subcontractors.

Subrules 4-002(2) and 4-002(3)

No explanation required.

Subrule 4-002(4)

Utility tree trimmers are also considered utility employees when working near power lines.

Subrule 4-002(5)

Utility tree workers are also considered utility employees when working near power lines.

Rule 4-004 Interpretation of Rules

With the transfer of these selected rules from the ECUC to the *OHS Code*, the authority having jurisdiction is now the Minister responsible for the *OHS Act*.

Division A—General requirements for employers

Rule 4-006 Duties

The duties described in this rule are consistent with employer responsibilities described elsewhere in the *OHS Code* and the *OHS Act*. As required by this rule, the employer:

- (a) must ensure that a copy of the ECUC safety rules referenced by the *OHS Code* are accessible to each utility employee. This is meant to include all workers working on behalf of the utility, including those working for contractors and subcontractors on behalf of the utility. A copy of the safety rules need not be carried by each worker—the rules can be at a local office, in a truck, or available on-line as examples;
- (b) must ensure that the worker has received instruction in how the safety rules are applied. This instruction should reflect the appropriate safety rules applicable to the work being done and the worker's scope of work. Although not a requirement, it is suggested that a record of the completion of this instruction be kept by the employer;
- (c) must ensure that workers follow the rules, perhaps through a system of supervision; and
- (d) must have a method of evaluating worker competence to ensure that the worker is adequately qualified, suitably trained, and with sufficient experience to safely perform the assigned work.

Rule 4-008 Instruction

The employer must have a process to make sure that the state of electrical lines and equipment, and any abnormal conditions, is identified to workers to protect them from potential hazards.

Rule 4-010 Visitors

The employer is required to ensure the safety of all workers, visitors and employees who enter restricted areas. Examples are any area considered restricted by the employer. This includes locked areas such as substations, generating stations, fenced areas, and underground vaults, and unlocked areas such as transmission towers. A person authorized by the employer who is familiar with the hazards must accompany workers, visitors and employees who are unfamiliar with the hazards.

“Continuously supervised” is understood to mean the same as “direct supervision” as defined in the *OHS Code*, i.e., that a competent worker is personally and visually supervising the worker, visitor or other employee in the restricted area, and that the competent worker is able to communicate readily and clearly with the worker, visitor or other employee in the restricted area.

Rule 4-012 Employee in Charge

Subrule 4-012(1) More than one employee

If two or more utility employees are working on or near the same electrical equipment or line at the same location, then one of the workers must be designated as the utility employee in charge. Doing so is intended to prevent any confusion as to who is in charge and directing work activities. While the term “utility employee” is used in this subrule, subrule 4-002(2) ensures that the requirement also applies to “qualified utility employees.” Depending on the type of work being done, the qualified utility employee or the utility employee could be identified as being the employee in charge.

Subrule 4-012(2) Worker instruction

The employer is responsible for ensuring that the employee in charge provides work instruction to all the workers under his or her direction. This should include a review of the identified hazards involved in the work and how these hazards will be controlled or eliminated. A tailboard meeting is one means of providing this information to affected workers.

Rule 4-014 Work area

This rule applies when work is required near energized electrical equipment that has been exposed and could be inadvertently contacted, e.g., an open energized underground cabinet. The employer must ensure that work area protection is provided, e.g., permanent or temporary barriers, rubber gloves, cover up, signage, limits of approach, etc.

Rule 4-016 Coordination

An employer must assign an operator-in-charge (OIC) for the entire power system or, if more than one OIC is required, assign an OIC for each portion of the system that that OIC is in control of. This serves to prevent any confusion as to who controls the operation of the electric utility system or each specific portion of the electric utility system. The employer must provide the OIC with sufficient information to allow the OIC to carry out his or her duties, e.g., maps, logs, SCADA, switching diagrams, equipment information, etc.

The employer must provide written procedures to workers that describe the operation, isolation and maintenance of the power system. These procedures represent the general practices to be followed—they are not always a step-by-step procedure. The employer must also provide written procedures describing the safe installation and use of protective grounds.

Information about power system operation and grounding applications must be kept up-to-date and made available to the OIC and qualified utility employees. The OIC should be made aware of all changes to single line diagrams (paper or electronic), grounding, on the system and any operating procedures affecting the system as soon as practicable. The OIC needs this information to safely operate the system.

Rule 4-018 Fire extinguishers

An employer must ensure that workers are trained in how to use approved fire extinguishing equipment on or in close proximity to energized electrical equipment. The fire extinguishing equipment must be in accordance with the requirements of the current *Alberta Fire Code*.

At the present time, the 1997 edition of the *Alberta Fire Code* applies. In particular, section 6.2.3.7 *Extinguishers for Class C Fires* specifies the requirements applicable to portable fire extinguishers:

- (1) portable fire extinguishers for class C fires, i.e., fires involving energized electrical equipment, must be provided in or near electrical equipment; and
- (2) the portable fire extinguishers must be distributed according to the applicable requirements of table 6.2.3.3 or table 6.2.3.5 of the *Alberta Fire Code*.

Readers are referred to these tables for information describing the size, quantity, and distribution of fire extinguishers required for their specific circumstances.

The *Alberta Fire Code* refers readers to National Fire Protection Association (NFPA) Standard 10, *Portable Fire Extinguishers*. The following explanatory information is based on what is presented in Section E.5 of the NFPA Standard.

When the power to a piece of electrical equipment is cut off, the fire changes character to that of a Class A fire (i.e., a fire involving combustible materials such as wood, cloth and paper), a Class B fire (i.e., fire involving a flammable liquid or combustible liquid, fat or grease), or a combined Class A and B fire, depending on the nature of the burning electrical components and any material burning in the immediate vicinity.

Isolating and grounding electrical equipment eliminates the possibility of shock hazards to the fire extinguisher operator if the operator accidentally comes into physical contact with the equipment, or if the operator brings any conductive part of a fire extinguisher within arcing distance. Isolating and grounding also eliminates fault currents from prolonging the fire or from being a source of re-ignition.

Switches or circuit breakers that cut electric power to specific equipment can prevent hazardous situations resulting from the loss of power. Often, fires involving an electrical component are relatively minor and, by a short application of a Class C

extinguishant, can be effectively extinguished without disturbing electrical continuity.

The capacity of the fire extinguisher supplied for each major Class C hazard situation should be individually judged according to the following factors:

- (1) size of the electrical equipment;
- (2) configuration of the electrical equipment—particularly the enclosures of units—that influences how the extinguishing agent is distributed;
- (3) effective range of the fire extinguisher stream; and
- (4) quantity of Class A and Class B material involved.

For large installations of electrical equipment where power continuity is critical, fixed fire protection is desirable. At locations where such fixed systems are installed, it is practical to also provide Class C portable fire extinguishers units to handle quickly discovered fires; obviously, the number and size of these units can be reduced under such conditions.

Rule 4-020 Equipment supply

No explanation required.

Rule 4-022 Training and space

Training workers in the safe use of protective devices and equipment is a basic requirement and dealt with in its most general sense in section 15 of the *OHS Regulation*.

The employer is responsible for ensuring that workers have sufficient working space to safely operate live line tools and associated equipment so that the limit of approach distances are not violated in such spaces. Minimum working space requirements appear in CSA Standards C22.3 No. 1, *Overhead Systems*, and C22.3 No. 7, *Underground Systems*.

In the context in which it was originally written, the term “confined spaces” in paragraph (b) more correctly refers to “restricted spaces,” i.e., spaces in which the amount of room provided to workers for easy movement is limited or “restricted.” The term does not refer to confined spaces as used in Part 5 of the *OHS Code*.

Rule 4-024 Identification

The employer must identify electrical equipment and power lines so that workers know what to safely operate. The identification of electrical equipment and circuits is described in rule 8-046 of the ECUC as follows:

8-046(1) Electrical equipment and circuits shall be identified for safety purposes by position, colour, number, letter, nameplate, label, design or equivalent means and the method of identification shall be uniform throughout the electrical utility system.

8-046(2) Identification marks shall not be placed on removable covers or casings where the interchanging of these removable parts would result in incorrect identification.

Rule 4-026 Rescue training

Utility employees required to work on or near energized electrical equipment or lines must be instructed in rescue and resuscitation practices. The rescue training employees receive must be appropriate to the type of work they perform and where the work is performed, i.e., on a pole top, from a bucket, on a tower, inside a confined space, etc. Training in resuscitation practices includes training in cardiopulmonary resuscitation and first aid.

Rule 4-028 Prohibited equipment

Utility workers are trained to recognize electrical hazards and understand the limits of approach concept and the hazards conductive materials present near energized electrical equipment. Prohibiting the listed types of equipment from being used near energized electrical equipment reduces the potential for a contact.

The term “near” in this case means within the limits of approach applicable to that equipment and the worker’s authorization—qualified utility employee, utility employee, utility tree trimmer, utility tree worker. In cases where conductive materials must be moved in areas occupied by energized equipment, the safe limit of approach distances must be respected.

Division B—General requirements for utility employees

Rule 4-30 Duties

These duties are already recognized in a general sense in Part 1 of the *OHS Act* and section 14 of the *OHS Regulation*. Regarding paragraph 4-030(e), the ECUC has historically been concerned with the safety of both workers and the public.

Rule 4-032 Instruction

A utility employee who is not competent to perform work must not perform the work unless he or she is under the direct supervision of a competent worker. For more

information about competency, readers are referred to the explanation for the term “competent” appearing in Part 1 Definitions of this Explanation Guide.

The term “direct supervision” is defined in Part 1 Definitions of the *OHS Code*. Specifically, it means that a competent worker is personally and visually supervising the worker who is not competent and is able to communicate readily and clearly with the worker who is not competent.

Rule 4-034 Authorized entry

No explanation required.

Rule 4-036 Hazard report

Utility employees and qualified utility employees have a responsibility to identify and report hazardous conditions to the operator of the utility system or their designate, guard the hazardous conditions and, where possible, take steps to eliminate or control the hazard for other workers and the public.

This last responsibility is a noteworthy departure from the *OHS Code*. With few exceptions, workers are rarely required to take direct action that results in a hazard being eliminated or controlled. Hazard elimination and control is normally an employer responsibility.

Rule 4-038 Equipment

Utility employees and qualified utility employees must use the proper tools and equipment in accordance with the regulation, standards identified, and the employer’s safety rules.

Rule 4-040 Clothing

The requirements of paragraphs (1)(a) and (1)(b) do not apply — they have been superceded by section 232 of the *OHS Code* that reads as follows:

232(1) If a worker may be exposed to a flash fire or electrical equipment flashover, an employer must ensure that the worker wears flame resistant outerwear and uses other protective equipment appropriate to the hazard.

(2) A worker must ensure that clothing worn beneath flame resistant outerwear and against the skin is made of flame resistant fabrics or natural fibres that will not melt when exposed to heat.

Readers are referred to section 232 of this Explanation Guide for a complete explanation of this requirement.

Paragraph (1)(c) and subsection (2) prohibit metallic articles from being in contact with the skin unless the articles are conductive clothing, eyeglasses or hearing protection acceptable for such use by the employer. These exceptions are noted because they are essential pieces of equipment that may not be available with totally non-metallic components. The prohibition on metallic articles against the skin reflects the fact that these articles can melt during an arc event and seriously injure a worker.

Paragraph (1)(d) requires workers to wear approved industrial protective headwear when working on or near energized equipment. This is a very general and non-specific requirement. Readers must follow the head protection requirements specified in sections 234 through 239 of the *OHS Code* that are far more detailed. Readers should refer to this Explanation Guide for these sections to understand the headwear requirements.

Paragraph (1)(e) requires that when a worker is working on or near energized equipment, the worker must wear a long sleeved garment and the sleeves must be rolled down. This is intended to minimize the potential for electrical burns to the skin.

Rule 4-042 Climbing

The employer is required to have procedures in place that describe how a worker determines if a pole, wooden structure or tree will safely support the worker's weight. The employer is also required to have procedures that allow a worker to determine that elevated portions of structures used for supporting a pole, wooden structure or tree will safely support the worker's weight.

Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. Subrules (1) and (3) require the worker to follow these procedures.

In general, an articulating boom truck is used to support the pole, wooden structure or tree. In cases where a boom truck cannot get into the area to provide support, ropes and guy wires may be used.

The removal of guy wires or conductors, or alternating tensions in them, can cause a standing pole or structure to become unstable. Workers must be aware of this and make sure that additional support is provided to poles and structures as necessary.

Rule 4-044 Climbing spurs

Paragraph (a) does not apply.

To reduce the possibility of a worker gaffing himself or herself, climbing spurs must only be worn when required. While it is reasonable to wear them while walking or being transported from pole to pole, climbing spurs should not be worn in the office, restaurant, or similar location. Gaff guards are available to prevent injuries while the spurs are being worn.

Rule 4-046 Carrying tools

No explanation required.

Rule 4-048 Standards

The standards in this rule do not apply—they have been replaced by standards listed in section 799.

Rule 4-060 Authorization to perform operations or work

Subrule 4-060(1)

The qualified utility employee (QUE) or the qualified utility employee in charge (QUEIC) must get authorization from the operator in charge (OIC) before operating the system. This includes getting permission to remove the tags on tagged equipment.

Subrule 4-060(2)

When there are more than two workers, all QUEs must get authorization from the QUEIC to work on the system. This ensures that the work activities of all workers are coordinated.

Subrule 4-060(3)

Before beginning any work, the QUEIC must advise the OIC that work will begin soon. This ensures that the work activities of all workers are coordinated.

Subrules 4-060(4) and 4-060(5)

Paragraphs (a) through (c) describe special circumstances under which a QUE is allowed to do things in a way that would otherwise be prohibited.

Paragraph (a) allows a QUE to do what is necessary to safely protect life and property without having to get authorization from the OIC. However, the QUE must let the OIC know what was done and why as soon as possible after the event. This provision should rarely be used.

Paragraph (b) allows a QUE to replace a fuse, operate an automatic sectionalizer, oil circuit recloser, or 3-phase recloser to maintain continuity of service without having to get the authorization of the OIC. This is an initial troubleshooting technique for a power outage call and is done to determine if the fault is temporary. However, the QUE must let the OIC know what was done and why as soon as possible after the event. In the case of control centres operating on a 24/7 basis, the OIC is always contacted for prior authorization.

Paragraph (c) allows a QUE to operate the system in situations where communication with the OIC is impossible and operation of the system will not create an electrical hazard. However, the QUE must let the OIC know what was done and why as soon as possible after the event. This provision should rarely be used.

Rule 4-062 Authorization to work

Subrule 4-062(1)

Before performing work on electrical equipment or lines, a utility employee must get authorization to do so from the qualified utility employee in charge (QUEIC). This serves as a way of making sure that the utility employee is competent to safely perform the work.

Subrule 4-062(2)

This subrule allows a utility employee to work on electrical equipment and lines without having to get authorization from the QUEIC. The provision only applies if an emergency has occurred and the utility employee must perform the work in order to protect life and property. This provision is limited to tasks that involve working on the system, e.g., cutting a line clear to protect another worker's life—it does not include operating the system. This provision should rarely be used.

Although it is not stated as a requirement, the utility employee must let the QUEIC know what was done and why as soon as possible after the event.

Rule 4-064 Identification

Identification markings are required on switches, lines and equipment. These markings allow workers to correctly identify components when requests to perform work are made and authorized. Workers are required to use these identification markings when requesting or granting authorization to work on electrical equipment or lines.

Rule 4-066 Duties of an operator-in-charge

The operator-in-charge (OIC) must:

- (a) be aware of the status of equipment, e.g., open or closed, out of service, recloser blockings, faulty equipment, etc.;
- (b) be aware of the work being done that may affect operation of the system, e.g., live line work, permits establishing safe work areas for workers, switching that has occurred, etc., system capacity, system loading, flow, interconnection agreements, and the status of interconnection points; and
- (c) have up-to-date information on the status of the system—this can be through maps, status boards, logs, computer software systems, etc.

Control centres are the locations that system status and operation information is kept and from where the OIC communicates with workers. A control centre can be in an office or in a vehicle, as long as all the requirements of paragraph (d) are met.

Rule 4-068 Duties of a qualified utility employee in charge

A qualified utility employee in charge must:

- (a) make sure all workers working under his or her direction are aware of the safety rules that apply to the work being done;
- (b) keep all necessary documentation such as permits, job plans, hazard assessments, etc.;
- (c) follow the communication requirements of the operating procedures;
- (d) as far as reasonably possible, keep unauthorized workers away from hazardous areas; and
- (e) prohibit the use of any tools or devices unsuited to the work—equipment must be properly rated, tested and certified as appropriate for the work being done.

There should always be a qualified utility employee in charge at a worksite where work is being done on energized equipment operating at 750 volts or greater, e.g., foreman, sub-foreman, lead hand.

Rule 4-070 Repeating messages

Verbal messages are often exchanged during work on electrical equipment and lines, and to request or grant authorizations. To prevent mistakes resulting from misunderstood messages, this rule requires that verbal messages be repeated so that the sender and receiver understand one another correctly. The use of full names is required to eliminate the chance of an error happening should multiple workers involved in the work have the same first name.

Rule 4-072 Handling underground electrical equipment

This requirement ensures that underground cables are safe to handle. In general, positively identifying the cable involves spiking or cutting the cable with insulated tools.

Rule 4-074 Disconnecting devices

Disconnecting devices such as switches, breakers and overcurrent relays must be capable of safely breaking the arc when the contacts are opened. Paragraph (2) specifies the order in which load break and non-load break switches are to be opened and closed.

Rule 4-076 Air gap devices

Visible air gaps are the preferred method of indicating isolation because of their simplicity and reliability. Non-air gap devices can be used but their use is subject to the conditions listed in paragraph (2).

Rule 4-078 Non-air gap devices

Visible air gaps are the preferred method of indicating isolation because of their simplicity and reliability. Non-air gap devices can be used but their use is subject to the conditions listed in this rule.

Rule 4-080 Isolation

To safely isolate equipment and lines, workers must follow the isolation procedure in the step-by-step sequence described in rules 4-082 to 4-098. Because of conditions related to the work or worksite, a qualified utility employee may be switching at one location and another qualified utility employee testing for potential. In this case each employee completes a portion of the step-by-step sequence, in the correct sequence. In another case a qualified utility employee may switch, then test for potential on the same pole, then ground, and finally tag when he or she comes down the pole.

Rule 4-084 Tagging

Subrule 4-084(1)

The purpose of tagging is to advise others of the status of the power system, thereby preventing it being operated or inadvertently energized. This tagging applies to all utility power system operations and the ancillary systems that can affect the utility power system. Service panels, shop cranes, appliances and similar equipment, etc., that do not affect the operation of the utility system must follow the control of hazardous energy requirements of Part 15 of the *OHS Code*.

The electrical utility industry must follow two different safety regulations when dealing with lock out situations—Alberta's *Electrical and Communication Utility Code* (ECUC) and the *OHS Code*. The lock out requirements of the ECUC apply to electrical utility systems operating at voltages greater than 750 volts, i.e., generation, transmission and distribution systems, and to the auxiliary metering and control circuits operating at lower voltages that affect or influence these high voltage systems.

Strict adherence to the requirements of the ECUC ensures the safety of workers working on such systems and circuits. This is achieved through the use of elaborate procedures involving an operator-in-charge, voice commands, non-personal locks and/or warning tags.

For voltages and systems other than those described above, the electrical utility industry must meet the requirements of Part 15 of the *OHS Code*.

Subrules 4-084(2) and 4-084(3)

The time and date required in this subrule is the time and date at which the device is actually tagged. Sometimes devices will be tagged that are already open, e.g., a normally open switch or a fuse that opened in the night and is tagged in the morning once it has been discovered. The worker who requests the isolation could be the operator-in-charge or the operator-in-charge of an adjoining area. The operator-in-charge is responsible for recording the information that appears on the tag.

Subrule 4-084(4)

Once the designated switches have been isolated, the qualified utility employee directing the switching must inform the worker who requested the isolation that the electrical equipment or lines have been isolated.

Rule 4-086 Test for potential

Electrical equipment or lines that have been isolated must have their isolation confirmed before they are grounded. The potential testing device used to confirm isolation must be tested immediately prior to checking the isolation to make sure that it is working properly. Testing of the potential testing device must be done according to the manufacturer's specifications.

Although the use of potential testing devices is the preferred and most reliable method of confirming isolation, buzzing with a live line tool is acceptable for voltages greater than 5 kV. In situations where buzzing is of questionable reliability, in windy conditions or in areas with the potential for induction for example, isolation should be confirmed using a potential testing device.

Rule 4-088 Installing protective grounds

Subrule 4-088(1)

Protective grounds are installed to protect workers from electrical equipment or lines that could become unintentionally energized, e.g., accidentally energized by a worker, through induction, by lightning, etc. The employer is required to have procedures for installing protective grounds. Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Subrules 4-088(2) and 4-088(3)

Live line tools must be used when installing protective grounds. These tools protect the worker performing the work by isolating him or her from direct contact with ungrounded conductors. However, some switchgear assemblies eliminate the need to use live line tools when grounding. Examples include grounding switches in substations, grounding buggies on SF6 and submersible switchgear, and network transformers.

Subrules 4-088(4) and 4-088(5)

Grounds must be installed between the point on the electrical equipment or line where the worker is working and every potential source of energy that may feed energy into the system being worked on. This is to protect the worker in case any equipment or lines become energized. This grounding must be done in accordance with procedures prepared by the employer.

When equipotential bonding and grounding techniques are used this places the worker at the same potential as the electrical equipment or lines that are being worked on.

Subrule 4-088(6)

Because it is possible for there to be electrical potential on the isolated circuit, the ground must be connected first to prevent having a live conductor in the work area.

Subrule 4-088(7)

“Stations” means locations such as substations, generating stations and switch yards. Switches may make grounding easier to complete.

Rule 4-090 Proceeding with work

Subrules (1) and (2) describe various responsibilities that ensure that there is always someone in charge at the worksite.

After the protective grounds have been connected, the qualified utility employee in charge is authorized to work on or near the isolated and grounded electrical equipment or lines. Before performing work, or directing the work of utility employees on isolated and grounded electrical equipment or lines, each utility employee in charge must first get direction from the qualified utility employee. The utility employee in charge and the utility employee can only work on isolated and grounded circuits; they are not authorized to work on energized equipment.

Rule 4-092 Restoring equipment to operating conditions

Before equipment or lines are restored to operating condition, all workers must be clear of the equipment or lines. Utility employees in charge must report to their qualified utility employee in charge and, if multiple working groups are involved, the utility employee in charge of each group must report clear conditions to the qualified utility employee in charge of the entire operation.

Rule 4-094 Removing protective grounds

This rule ensures that an authorized employee removes the protective grounds and notifies the operator-in-charge that the grounds have been removed and all workers are clear.

Rule 4-096 Tag removed

No explanation required.

Rule 4-098 Closing switches

A switch cannot be closed unless the tag has been removed.

Rule 4-100 Transfer of work permission

The transfer of work permission between workers can occur in circumstances such as shift changes, illness and personal emergencies. The “record” referred to in subrule (3) could include a permit, tag, or day timer entry.

Rule 4-102 Transfer of work permission

The transfer of work permission must be done in an orderly manner so that all workers involved know who is in charge and who is responsible for the workers under their direction.

Rule 4-104 Blocking reclosing devices

Subrules 4-104(1) and 4-104(2)

Blocking a reclosing device makes the device inoperable, preventing electrical equipment or lines from being energized after a fault. Reclosing allows lines to be energized after a temporary fault to minimize customer service interruptions.

If rendered inoperable, the reclosing device must be tagged and although it is not explicitly stated in this rule, it is understood that the tag will bear the information required by rule 4-084. If the automatic reclosing device is operated remotely, it must be appropriately controlled to prevent reclosing.

Rule 4-106 Connecting to an energized circuit

Because it is possible for there to be electrical potential on the isolated circuit, the connecting conductor or device must be connected to the isolated electrical equipment or lines before being connected to the energized circuit. Doing so prevents the possibility of having a live connecting conductor or device in the work area.

Rule 4-108 Disconnecting from an energized circuit

Following the procedure described in this rule prevents the possibility of having a live connecting conductor or device in the work area. This is the reverse of the procedure described by rule 4-106.

Rule 4-110 Switches on energized equipment

Some manually operated switches on energized equipment or lines have operating handles that require the use of live line tools in order to operate the switches safely. By requiring the use of live line tools with these switches, workers are protected from electric shock and being in the flash zone.

Rule 4-112 Conductors

It is possible for a conductor being strung or removed near energized electrical equipment or lines to become energized through induction or direct accidental contact. Because of this, the conductor must be grounded or treated as if it was energized.

Rule 4-114 Current transformers

Following the specified procedure protects the worker doing the work from contacting energized high voltage windings.

Rule 4-116 Capacitor banks

Subrule 4-116(1)

Waiting five minutes allows the capacitor to discharge its stored energy, eliminating the possibility of an arc forming when the grounds are applied.

Subrule 4-116(2)

Short circuiting or grounding an isolated capacitor protects workers from a discharge should they need to contact the capacitor's terminals, jumpers or conductors during work activities.

Rule 4-118 Fuses

At voltages greater than 300 volts between conductors, workers are required to use protective insulated devices to handle fuses. Commonly used devices are insulated pullers and hot sticks. These devices ensure that the worker is a safe distance away from the fuse should a fault occur while it is being handled.

Rule 4-120 Work on equipment below 750 V

Rubber gloves with leather protectors are required when workers work on or near exposed electrical equipment or lines operating at voltages between 300 volts and 750 volts, AC or DC. Being energized, the equipment or lines have not been isolated or grounded, and therefore present a potential hazard to workers. Standard work practices address work done on 120/240-volt circuits.

Rule 4-122 Contact with equipment below 750 V

Utility employees can only contact isolated electrical equipment or lines operating at less than 750 volts if the equipment or lines have been potential tested, grounded, or both. Potential testing and grounding are additional checks to confirm that the equipment or lines are safe to contact without workers having to use rubber gloves.

A voltmeter or potential testing device must be used to positively identify that the equipment or lines are safe to contact.

Rule 4-124 Work on equipment in joint use

Communication equipment and lines may be in joint use, sharing a common space with electrical equipment and lines. Prior to working on any of this equipment or lines, utility employees are required to perform tests to confirm that there are no hazardous potentials.

This requirement only applies if a utility employee is actually working on communication equipment or lines. If the utility employee is not actually working on the communication equipment or lines, e.g., a lineman is simply climbing over the communication space, then testing is not required.

Rule 4-126 Communication lines, cable

This rule does not apply. It has been replaced by section 803 of the *OHS Code*.

Rule 4-128 Overhead lines in joint use

No explanation required.

Division E—Limits of approach

Rule 4-130 General application

Subrule 4-130(1)

Electrical equipment and lines are sometimes operated at less than their design voltage. In such cases a utility employee can establish the safe limit of approach distance based on the operating voltage rather than the design voltage. Despite this, all other workers must continue to use the design voltage in determining the safe limit of approach distance that applies to them. Also see subrule 4-130(4).

Subrules 4-130(2) and 4-130(3)

To simplify the use of limit of approach distances, all voltages between 750 volts and 41.4 kilovolts must use the distance required for 4.16 kilovolt systems.

To ensure worker safety, the next higher nominal voltage level must be used if the operating voltage of a system exceeds the nominal voltage shown in Tables presented in the ECUC. Also see subrule 4-130(4).

Subrule 4-130(4)

Subrules 4-130(1), 4-130(2) and 4-130(3) do not apply if the employer calculates the approach distance based on the operating voltage and insulating level of the electrical equipment or lines. The employer could have an engineer calculate the limit of approach distance using accepted mathematical models or recognized national or international standards. The resulting calculation or report should be available should an officer wish to confirm the basis for the distance being used.

Rule 4-132 Utility employee distances

Subrules 4-132(1) and 4-132(2)

Unless the utility employee is in the continual presence of and under the direction of a qualified utility employee, or the energized parts of the electrical equipment or lines involved are guarded as required by Section 8 of the ECUC, a utility employee must follow the limit of approach distances shown in Table 4-1 of the ECUC.

Subrules 4-132(3) and 4-132(4)

These subrules require that a utility employee working on energized equipment that has not been properly insulated is either trained to do the work, i.e., competent, or must maintain the minimum specified approach distance of 800 mm. These subrules apply at operating voltages of less than 750 volts between conductors. Because qualified utility employees are appropriately trained, the 800 mm distance does not apply to them.

Rule 4-134 Tree work distances

In paragraph (a), utility tree trimmers performing tree work near energized power lines follow the limit of approach distances listed in Table 4-5. The decreased approach distances shown in columns 5(2) and 6(3) of Table 4-5 reflect the fact that in some cases insulated tools are being used, while in others the work is done out of an insulated aerial device that is electrically rated and insulated.

Paragraph (b) requires utility tree workers and utility workers to follow the “regular” approach distances of Table 2-1 that apply to persons and equipment. Utility tree workers are not qualified to perform aerial trimming so different rules apply to them as compared to utility tree trimmers.

Rule 4-136 Qualified utility employee distances

Subrules 4-136(1) and 4-136(2)

Qualified utility employees are required to follow the limit of approach distances shown in Table 4-2, Column 4 unless:

- (a) live line tools are used—these are electrically rated and insulated;
- (b) the energized electrical equipment or lines are protected with rated protective insulating devices or guarded in accordance with Section 8 of the ECUC—rated insulating devices allow approach distances to be reduced. Limits of approach for qualified utility employees using rated protective insulating cover-up is generally considered to be up to and not touching, accidental brush contact. Protective insulating devices are considered to be “insulating cover-up” as mentioned in rules 4-166 and 4-168; or

- (c) rubber insulating gloves or barehand techniques are used — these must be used according to the safety rules of the ECUC.

Rule 4-142 Working from a structure

This rule provides minimum clearance distances in situations where a qualified utility employee performs live line work from a pole or structure on electrical equipment or lines using rubber gloves. The electrical equipment or lines must operate at voltages below 5 kilovolts between conductors.

Rule 4-144 Exception

Rated insulated devices provide a safety barrier—if used, rules 4-140 and 4-142 do not apply.

Rule 4-146 Employee in training

A utility employee in training is learning specialized skills and is not yet considered to be fully competent. He or she must therefore be under the direct supervision of a qualified utility employee when performing work in accordance with rules 4-140 to 4-144.

Rule 4-148 Barehand techniques

This rule specifies clearance distances that must be maintained when a qualified utility employee performs barehand work. The distances are shown in Table 4-4 and Table 4-2.

Rule 4-150 Employee in training

A utility employee in training is learning specialized skills and is not yet considered to be fully competent. He or she must therefore be under the direct supervision of a qualified utility employee when performing work in accordance with rule 4-148.

Division F—Work on energized electrical equipment or lines (above 750 V)

Rule 4-152 Application

No explanation required.

Rule 4-154 Employer duties

The employer is required to establish and maintain safe work procedures for live line work. Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

The procedures must meet the minimum requirements of the ECUC. Being specialized work that may not be adequately covered by existing legislation, the employer must ensure that the procedures are in accordance with recognized electrical industry standards such as those prepared by CSA, IEC, IEEE, ANSI, etc.

Rule 4-156 Qualified utility employee duties

This rule makes the qualified utility employee responsible for performing live line work in accordance with the ECUC and the employer's safe work procedures.

Rule 4-158 Training

A qualified utility employee being trained to perform live line work is learning specialized skills and is not yet considered to be fully competent. When being trained in live line work, he or she must therefore be under the direct supervision of a qualified utility employee trained in live line work techniques.

Rule 4-160 Work standards

This rule does not apply. It has been replaced by subsection 804(1).

Rule 4-162 Exceptions

This rule does not apply. It has been replaced by subsection 804(2).

Rule 4-164 Exceptions

This rule does not apply. It has been replaced by subsection 804(3).

Rule 4-166 Insulating cover-up

No explanation required.

Rule 4-168 Rated insulating devices

Rated insulating devices must be used when insulating cover-up is placed on electrical equipment or lines. The insulating devices, such as live sticks, must be rated for the voltage to which they will be exposed.

Rule 4-170 Live line tool work

Qualified utility employees performing live line work must be trained in live line tool techniques—they must be competent in this skill.

Rule 4-172 Distances

When performing live line work with live line tools, the qualified utility employee must still maintain the approach distance limits of Table 4-2 between the employee's unprotected body parts and the energized electrical equipment or lines. This helps ensure that the work is performed safely.

Rule 4-174 Tools

This rule refers to Division C of the ECUC which contains only a single rule, rule 4-148. However, subsection 800(2) of the *OHS Code* indicates that rule 4-148 does not apply. This is because the standards listed in 4-148 have been replaced and moved to section 799 of the *OHS Code*.

Insofar as they describe the safe use of live line tools, the listed standards must be used. Otherwise, the manufacturer's specifications for the live line tools must be followed as required by section 12 of the *OHS Code*.

Rule 4-176 Gloves prohibited

This rule does not apply. The prohibition described in subrule 4-176(1) came from a time when wooden live line sticks were used and is no longer applicable.

Rule 4-178 Rubber glove work

Live line work involving the use of rubber gloves can only be performed by qualified utility employees trained in rubber glove work techniques—the workers must be competent in this skill.

Rule 4-180 Rubber gloves

Paragraph (a) refers to Division C of the ECUC, which contains only a single rule, rule 4-148. However, subsection 800(2) of the OHS Code indicates that rule 4-148 does not apply. This is because the standards listed in rule 4-148 have been replaced and moved to section 799 of the *OHS Code*.

Insofar as they describe the safe use of rated insulated devices, the listed standards must be used. Otherwise, the manufacturer's specifications for the rated insulated devices must be followed as required by section 12 of the *OHS Code*.

Paragraph (b) requires that the limit of approach distances specified in Table 4-3 be followed when live line work using rubber insulating gloves is performed.

Paragraph (c) requires the qualified utility employee performing this work to work from a rated insulated device, e.g., rated aerial device, rated work platform ("insulated diving board"), etc. Readers are referred to rule 4-182 for an exception.

Rule 4-182 Work from uninsulated surface

Subrule 4-182(1) exempts a qualified utility employee from having to perform rubber glove work from a rated insulated device (as required by subrule 4-180(c)) if the electrical equipment or lines operate at a voltage less than 5 kilovolts between conductors. As long as this voltage limit is not exceeded, work can be performed from a non-insulated surface such as a dry wooden pole which is not likely to conduct electricity.

If work is done in this way, subrule 4-182(2) requires that, as specified in rule 4-142, the worker must maintain a limit of approach distance of:

- (a) 150 mm between unprotected body parts and the exposed energized phase being worked on; and
- (b) 500 mm between unprotected body parts and exposed adjacent phases or exposed grounded parts.

Rule 4-184 Barehand work

Live line work using barehand techniques can only be performed by qualified utility employees trained in barehand techniques—the workers must be competent in this skill.

Rule 4-186 Insulating devices

This rule refers to Division C of the ECUC, which contains only a single rule, rule 4-148. However, subsection 800(2) of the *OHS Code* indicates that rule 4-148 does not apply.

This is because the standards listed in rule 4-148 have been replaced and moved to section 799 of the *OHS Code*.

Insofar as they describe the safe use of live line tools, the listed standards must be used. Otherwise, the manufacturer's specifications for the live line tools must be followed as required by section 12 of the *OHS Code*.

Insulating devices must be handled, supported or contained in a manner that minimizes contamination to ensure that they function properly, e.g., contaminants may reduce the dielectric strength of a device and reduce its insulating performance.

Rule 4-188 Barehand techniques

Leakage current must be continuously monitored to ensure that the insulating ladders and aerial devices being used provide adequate levels of insulation protection. Leakage current levels serve as a measure of potential flashover.

Shielding and bonding techniques must be used to limit the potential difference between surfaces that a worker can contact while working. Shielding and bonding techniques limit the possibility of workers being subjected to an electric shock event by keeping them at the same potential as the line voltage.

The employer is required to have specific instructions covering shielding and bonding in the employer's operating procedures. Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one.

Areas where workers may be subjected to hazardous potential differences must be roped off or guarded to prevent workers from contacting surfaces that could be dangerous.

Rule 4-190 Work methods

This rule presents the techniques that a qualified utility employee must follow when using barehand techniques. Specifically, the worker must:

- (a) use rated insulating devices when approaching energized parts;
- (b) maintain the limit of approach distances specified in Table 4-2, column 4 and Table 4-4, columns 4 and 5;
- (c) measure the actual limit of approach distances rather than simply estimate them,
- (d) use shielding and bonding methods and equipment—these will be described in the employer's operating procedures as required by rule 4-188(e); and
- (e) not reach across insulators that have not been jumpered—this is intended to keep the qualified utility employee at the same potential as his or her immediate work area.

Rule 4-192 Flashover prevention

The insulation must be checked to confirm that its insulating performance is sufficient to prevent flashover. An insulation tester should be used for making this assessment. Insulation testers can only be used on ceramic insulation, not synthetic insulation.

Division G—Electrical transportation systems

Rule 4-194 Safety rules and electrical transportation systems

“Electrical transportation systems” include electric trolley systems and light rail transit systems. The rules that apply to electrical equipment or lines also apply to transportation systems.

Rule 4-196 Electrical transportation right-of-way

Subrule 4-196(1)

Before entering an electrical system right-of-way to perform work on electrical equipment or lines, a utility employee must first get the authorization of the transportation system operator-in-charge. This ensures that the operator-in-charge is aware of the worker’s presence.

As required elsewhere in the rules, the utility employee must also get the authorization of the utility operator-in-charge before beginning work on the electrical equipment or lines.

Subrule 4-196(2)

Utility employees must be able to communicate with the transportation system operator-in-charge at all time. Portable two-way radios, cellular telephones, or similarly effective means are considered acceptable.

Utility employees working in transportation right-of-ways must wear high visibility vests or similar clothing so that the transportation vehicle operator can see them. This requirement is consistent with subsections 194(2) and 194(3) of the *OHS Code*.

Rule 4-198 Electrical transportation tunnels

When working in transportation tunnels, at least two utility employees are required as a way of improving the personal safety of the workers. Poor lighting, working in spaces that may have limited workspace and difficulty in seeing or hearing transportation vehicles are examples of the type of hazards that may be present. A second worker can help to overcome or deal with these hazards.

Auxiliary lighting devices must be available to the utility employee working in the tunnel. Each device must bear the mark or label of a nationally accredited testing organization such as CSA, ULC, UL, ETL, etc., as evidence that the device has been approved to a Canadian electrical safety standard appropriate to that specific device.

Division H—Tree work near energized electrical equipment or lines performed by utility tree trimmers, utility tree workers or other workers

Rule 4-200 Applicability

The rules of this Division apply to workers, other than utility employees, that perform tree work near energized electrical equipment or lines.

Rule 4-202 Worker requirements

Utility tree trimmers, utility tree workers and “other” workers are required to be familiar with (know and understand) and comply with Sections 0, 2 and 4 of the ECUC. “Other” workers are considered to be individuals working under the direct supervision of a tree trimmer or tree worker, i.e., an entry-level position within the utility tree work industry.

Rule 4-204 Control of tree work

A qualified utility employee must be in control of the tree work. This is because the qualified utility employee is familiar with the hazards associated with the electric system and the appropriate controls.

“Control” means having systems and processes in place to monitor the work activities and mitigate any hazards that might occur related to the work activities. It also means assisting with securing work permissions and establishing the safe work area. The qualified utility employee can be an operator-in-charge as long as he or she can effectively control the tree work.

Rule 4-206 Aerial tree trimming

Aerial tree trimming includes trimming aloft in trees as well as in an insulated aerial device. Work must be done in teams of at least two workers, one worker having to be a utility tree trimmer. Tree workers are not qualified to do aerial tree trimming.

Rule 4-208 Non-aerial trimming

For tree trimming done from the ground near energized equipment or lines, a utility tree trimmer or utility tree worker must be designated as being in charge. As required by rule 4-012, the employer must designate this person. Work must be done in teams of at least two workers, one worker having to be a utility tree trimmer or utility tree worker.

Rule 4-210 Establish voltage

Limit of approach distances are based on operating voltages. To be able to perform work safely, the utility tree trimmer or utility tree worker in charge of the tree work must contact the qualified utility employee controlling the work to establish the nominal voltage of the electrical equipment or lines. The utility tree trimmer and utility tree worker are not considered to be competent to establish this nominal voltage.

Rule 4-212 Establishing procedures

The employer responsible for the workers performing the tree work must prepare procedures that describe how the work is to be safely done. Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. Further, the procedures must be “acceptable,” a word defined in the ECUC to mean “acceptable to the owner/operator of the utility.”

These procedures must reflect, as applicable, the distance limits specified in Table 4-6 and Table 4-7 of the ECUC.

Rule 4-214 Tree handling

Workers performing tree work near energized electrical equipment or lines must follow the procedures required by rule 4-212.

Rule 4-216 Duties of worker in charge

The duties of the worker in charge are largely self-evident. To prevent mistakes resulting from misunderstood messages, paragraph (d) requires that verbal messages be repeated so that the sender and receiver understand one another correctly.

Rule 4-218 Trimming above electrical equipment

This rule deals with the situation in which trimming cannot be safely done from below energized equipment or lines—the option presented in this rule should be used as a last resort.

Paragraph (a) requires that a tree trimming procedure, which is required by rule 4-212, be acceptable. Section 14 of the *OHS Act* requires that the procedures be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. Further, the procedure must be “acceptable,” a word defined in the ECUC to mean “acceptable to the owner/operator of the utility.”

Use of this trimming approach

- (a) is restricted to electrical equipment or lines operating at voltages less than 30 kilovolts between conductors;
- (b) requires a fully insulated aerial device with an articulating boom;
- (c) requires a utility tree trimmer to operate the aerial device (this worker is trained to perform trimming work from an aerial device);
- (d) the boom is controlled by the worker in the bucket; and
- (e) the aerial device is positioned and stabilized according to the manufacturer’s specifications.

Rule 4-220 Worker in training

A worker in training is learning specialized skills and is not yet considered to be fully competent. He or she must therefore be in the continual presence of, and under the direct supervision of, a utility tree trimmer. This requirement allows a worker that is not trained as a tree trimmer to be trained in a controlled environment.

Rule 4-222 Insulating devices

This rule refers to Division C of the ECUC, which contains only a single rule, rule 4-148. However, subsection 800(2) of the *OHS Code* indicates that rule 4-148 does not apply. This is because the standards listed in 4-148 have been replaced and moved to section 799 of the *OHS Code*.

Insofar as they describe the safe use of insulating devices used to perform tree work near energized electrical equipment or lines, the listed standards must be used. Otherwise, the manufacturer’s specifications for the live line tools must be followed as required by section 12 of the *OHS Code*.

Rule 4-224 Trimmer approach limit

Utility tree trimmers must respect the limit of approach distances specified in Table 4-5.

Subrule 4-224(2) allows for an air gap as a barrier from a grounded object to eliminate a possible second point of contact and electrical path to ground. This provides the utility tree trimmer with additional protection.

This subrule only applies when tree-trimming work involves the use of insulated tools in an insulated aerial device. It does not apply when moving into position. It is good practice to prevent the insulated portion of the boom or bucket from contacting any grounded objects when moving or repositioning. Travel can be up to but not touching grounded objects when moving the bucket and not trimming.

Rule 4-226 Climbing tree distance

Utility tree trimmers, utility tree workers or other workers are prohibited from cutting or climbing any tree, or portion of a tree, that is closer to energized electrical equipment or lines than the distances specified in Table 4-6. “Other” workers are considered to be individuals working under the direct supervision of a tree trimmer or tree worker, i.e., an entry-level position within the utility tree work industry.

This prohibition does not apply to utility tree trimmers using rated insulated devices and following these safety rules. Utility tree trimmers have more extensive training than the other listed workers and when using rated insulated devices, can use the clearance distances specified in Table 4-7 (see rule 4-228).

Rule 4-228 Trimming tree distance

As mentioned in the explanation to rule 4-226, utility tree trimmers are subject to the clearance distances specified in Table 4-7 when they use rated insulated tools and when they use rated insulated tools from a rated insulated aerial device.

Utility tree trimmers have more extensive training than utility tree workers or other workers and therefore different clearance distances apply. “Other” workers are considered to be individuals working under the direct supervision of a tree trimmer or tree worker, i.e., an entry-level position within the utility tree work industry.

Table 2-1 Limits of Approach Distances from Overhead Power Lines for Persons and Equipment
(See Rules 2-012 & 4-134)

Operating voltage of overhead power line between phase conductors	Safe limit of approach distance for persons and equipment
0–750 V insulated or polyethylene covered conductors (1)	0.3 m
0–750 V bare, uninsulated	1.0 m
Above 750 V insulated conductors (1)(2)	1.0 m
.75 kV–40 kV	3.0 m
69 kV, 72 kV	3.5 m
138 kV, 144 kV	4.0 m
230 kV, 260 kV	5.0 m
500 kV	7.0 m

Note:

- (1) Conductors must be insulated or covered throughout their entire length to comply with these groups.
- (2) Conductors must be manufactured to rated and tested insulation levels.

Table 4-1 Limit of Approach Distances in Millimetres for Utility Employees

Voltage Levels			Utility employees
Nominal voltage to ground kV	Nominal voltage phase to phase kV	Maximum operating V phase to phase kV	Limit of approach to exposed energized parts mm
Column 1	Column 2	Column 3	Column 4(1)
0.6 (DC only)			800
0.3–2.4	0.6–4.16	4.58	800
8	13.8	15.18	850
14.4	25	27.5	950
19.9	34.5	37.95	1050
	69, 72	79.2	1350
	138, 144	158.4	1650
	230, 260	285	2150
	500	550	3450

Note:

- (1) Limit of approach distances in Column 4 have been calculated using IEEE minimum tool distances plus 750 mm safety factor, rounded to the nearest 50 mm.

Table 4-2 Limit of Approach Distances in Millimetres for Qualified Utility Employees
(See Rules 4-136 & 4-148)

Voltage Levels			Qualified Utility Employees
Nominal voltage to ground kV	Nominal voltage phase to phase kV	Maximum operating voltage phase to phase kV	Limit of approach to exposed energized parts mm
Column 1	Column 2	Column 3	Column 4(1)
0.6 (DC only)			500
2.4	4.16	4.58	500
8.0	13.8	15.18	550
14.4	25	27.5	650
19.9	34.5	37.95	750
	69, 72	79.2	1050
	138, 144	158.4	1350
	230, 260	285	1850
	500	550	3150

Note:

- (1) Limit of approach distances in Column 4 have been calculated using IEEE minimum tool distances plus 450 mm safety factor, rounded to the nearest 50 mm.

Table 4-3 Limit of Approach Distances in Millimetres for Qualified Utility Employees Performing Live Line Work Using Rubber Gloves (See Rule 4-140)

Voltage levels			Qualified utility employees	
Nominal voltage to ground kV	Nominal voltage phase to phase kV	Maximum operating voltage phase to phase kV	Limit of approach for work performed from a rated insulated device	
			Unprotected body parts to exposed work mm	Unprotected body parts to exposed adjacent phases, structure surfaces or ground parts mm
Column 1	Column 2	Column 3	Column 4(1)	Column 5(2)
2.4	4.16	4.58	40(3)	500
8	13.8	15.18	120	550
14.4	25	27.5	210	650
19.9	34.5	37.95	290	750
	69, 72	79.2	(4)	(4)
	138, 144	158.4	(4)	(4)
	230, 260	285	(4)	(4)
	500	550	(4)	(4)

Note:

- (1) Limit of approach distances in Column 4 have been calculated using IEEE minimum tool distances rounded to the nearest 10 mm.
- (2) Limit of approach distances in Column 5 have been calculated using IEEE minimum tool distances plus 450 mm safety factor, rounded to the nearest 50 mm.
- (3) Work performed directly from a pole or structure on electrical equipment or lines operating at voltages below 5 kV between conductors must be done in accordance with Rule 4-142.
- (4) Live line work using rubber gloves is not normally done at these voltage levels. Rubber insulating equipment may be required to handle isolated and grounded lines that normally operate at these voltage levels.

Table 4-4 Limit of Approach Distances in Millimetres for Qualified Utility Employees Performing Live Line Work Using Barehand Techniques (See Rule 4-148)

Voltage levels			Qualified utility employees	
Nominal voltage to ground kV	Nominal voltage phase to phase kV	Maximum operating voltage phase to phase kV	Limit of approach for work performed from a rated insulated device or from an energized phase conductor	
			Energized body parts to exposed structure surfaces or grounded parts mm	Energized body parts to exposed adjacent phases mm
Column 1	Column 2	Column 3	Column 4(1)	Column 5(2)
2.4	4.16	4.58	(3)	(3)
8	13.8	15.18	(3)	(3)
14.4	25	27.5	(3)	(3)
19.9	34.5	37.95	(3)	(3)
	69, 72	79.2	610	1060
	138, 144	158.4	920	1590
	230, 260	285	1410	3050
	500	550	2710	6650

Note:

- (1) Limit of approach distances in Column 4 have been calculated using IEEE minimum tool distances rounded to the nearest 10 mm.
- (2) Limit of approach distances in Column 5 have been calculated using IEEE minimum tool distances formula applied to phase-to-phase voltage, rounded to the nearest 10 mm.
- (3) Live line work using barehand techniques is not normally done at these voltage levels. Barehand techniques may be used with other work techniques on lines operating at these voltage levels.

Table 4-5 Limit of Approach Distances in Millimetres for Utility Tree Trimmers

Voltage levels			Utility tree trimmers		
Nominal voltage to ground	Nominal voltage phase to phase	Maximum operating voltage phase to phase	Limit of approach for utility tree trimmers and conducting objects to exposed energized parts	Limit of approach for rated insulating tools to exposed energized parts	Limit of approach for rated insulating booms
kV	kV	kV	mm	mm	mm
Column 1	Column 2	Column 3	Column 4(1)	Column 5(2)	Column 6(3)
0.6 (DC only)			1050	40	500
2.4	4.16	4.58	1050	40	500
8	13.8	15.18	1100	120	550
14.4	25	27.5	1200	210	650
19.9	34.5	37.95	1300	290	750
	69, 72	79.2	1600	610	1050
	138, 144	158.4	1900	920	1350
	230, 260	285	2400	1410	1850
	500	550	3700	2710	3150

Note:

- (1) Limit of approach distances in Column 4 have been calculated using IEEE minimum tool distances plus 1000 mm safety factor, rounded to the nearest 50 mm.
- (2) Limit of approach distances in Column 5 have been calculated using IEEE minimum tool distances, rounded to the nearest 10 mm.
- (3) This column does not apply to utility or qualified utility employees doing tree work near energized electrical equipment or lines.

Table 4-6 Tree to Energized Electrical Equipment or Line Distances in Millimetres for Utility Tree Trimmers, Utility Tree Workers and Other Workers (See Rules 4-212, 4-214 & 4-226)

Voltage levels			Utility tree trimmers, utility tree workers and other workers
Nominal voltage to ground	Nominal voltage phase to phase	Maximum operating voltage phase to phase	Tree to energized electrical equipment or lines distance for slashing and brushing
kV	kV	kV	mm
Column 1	Column 2	Column 3	Column 4(1)
0.6 (DC only)			800
2.4	4.16	4.58	800
8	13.8	15.18	850
14.4	25	27.5	950
19.9	34.5	37.95	1050
	69, 72	79.2	1350
	138, 144	158.4	1650
	230, 260	285	2150
	500	550	3450

Note:

- (1) Tree to energized electrical equipment or line distances in Column 4 have been calculated using IEEE tool distances plus 750 mm safety factor, rounded to the nearest 50 mm.

Table 4-7 Tree to Energized Electrical Equipment or Line Distances in Millimetres for Utility Tree Trimmers Using Rated Insulated Tools (See Rules 4-212, 4-214 & 4-228)

Voltage levels			Utility tree trimmers	
Nominal voltage to ground	Nominal voltage phase to phase	Maximum operating voltage phase to phase	Tree to energized electrical equipment or lines distance using rated insulating tools	Tree to energized electrical equipment or lines distance using rated insulating tools from a rated insulating aerial device
kV	kV	kV	mm	mm
Column 1	Column 2	Column 3	Column 4(1)	Column 5(2)
0.6 (DC only)			350	not touching
2.4	4.16	4.58	350	not touching
8	13.8	15.18	400	not touching
14.4	25	27.5	500	not touching
19.9	34.5	37.95	600	not touching
	69, 72	79.2	900	600
	138, 144	158.4	1200	900
	230, 260	285	1700	1400
	500	550	3000	2700

Note:

- (1) Tree to energized equipment or lines distances in Column 4 have been calculated using IEEE minimum tool distances plus 300 mm safety factor, rounded to the nearest 50 mm.
- (2) Tree to energized electrical equipment or lines distances in Column 5 for 69 kV lines and higher have been calculated using IEEE minimum tool distance rounded to the nearest 50 mm.

Part 41 Work Requiring Rope Access

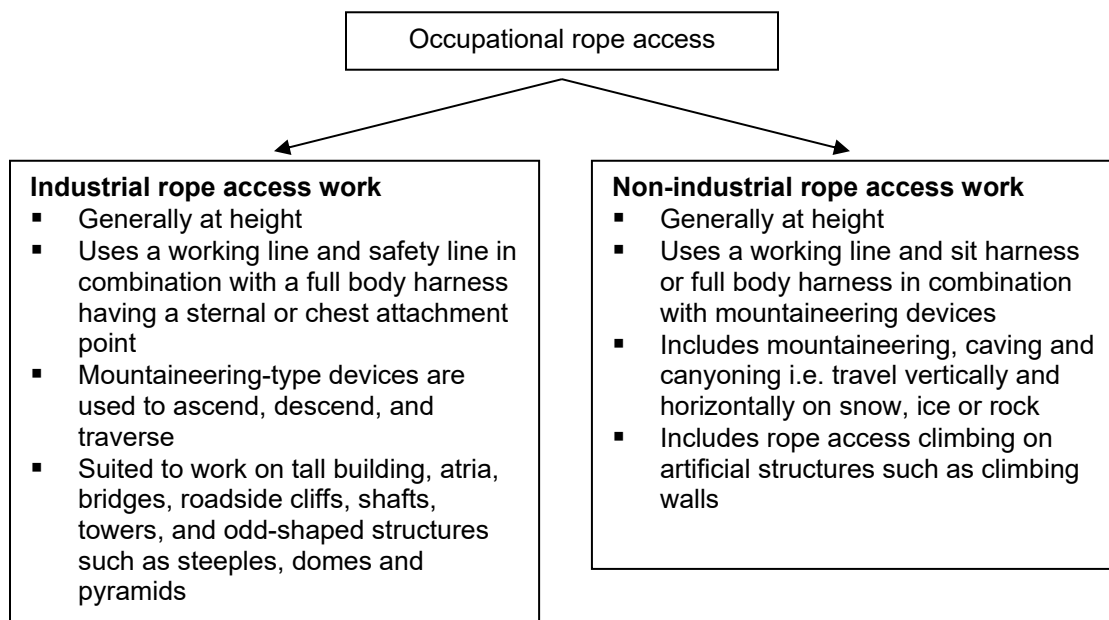
Highlights

Occupational rope access work includes “industrial rope access work” that involves double rope technique in industrial settings. “Non-industrial rope access work” uses single rope technique in activities such as mountaineering, caving and sport climbing, and the requirements for this type of rope access work apply to the workers involved, not the clients.

- Section 808 requires an employer to develop a written occupational rope access safe work plan and section 809 describes its elements.
- Section 811 describes the elements to be included in the employer’s safe work practices.
- Sections 821 and 822 deal with worker rescue and self-rescue.
- Section 823 recognizes industrial rope access practice guidelines used in the United Kingdom (IRATA), the U.S. (SPRAT) and Australia (ARAA). Employers are required to follow one of the listed guidelines.
- Section 826 requires industrial rope access workers to have the applicable skills and practical experience hours described in the certification guidelines published by IRATA, SPRAT, or the ARAA. Certification of Alberta workers by one or more of the organizations is not required.
- Section 827 requires industrial rope access workers to maintain a personal logbook of work hours and activities.
- Section 841 requires non-industrial rope access workers to have the applicable skills described in manuals and guidelines published by the Association of Canadian Mountain Guides (ACMG) or, in the case of caving activities, guidelines published by the Canadian Cave Conservancy and British Columbia Cave Rescue.
- This Part references many European standards for equipment.

Introduction

“Rope access” work involves rope-based techniques for gaining access to, or working at, work locations that are difficult or impossible to access by other means. For the purposes of the OHS Code, occupational rope access work is divided into two categories:



Industrial rope access work

As a method of working at height, industrial rope access techniques can be used as an alternative to scaffolds, man lifts, and elevated work platforms. The techniques are best used for light to medium tasks such as:

- inspection and testing—surveys, non-destructive testing;
- maintenance and repair—sealant installation, replacing cladding and glazing;
- cleaning and painting—jet spray, spray/roller/brush painting; and
- geotechnical work—surveying, rockfall prevention.

Industrial rope access systems are quick to assemble and disassemble, and require a small number of workers for a relatively brief period of time. Thus, the number of “man-risk” hours is kept to a minimum.

There is a small but growing industry in Alberta providing industrial rope access services. However, the traditional fall protection requirements of Part 9 of the *OHS Code* have limited or restricted the ability of workers in this industry to use the full range of rope access techniques and equipment used elsewhere in the world. Part 41 addresses the needs of this industry.

Non-industrial rope access work

Non-industrial rope access work includes the work activities of mountain guides, professionally certified mountain guides (Association of Canadian Mountain Guides—ACMG), guides involved in caving, workers involved in delivering outdoor education courses in rock and ice climbing and glacier travel, and workers who work at sport climbing walls and gyms.

The equipment and techniques these workers use, and their dependence on primarily natural terrain features for their safety, makes compliance with the fall protection requirements of Part 9 of the *OHS Code* impossible or dangerous. Part 41 addresses the needs of this industry.

General requirements

Exemptions

Section 805

The industrial-type fall protection requirements of Part 9 do not apply to workers involved in training for occupational rope access work or performing occupational rope access work. These workers may use equipment and practices other than those specified in Part 9, i.e., the equipment and practices described in Part 41.

Section 806

Workers involved in emergency rescue services or training for the purpose of emergency rescue are not bound by the requirements of the Part. This exemption allows rescue personnel to use equipment and practices other than those specified in this Part; it *does not* exempt rescue personnel from using fall protection equipment and practices. The equipment and practices used must provide an effective measure of worker safety and address the unique hazards that a rescue situation presents.

Section 807

In situations such as window washing, a worker can use a fall protection system that complies with Part 9, or can use an industrial rope access system that complies with Part 41 (including all its training requirements). It must be one or the other, not a combination of the requirements from the two Parts.

Self-progression is a key concept that differentiates and distinguishes occupational rope access work from work to which industrial fall protection techniques apply, i.e., Part 9. Part 41 does not apply to systems that are used for descent purposes only, or to systems

in which the worker is raised or lowered by others. In these cases, the industrial fall protection systems required by Part 9 should be used.

This section makes it clear that if a worker uses a traditional industrial-type fall protection system that meets the requirements of Part 9, then the requirements of Part 41 do not apply to that worker.

Rope access safe work plan

Section 808 3 metre fall height

An unusual possibility of injury exists if the injury may be worse than an injury from landing on a solid, flat surface. Examples include falling onto exposed rebar, a stairway, or the top of a fence.

Sections 809 and 810 Components of the plan

The purpose of the rope access safe work plan is to have the employer address a variety of issues that will help ensure the safety of workers involved in the rope access work. Section 14 of the *OHS Act* requires that the plan be in writing and a paper or downloaded or stored electronic copy is readily available for reference by workers, the joint work site health and safety committee and the health and safety representative, if there is one. The plan must be available at the work site before work with a risk of falling begins.

A unique rope access safe work plan need not be created for each work site. If an employer faces the same hazards at multiple work sites, and the rope access equipment and rescue procedures are identical at each work site, then a single plan applicable to all work sites is acceptable. Alternatively, an employer can create a single rope access safe work plan that covers all of the hazards likely to be encountered during normal operations. Only in the event of a unique work situation arising would a new or amended rope access safe work plan be required.

Before occupational rope access work begins at a work site, a written hazard assessment as required by Part 2 must be completed. This helps to establish the appropriateness of using rope access techniques, identifies hazards, and should help the employer to determine how the hazards will be eliminated or controlled.

The rope access safe work plan needs to describe the rope access system that will be used. This helps ensure that workers use the correct equipment, that the correct equipment is on site, and that the system is set up correctly.

The procedures used to assemble, maintain, inspect, use, and disassemble the rope access system must be part of the rope access safe work plan. These procedures serve as

a source of reference information when questions arise and they can help reinforce best practices.

Describing the duties of each member of the work team helps workers understand what they are responsible for, and what they are not. The duties assigned must be consistent with the workers' level of training and skills.

All personal protective equipment must be listed in the plan. This is not limited solely to rope access equipment. If respiratory protective equipment, protective eyewear, crampons, avalanche transceiver, etc., are required to perform the work safely, then this personal protective equipment needs to be specified in the plan. Listing this equipment in the plan serves as a check that each hazard identified in the hazard assessment has, to the extent necessary, been addressed by some type of personal protective equipment. The list can also serve as an equipment checklist to ensure that all the correct personal protective equipment has been taken to the work site.

The emergency response plan is an essential part of the overall plan. This plan deals not only with the direct hazards associated with working at height, but also all the other hazards identified in the hazard assessment. For example, what is the response plan in the event of extreme weather, a fire, a medical emergency, etc.?

Section 811 Safe work practices

The employer is responsible for developing and implementing safe work practices that ensure that the work is performed safely. The safe work practices must include each of the topics listed in this section.

Section 812 Instruction of workers

Workers must be trained in the rope access safe work plan and the practices and procedures they must follow to ensure their personal safety while using the rope access system. This training must include the procedures to assemble, maintain, inspect, use and disassemble the rope access system or systems in use (see section 15 of the *OHS Regulation*). Workers expected to rescue a worker who has fallen or is injured and remains suspended by the rope access system must be trained in rescue procedures.

Workers must be competent to perform their work activities. Requirements specific to the training of workers in occupational rope access techniques are described in section 826 for industrial rope access work and section 841 for non-industrial rope access work.

Section 813 Tools and equipment

In many cases, the greatest danger of occupational rope access work is the dropping of tools on workers below the work area. To guard against this, small tools such as

hammers and drills, weighing up to 8 kg, must be securely attached to the rope access worker's harness by lanyards. Alternatively, small items should be carried in a bucket or bag securely attached to the worker's harness.

Tools should only be carried like this if they are not of such weight that they could cause a significant reduction in the factor of safety of either the suspension system as a whole or any part of it. Where a tool needs to be pressed hard against the work face, or where the reaction from the tool could unbalance the worker, a light anchor should be pre-drilled or clamped on to the work face and the tool attached to it.

Equipment weighing more than 8 kg should be fitted with a separate suspension system secured to an independent anchor. Anchors and suspension ropes used for equipment should be clearly identified to avoid confusion with those used to support workers.

Section 814 Equipment compatibility

Compatible system components can be safely interconnected, e.g., carabiners and harness D-rings, ropes and ascenders, etc., without compromising equipment function or worker safety. It is also important that components be compatible with the environment in which they are being used, i.e., high heat, corrosive, exposed to welding spatter, etc.

Section 815 Inspection and maintenance

It is essential that all load-bearing equipment is inspected before each use to ensure that it is in a safe condition and operates correctly. The manufacturer's specifications should be consulted to determine the equipment's inspection and maintenance requirements.

Low stretch (static) and high stretch (dynamic) rope

Section 816 Same diameter of rope

Having rope of the same diameter allows for worker self-rescue because ascenders, descenders and other hardware are compatible with either rope. If the working and safety lines are inadvertently reversed, rope adjustment hardware will be unaffected and continue to function properly. While it is recognized that laid ropes are sometimes being used as the safety line in combination with standard industrial rope grabs, doing so limits or altogether prevents a worker from performing self-rescue. The ability to perform self-rescue is considered to be a key element of occupational rope access work.

Section 817 Standards for low stretch (static) rope

Efficiency in descending, ascending and, to some extent, working in one place for any length of time, depends on the elongation characteristics of the working line. Therefore, in most cases, the working line (and normally the safety line) should be a low stretch kernmantle rope. However, in situations where the possibility of a substantial dynamic load exists, e.g., when using lead-climbing techniques, a dynamic rope should be used.

For compliance purposes, the rope must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the rope meets the requirements of at least one of the listed standards. Rope bearing a CE mark is considered acceptable for the purpose of this Code, as is rope bearing the UIAA label. The CE mark—Conformite Europeenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the rope already bears a CE mark.

CEN Standard EN 1891

CEN Standard EN 1891: 1998, *Personal protective equipment for the prevention of falls from a height. Low stretch kernmantle ropes*, applies to low stretch textile rope of kernmantle construction from 8.5 mm to 16 mm in diameter, for use by persons in rope access including all kinds of work positioning and restraint, for rescue and in caving. Low stretch kernmantle ropes are defined as Type A and Type B.

Kernmantle rope is a textile rope consisting of a core enclosed by a sheath. The core is usually the main load-bearing element and typically consists of parallel elements that have been drawn and turned together in single or multiple layers, or of braided elements. The sheath is braided or woven and protects the core from, for example, external abrasion and degradation by ultraviolet light.

Type A rope is designed for general use by persons in rope access including all kinds of work positioning and restraint, rescue and caving. Type B rope is of a lower performance than Type A rope, requiring greater care in use.

Type A rope has the following performance characteristics:

- elongation (stretch) must not exceed 5 percent under test conditions;
- static strength without terminations—at least 22 kN;
- static strength when terminated with a knot or other method—at least 15 kN; and
- fall arrest peak force must not exceed 6 kN under the test conditions.

NFPA Standard 1983

Chapter 5 of NFPA Standard 1983: 2006, *Standard on Fire Service Life Safety Rope, Harness and Hardware*, presents requirements for life safety rope. The rope must have the following performance characteristics:

- elongation must be at least 1 percent but not more than 10 percent at 10 percent of minimum breaking strength;
- the breaking strength of light use rope must be at least 20 kN (4500 lbs-force);
- the breaking strength of general use rope must be at least 40 kN (9000 lbs-force);
- light use rope must have a diameter of not less than 9.5 mm (3/8 in) and not more than 13 mm (1/2 in);
- general use rope must have a diameter of not less than 13 mm (1/2 in) and not more than 16 mm (5/8 in); and
- fibre used in rope must have a melting point of not less than 204° C (400° F).

UIAA Standard 107

UIAA Standard 107: 2004, *Mountaineering and Climbing Equipment—Low Stretch Ropes*, requires that the rope meet the requirements of CEN Standard EN 1891 plus several additional requirements. These additional requirements involve colour marking of the rope sheath.

Section 818 Standards for high stretch (dynamic) rope

For compliance purposes, the rope must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc., as evidence that the rope meets the requirements of at least one of the listed standards. Rope bearing a CE mark is considered acceptable for the purpose of this Code, as is rope bearing the UIAA label. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the rope already bears a CE mark.

CEN Standard EN 892

CEN Standard EN 892: 2004, *Mountaineering equipment. Dynamic mountaineering ropes. Safety requirements and test methods*, specifies safety requirements and test methods for dynamic rope (single, half and twin ropes) in kernmantle construction for use in mountaineering, including climbing. Dynamic mountaineering rope is defined by the Standard as rope that is capable of arresting the free fall of a person engaged in mountaineering or climbing with a limited peak force.

Dynamic rope has the following performance characteristics:

- static elongation must not exceed 10 percent in single ropes, 12 percent in half ropes, and 10 percent in twin ropes;

- dynamic elongation cannot exceed 40 percent during the first drop of each test sample;
- the peak force in the rope, during the first drop for each test sample, must not exceed 12 kN in single ropes, 8 kN in half ropes, and 12 kN in twin ropes; and
- under test, slippage between the sheath and core must not exceed 20 mm.

UIAA Standard 101

UIAA Standard 101: 2004, *Mountaineering and Climbing Equipment—Dynamic Ropes*, requires that the rope meet all the requirements of CEN Standard EN 892 plus an additional requirement for slippage.

Section 819 Cow's tail

A cow's tail is defined in the *OHS Code* as a short strap, lanyard or sling connected to the main attachment point of a harness. Cow's tails are used to connect the worker's harness to the safety line via a back-up device and to the working line via an ascender. Cow's tails should be able to withstand any dynamic forces that may be imposed on them in case of a fall.

While manufactured cow's tails are available, and therefore subject to a manufacturer's testing and quality assurance programs, many rope access workers create their own from short lengths of rope. If a cow's tail is made of rope (some are made of webbing), it must be made of dynamic kernmantle rope. The rope must be approved to CEN Standard EN 892: 2004 or UIAA Standard 101: 2004. Readers are referred to the explanation for section 818 for information about these standards.

If a cow's tail is not made of dynamic rope, it must be approved to CEN Standard EN 354: 2002, *Personal protective equipment against falls from a height—Lanyards*. This Standard specifies the requirements, test methods, marking, and information to be supplied by the manufacturer for non-adjustable and adjustable lanyards. The Standard allows lanyards to be made of synthetic fibre rope, wire rope, webbing or chain and limits their overall length to 2 m. Lanyards made from synthetic fibre ropes or webbing must be able to sustain a force of at least 22 kN without separating, tearing or rupture of any lanyard element. The force applicable to lanyards made of metallic material is 15 kN.

Section 820 Removal from service

It is important that there is a procedure for ensuring that defective or suspect equipment that has been withdrawn from service does not get back into service without inspection and approval by a professional engineer or the manufacturer. Any equipment considered to be defective should be cut up or broken before being disposed of, to ensure that it cannot be retrieved and used again.

Sections 821 and 822 Worker rescue

Rescue procedures are a vital part of an employer's safe work practices. The survival of an injured worker often depends on the speed of rescue and the care given to the casualty during and after rescue. As a result, the work site should be regularly assessed to anticipate emergency situations and to plan how any resulting rescues would be carried out. Specific rescue equipment should always be at the worksite.

Section 811 requires written procedures. After an arrested fall, the fallen worker remains suspended in mid-air from his or her full body harness, awaiting rescue. In most cases, the worker is not injured and can alter body position within the harness to be more comfortable.

Unfortunately, a worker suspended in an upright position with the legs dangling in a harness of any type is subject to what has come to be known as "suspension trauma." This is one of the reasons that the fall protection plan must include rescue procedures.

Suspension trauma death is caused by orthostatic incompetence. A soldier standing almost motionless at attention for a long period of time and then fainting is an example of the problem. What happens with orthostatic incompetence is that the circulation of blood is reduced because the legs are immobile and the worker is in an upright position.

Gravity pulls the blood into the lower legs, which have a very large storage capacity. Enough blood eventually pools in the legs that return blood flow to the right side of the heart is reduced. This causes blood supply problems for both the heart and the brain. Normally the person faints at this point and falls to the ground. Now that the person is horizontal, blood from the legs flows back to the heart and on to the rest of the body.

While suspended in a harness however, the worker cannot fall into a horizontal position. Fall victims can slow the onset of suspension trauma by pushing down forcefully with the legs, by positioning their body in a horizontal or slightly leg-high position, or by standing up.

However, the design of the harness, the attachment points used, and the presence of fall injuries may prevent these actions. The suspended worker faces several problems:

- (1) the worker is suspended in an upright posture with legs dangling;
- (2) the safety harness straps exert pressure on leg veins, compressing them and reducing blood flow back to the heart; and
- (3) the harness keeps the worker in an upright position, regardless of consciousness.

Rescue must happen quickly to minimize the dangers of suspension trauma. Time is of the essence because the suspended worker may lose consciousness in as few as five minutes.

If a worker is suspended long enough to lose consciousness, rescue personnel must be careful in handling such a person or the rescued worker may die anyway. This post-rescue death is apparently caused by the heart's inability to tolerate the abrupt increase in blood flow to the right side of the heart after removal from the harness. Current recommended procedures are to take from 30 to 40 minutes to move the victim from kneeling to a sitting to a laying down position. A physician should examine the rescued victim. Among other things, the reduction in blood flow while suspended can affect the kidneys and lead to permanent damage. For more information about suspension trauma, readers are referred to the sources listed below.

A motionless, suspended victim suggests serious injury and a rescue must be performed quickly. A non-breathing, motionless victim must be ventilated within four minutes of when they stop breathing in order to prevent irreversible brain damage. If a work platform or man basket is suspended from a crane or hoist, a fall protection plan must be in place for the rescue of the occupant(s) in the event that the crane or hoist is unable to lower the work platform or man basket.

Industrial rope access work

Industrial rope access work is defined in the *OHS Code* as work activities at height which incorporate a working line, safety line and a full body harness in combination with other devices that allow a worker to ascend, descend and traverse to and from a work area under his or her own control.

The advantage of industrial rope access work is primarily the speed at which workers can get to or from difficult locations. In some cases, the cost or difficulty of using other means of access can be prohibitive. Rope access tends to be at its most efficient when used for inspection and similar light to medium duty tasks such as:

- inspection and testing—surveys, non-destructive testing;
- maintenance and repair—sealant installation, replacing cladding and glazing;
- cleaning and painting—jet spray, spray/roller/brush painting; and
- geotechnical work—surveying, rockfall prevention.

An industrial rope access system as required by the *OHS Code* requires two independently anchored vertical lifelines. One lifeline provides a means of primary support to the suspended worker—the working line. The other line provides backup security to the suspended worker should the working line fail or there is an equipment malfunction—the safety line. Both lifelines are used in conjunction with a full body harness and other ascent and descent devices whereby the suspended worker, responsible for his or her own progression, can access a work area by means of ascent, descent or traversing the lifelines.

Safe work practices

Section 823 Recognized safe work practices

An employer is required to select and follow the safe work practices of one of the listed publications. An employer cannot blend together the safe work practices of two or more of the listed publications. The resulting practices might not be endorsed by any one of the referenced organizations and could create unsafe situations for workers.

While some employers may feel that this requirement places restrictions on what an employer can do in terms of safe work practices, the listed safe work practices constitute industry recognized best practices, have proven to be safe after many years of use, take the guesswork out of what an employer needs to follow, and create a defined minimum standard against which an employer's operations can be assessed.

Section 824 Conflicting requirements

The requirements of some of the reference publications listed in section 823 may conflict with the requirements of the *OHS Code*. This section clarifies which requirement takes precedence.

Section 825 Two workers per team

Workers must work in teams of at least two, one of whom should be competent to supervise.

Section 826 Worker competency

Safe and competent rope access workers require a combination of both training and practical experience hours. Competent workers must be adequately qualified, suitably trained, and have sufficient experience to perform their work safely. Working a minimum number of hours at height helps ensure that workers meet the third component—sufficient experience—of the competency requirement. Documenting those hours in a logbook (see section 827) provides a record to employers of the practical experience hours a worker has gained while working at height.

Despite adopting the safe work practices of the Industrial Rope Access Trade Association (IRATA), the Society of Professional Rope Access Technicians (SPRAT) and the Australian Rope Access Association (ARAA,) and the technical skills and practical experience hours of these organizations, worker certification by these organizations remains optional at this time for industrial rope access workers in Alberta—it is not a mandatory requirement to be certified by one of these organizations. Requiring certification by these organizations would tie Alberta workers to having to become

members of one or more of these associations, may limit worker access to training programs, and might prevent agencies presently involved in worker training from entering the industrial rope access training market.

Embracing the safe work practices, technical skill requirements, and practical experience hours of these organizations will help ensure the safety of workers engaged in work at height. By making worker certification by these organizations optional, employers can employ non-certified workers as long as the employer can assess a worker's competency against the stated requirements and the worker meets those requirements. This is the same worker competency model followed elsewhere in the *OHS Code*.

The employer is responsible for ensuring that workers performing industrial rope access work have the skills referred to in section 812, appropriate to the level of work assigned. The *OHS Code* considers a worker to be competent if the worker meets the following three conditions:

- (1) adequately qualified—the worker has some type of qualification, usually earned through a formal education program, training course, etc., or a combination of education and practical experience. With certain exceptions such as professional designations, e.g., professional engineer, nurse, physician, etc., or other legal requirement involving qualifications, the employer is responsible for evaluating and deciding if a worker is adequately qualified. The employer should be able to justify the basis on which a worker is considered to be “adequately qualified”;
- (2) suitably trained—the worker must have training that is appropriate to the tasks, equipment, etc., that will be performed or used. The employer is responsible for evaluating and deciding if a worker is suitably trained. The employer should be able to justify the basis on which a worker is considered to be “suitably trained”; and
- (3) with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision—determining whether a worker has sufficient experience to safely perform work is the employer's responsibility. A worker's qualifications, training and experience are no guarantee that work will be performed safely. The employer should be able to justify the basis on which a worker is considered to have “sufficient experience.”

In cases where an employer is unable or unwilling to assess the competency of a worker planning to perform industrial rope access work against these criteria, a worker performing industrial rope access work would be considered to meet the requirements if the worker possessed a valid certificate from

- (a) IRATA, appropriate to the level of work being performed;
- (b) SPRAT, appropriate to the level of work being performed; or
- (c) ARAA, appropriate to the level of work being performed.

An employer in the situation described could simply require that his or her workers be certified, eliminating the employer's need to assess the worker's competency.

Section 827 Worker's personal logbook

Worker logbooks are a mandatory requirement of industrial rope access workers. The logbook concept is an essential component of modern industrial rope access. A worker's logbook should be considered a tool that an employer or prospective employer can use to verify and quantify the work history of the rope access worker.

The logbook should clearly indicate the duration and nature of the work performed as well as the access techniques employed by the worker. Given the freelance nature of rope access workers, the logbook accompanies the worker and details the breadth and experience of the worker.

Personal logbooks are not a new type of requirement for the *OHS Code*. Part 31 of the *OHS Code* requires that commercial divers maintain a personal logbook of their dives. The logbook maintained by workers engaged in industrial rope access work must include the following entries:

- (a) the date on which the work was performed;
- (b) type of work, including access method—the nature of the task performed, e.g., non-destructive testing (NDT), inspection, window cleaning or painting, as well as a brief description of the access method used, e.g., vertical rope work, traversing, fall arrest climbing, equipment maintenance, etc.;
- (c) the type of structure worked on—e.g., flare stack 30 m tall, high rise building 100 m tall, etc.; and
- (d) hours worked—this includes only those hours worked using rope access techniques including rigging, equipment maintenance and inspection. Work using fall arrest methods is of relevance only if used in combination with rope access. The number of hours logged will not necessarily be the number of hours spent at the worksite or the time shown on time sheets.

The rope access supervisor or worksite manager must sign each logbook entry.

Although not required by this section, the logbook can also be used as a means of documenting the rope access and other training that an industrial rope access worker receives.

Section 828 Maximum arrest force, clearance

The behaviour of load components in the system, such as dynamic cow's tails, load-limiting back-up devices and the extension of the low-stretch rope, can help absorb any forces generated, should there be a limited fall. However, the system generally should be designed to avoid this, i.e., it should function as a work positioning system.

Rather than stating a restrictive free fall distance, this section allows a worker to fall an unspecified distance as long as three conditions are met:

- (a) *the maximum arresting force on the worker is limited to 6 kN*—maximum arresting force is the short-duration (milliseconds to tenths of a second), peak dynamic force acting on a worker's body as the worker's fall is arrested. The maximum arresting force to which a worker can be exposed during fall arrest in Alberta is limited to 6 kN (1800 pounds-force);

Research studies have shown that the short duration forces that happen during fall arrest are unlikely to cause injury if they act vertically upwards through the buttocks and spine and are limited to no more than 9 kN (2000 pounds-force). The 6 kN limit is therefore considered safe but, as was discovered during the studies, is subject to the following conditions:

- (i) the maximum arresting force is applied upwards through the pelvic area;
 - (ii) the worker's physical condition is sufficient to withstand such a jolt; and
 - (iii) the duration of the maximum arresting force is limited to a fraction of a second;
- (b) *the worker is prevented from striking a lower surface that could cause injury*, unless preventing this possibility exposes the worker to other greater hazards; and
- (c) *the swing-fall hazard is minimized*.

Section 829 Anchorage strength

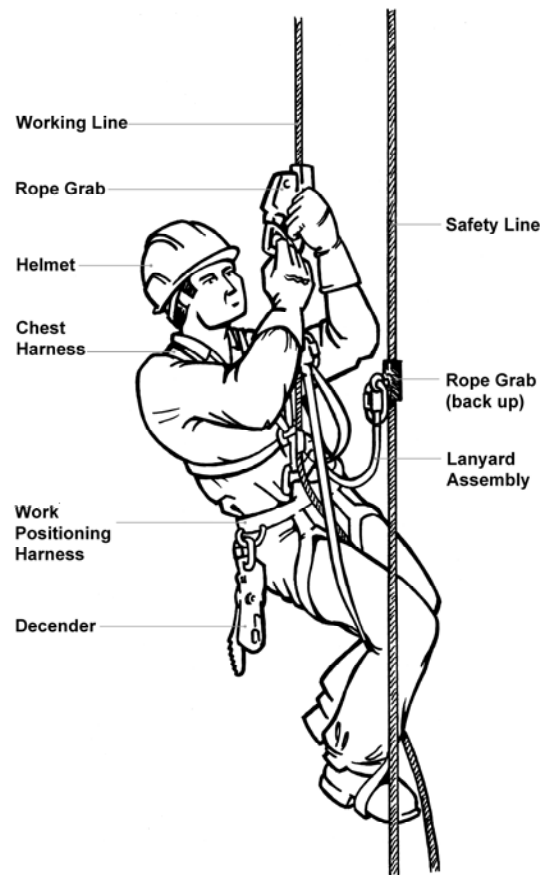
Anchors should be unquestionably reliable, i.e., “bomber” or “bomb-proof.” The strength of all anchors should be not less than 16 kN per worker attached. However, where this is not practicable, an anchor can be “de-rated” to have an ultimate load capacity of two times the estimated maximum arresting force created by a fall in the direction of the rope pull.

Section 830 Safety line

An industrial rope access system as required by the *OHS Code* requires two independently anchored vertical lifelines. One lifeline provides a means of primary support to the suspended worker—the working line. The other line provides backup security to the suspended worker should the working line fail or there is an equipment malfunction—the safety line. Both lifelines are used in conjunction with a full body harness and other ascent and descent devices whereby the suspended worker, responsible for his or her own progression, can access a work area by means of ascent, descent or traversing the lifelines.

As shown in Figure 41.1, it is appropriate for the worker's safety line to be connected to the sternal or frontal attachment point of the worker's full body harness. Unlike a full body harness used in industrial-type fall protection, a dorsal D-ring is not used.

Figure 41.1 Example of set-up used in industrial rope access work



Section 831 Head protection

Subsection 831(1) Headwear standards—lateral impact

If there is a foreseeable danger of injury to a worker's head during industrial rope access work, head protection must be worn. The type worn may vary based on whether a worker is likely to sustain a lateral impact to the head or not. For compliance purposes, industrial protective headwear intended for use where there is a significant possibility of lateral impact to the head must meet the requirements of one of the listed standards. Lateral impact occurs when an object strikes the headwear from any direction other than directly above. The headwear must be of the appropriate Class for the type of work being performed.

CSA Standard Z94.1

CSA Standard Z94.1-05, *Industrial Protective Headwear*, applies to headwear intended to protect the heads of industrial workers. The Standard defines the areas of the head that are to be protected and includes basic performance requirements for impact protection,

object penetration, stability and dielectric properties (the ability of a material to resist the passage of electric current).

The Standard divides protective headwear into three Classes according to its intended use:

- (a) *Class G (General Use)*—this Class is intended to provide workers with protection against impact and penetration. This headwear is non-conducting and must pass a 2200 V dielectric-strength test. This protective headwear provides limited protection against electric shock;
- (b) *Class E (Electrical Trades)*—this Class is intended to provide workers with protection against impact and penetration. This headwear is non-conducting and must pass a 20,000 V dielectric-strength test. This headwear provides improved protection against electric shock following accidental contact between the headwear and exposed energized electrical sources; and
- (c) *Class C (Conducting Headwear)*—this Class is intended to provide the user with protection against impact and penetration only.

Protective headwear meeting the CSA requirements may have a brim around the entire circumference of the shell or have a partial brim with a peak.

ANSI Standard Z89.1

Type II helmets that meet ANSI Standard Z89.1-2003, *American National Standard for Industrial Head Protection*, may also be used at the workplace. The Standard applies to protective helmets intended to provide limited protection for the head against impact, flying particles, electric shock or any combination of these hazards.

The Standard divides protective helmets into two types and three classes according to their intended use. Type I helmets are intended to reduce the force of impact resulting from a blow only to the top of the head. Type II helmets are intended to reduce the force of impact resulting from a blow that may be received off-centre or to the top of the head. The three classes are as follows:

- (a) *Class G (General Use)*—this Class is intended to reduce the danger of contact exposure to low voltage conductors and must pass a 2200 V dielectric-strength test;
- (b) *Class E (Electrical Trades)*—this Class is intended to reduce the danger of contact exposure to high voltage conductors and must pass a 20,000 V dielectric-strength test; and
- (c) *Class C (Conductive—no electrical protection)*—this Class is designed specifically for lightweight comfort and impact protection. This Class is usually manufactured from aluminum and offers no dielectric protection.

ANSI types and classes are combined to provide products classified as Type I, Class G or Type II, Class E, etc. Helmets meeting the ANSI requirements may have a brim around the entire circumference of the helmet shell or have a partial brim with a peak.

CEN Standard EN 12492

CEN Standard EN 12492: 2000, *Mountaineering equipment — Helmets for mountaineers — Safety requirements and test methods*, specifies safety requirements and test methods for safety helmets for use in mountaineering. Because they are intended for mountaineering, helmets meeting the requirements of this standard can only be used for industrial rope access work if the manufacturer's specifications allow the helmet to be used for industrial work at height.

The Standard requires a helmet:

- to have a retention system with three separate points of attachment to the shell. The helmet must have a chin strap;
- to be ventilated; and
- to be able to withstand a specified impact force delivered to the top, sides and rear of the helmet. The force transmitted to the headform must not exceed 10 kN.

UIAA Standard 106

UIAA Standard 106: 2004, *Mountaineering and Climbing Equipment — Helmets*, requires that the helmet meet all the requirements of CEN Standard EN 12492 but that the value of impact force transmitted to the headform during testing be limited to 8 kN rather than the 10 kN specified in CEN Standard EN 12492. Because they are intended for mountaineering, helmets meeting the requirements of this standard can only be used for industrial rope access work if the manufacturer's specifications allow the helmet to be used for industrial work at height.

Subsection 831(2) Helmet standards—lateral impact unlikely

If the possibility of lateral impact to the head is unlikely, the headwear can meet the requirements of one of the standards listed in this subsection. Because helmets designed for lateral impact protection are subjected to impact tests to the crown, the majority of the standards listed in subsection 831(1) also appear here. Readers should refer to that subsection for information about each of those standards. The only standard not included in that subsection but which appears in this subsection is CEN Standard EN 397: 2006, *Industrial safety helmets*.

This Standard specifies physical and performance requirements, methods of test and marking requirements for industrial safety helmets. The mandatory requirements apply to helmets for general use in industry. This Standard requires the following of a helmet:

- ventilation holes in the helmet shell are optional;
- the helmet must be able to withstand a specified impact force delivered to the top of the helmet. The force transmitted to the headform must not exceed 5 kN;
- the chin strap must open when subjected to a force ranging between 150 and 250 N; and
- optional requirements include a low temperature test, very high temperature test, electrical resistance, lateral deformation, and molten metal splash.

Section 832 Headwear retention system

To ensure that the protective headwear remains on the worker's head despite his or her position or orientation while working, the protective headwear must have a retention system. The retention system must have at least three separate points of attachment to the helmet shell and must include a chin strap.

Section 833 Worker to secure headwear

The employer must ensure that workers secure their protective headwear according to the manufacturer's specifications.

Section 834 Full body harness

For compliance purposes, the full body harness must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the full body harness meets the requirements of at least one of the listed Standards. A full body harness bearing a CE mark is considered acceptable for the purposes of the *OHS Code*, as is a full body harness bearing the UIAA label. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the full body harness already bears a CE mark.

Each of the listed harness standards recognizes the use of a sternal attachment point for rope access work.

NFPA Standard 1983

NFPA Standard 1983: 2006, *Standard on Fire Service Life Safety Rope, Harness and Hardware*, as a Class III harness. A Class III life safety harness is one that fastens around the waist, around the thighs or under the buttocks and is designed for rescue where two-person loads may be encountered and inverting may occur. A Class III life safety harness must meet the following requirements:

- all webbing, stitching and riveting must withstand a tensile test of at least 26.7 kN (6000 lbs-force) without failure;
- fibre used in the construction of the harness, including webbing, thread, and labels must have a melting point of at least 204°C (400°F); and
- drop testing is done in accordance with ANSI Standard A10.14, using a 136 kg (300 lb) manikin.

CEN Standard EN 361

CEN Standard EN 361: 2007, *Personal protective equipment against falls from a height—Full body harnesses*, specifies the requirements, test methods, marking, information supplies

by the manufacturer and packaging for full body harnesses. Drop testing involves both feet first and head first drops of a 100 kg mass through a free fall distance of 4 m.

ANSI Standard Z359.1

ANSI Standard Z359.1-2007, *Safety requirements for personal fall arrest systems, subsystems and components*, establishes requirements for the performance, design, marking, qualification, instruction, training, inspection, use, maintenance, and removal from service of connectors, full body harnesses, lanyards, energy absorbers, anchorage connectors, fall arresters, vertical lifelines, and self-retracting lanyards comprising personal fall arrest systems for users within the capacity range of 59 to 140 kg (130 to 310 pounds).

Connecting components

Section 835 Standards

For compliance purposes, the connector must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the connector meets the requirements of at least one of the listed standards. A connector bearing a CE mark is considered acceptable for the purposes of this Code, as is a connector bearing the UIAA label. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the connector already bears a CE mark.

CEN Standard EN 362

CEN Standard EN 362: 2004, *Personal protective equipment against falls from height. Connectors*, specifies the requirements, test methods, instructions for use and marking for connectors. Connectors according to this Standard are used in work positioning and fall arrest systems specified in EN Standard EN 358 and EN Standard 363 respectively. Lanyards with connectors as terminations are specified in EN Standard 354.

The Standard defines a connector as a connecting element or component of a system. Carabiners are one type of connector covered by the Standard. To reduce the probability of unexpected opening, connectors covered by the Standard must be self-closing and self- or manual locking. They must be capable of being opened only by at least two consecutive deliberate manual actions.

Connectors tested according to the Standard must be able to withstand a static strength test of at least 15 kN without tearing or rupture.

CEN Standard EN 12275

CEN Standard EN 12275: 1998, *Mountaineering equipment. Connectors. Safety requirements and test methods*, specifies safety requirements and test methods for connectors used in

mountaineering including climbing. This Standard defines “connector” as a device that can be opened, allowing a mountaineer to link himself or herself directly or indirectly to an anchor. Connectors are classified as types B (basic connector), H (HMS connector), K (Klettersteig connector), A (specific anchor connector), D (directional connector, excluding anchor connectors), Q (screwed gate connector—Quicklink), and X (oval connector). Depending on the type of connector, the minimum static strength required along the major axis of the connector with the gate closed ranges from 20 kN to 25 kN, although type X connectors require a minimum strength of 18 kN.

UIAA Standard 121

UIAA Standard 121: 2004, *Mountaineering and Climbing Equipment—Connectors*, requires that the connector meet all the requirements of CEN Standard EN 12275 and for type K connectors, additional strength and dimensional requirements are imposed.

CSA Standard Z259.12

CSA Standard Z259.12-01 (R2006), *Connecting Components for Personal Fall-Arrest Systems*, sets out design and performance requirements, test methods, and requirements for marking and labelling individual connecting components used as part of a personal fall arrest system (PFAS). This Standard applies to components that are

- (a) used in the interconnection of a complete unit referred to in other published Standards and/or projected Standards related to PFAS;
- (b) intended to be used as the primary single link to a permanent anchorage connector; and
- (c) intended to be used as a primary attachment point between two or more subsystems, as described and certified under other Standards related to PFAS.

According to the Standard, the term “connectors” refers to carabiners, D-rings, O-rings, oval rings, self-locking connectors and snap hooks used to interconnect the components of a personal fall arrest system. To comply with the CSA Standard, only snap hooks and carabiners that are self-closing and self-locking can be used as interconnecting hardware in fall arrest systems. For these connecting components to be acceptable for use, their gates require at least two consecutive, deliberate actions to open.

NFPA Standard 1983

Chapter 5 of NFPA Standard 1983: 2006, *Standard on Fire Service Life Safety Rope, Harness, and Hardware*, specifies design, labelling and performance requirements for connectors such as buckles, rings and snap-links. In terms of strength performance:

- (a) load-bearing hardware must withstand not less than a 5.3 kN (1200 lbs-force) tensile test without permanent deformation;
- (b) buckles must withstand a tensile test of not less than 22.2 kN (5000 lbs-force) without failure;

- (c) rings must withstand a tensile test of not less than 22.2 kN (5000 lbs-force) without failure; and
- (d) snap-links must withstand a tensile test of not less than 22.2 kN (5000 lbs-force) without failure when tested in manner of function.

Section 836 Acceptable styles of carabiners

Auto-locking and auto-closing carabiners reduce the likelihood of a carabiner being unintentionally left open, resulting in a potential worker injury or death. However, this type of carabiner may not be appropriate in all situations, e.g., manipulating a screw-gate carabiner while wearing welding gloves or cold weather gloves/mittens can be much easier than trying to manipulate a self-locking, self-closing carabiner under the same conditions. As a result, screw-gate type carabiners that lock manually are acceptable for use in industrial rope access systems.

Non-locking carabiners are not allowed for use in industrial rope access systems.

Section 837 Ascenders

An ascender is a rope adjustment device which, when attached to an anchor line of appropriate type and diameter, locks under load in one direction and slides freely in the opposite direction. Ascenders are normally used to ascend the working line or position the worker on the working line.

Ascenders used in industrial rope access systems must be approved to one or more of the listed standards. Compliance with these standards reduces the likelihood that an ascender will accidentally detach from the line/rope and limits the risk of damage to the line/rope when in use.

Typically, there are two types of ascenders used in a rope access system. The first is used to connect the worker directly to the working line; the other type is attached to a foot loop to aid climbing, and is also connected back to the harness to provide additional security. Ascenders should be of a type that cannot be accidentally detached from the line and should be chosen so that the risk of damage to the line is minimized during use. Any dynamic loading should be avoided, as damage could result to either the ascender or the line.

For compliance purposes, the ascender must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the ascender meets the requirements of at least one of the listed standards. An ascender bearing a CE mark is considered acceptable for the purposes of this Code, as is an ascender bearing the UIAA label. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the ascender already bears a CE mark.

CEN Standard EN 567

CEN Standard EN 567: 1997, *Mountaineering equipment — Rope clamps — Safety requirements and test methods*, specifies safety requirements and test methods for rope clamps for use in mountaineering, including climbing. A rope clamp is a mechanical device which, when attached to a rope or an accessory cord of appropriate diameter, locks under load in one direction and slips freely in the opposite direction.

UIAA Standard 126

UIAA Standard 126: 2004, *Mountaineering and Climbing Equipment — Rope Clamps*, requires that the ascender meet all the requirements of CEN Standard EN 567 plus an additional safety requirement that applies to rope clamps used for self-belaying.

NFPA Standard 1983

Chapter 5 of NFPA Standard 1983: 2006, *Standard on Fire Service Life Safety Rope, Harness, and Hardware*, specifies design, labelling and performance requirements for ascent devices. Ascent devices must withstand a tensile test of not less than 5.3 kN (1200 lbs-force) without failure when tested in manner of function.

Section 838 Back-up devices

Back-up devices are used to attach the worker to the safety line. In the event of a failure of the working line or loss of control by the worker, back-up devices are intended to lock on to the safety line without causing catastrophic damage to the line and also to absorb the limited shock load that might occur. The device acts to prevent or restrict a fall. Back-up devices used in industrial rope access systems must be approved to one or more of the listed standards.

For compliance purposes, the back-up device must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the back-up device meets the requirements of at least one of the listed standards. A back-up device bearing a CE mark is considered acceptable for the purposes of this Code, as is a back-up device bearing the UIAA label. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the back-up device already bears a CE mark.

CEN Standard EN 353-2

CEN Standard EN 353-2: 2002, *Personal protective equipment against falls from a height — Part 2: Guided type fall arresters including a flexible anchor line*, specifies the requirements, test methods, marking, information supplied by the manufacturer and packaging for guided type fall arresters including a flexible anchor line which can be secured to an upper anchor point. A “guided type fall arrester” travels along an anchor line,

accompanies the user without requiring manual adjustment during upward or downward changes of position, and locks automatically on the anchor line when a fall occurs. A “flexible anchor line” may be a synthetic fibre rope or a wire rope and is to be secured to an upper anchor point.

CEN Standard EN 567

CEN Standard EN 567: 1997, *Mountaineering equipment — Rope clamps — Safety requirements and test methods*, specifies safety requirements and test methods for rope clamps for use in mountaineering including climbing. A rope clamp is a mechanical device, which, when attached to a rope or an accessory cord of appropriate diameter, locks under load in one direction and slips freely in the opposite direction.

UIAA Standard 126

UIAA Standard 126: 2004, *Mountaineering and Climbing Equipment — Rope Clamps*, requires that the back-up device meets the requirements of CEN Standard EN 567 plus an additional safety requirement that applies to rope clamps used for self-belaying.

ANSI Standard Z359.1

ANSI Standard Z359.1-2007, *Safety requirements for personal fall arrest systems, subsystems and components*, establishes requirements for the performance, design, marking, qualification, instruction, training, inspection, use, maintenance, and removal from service of connectors, full body harnesses, lanyards, energy absorbers, anchorage connectors, fall arresters, vertical lifelines, and self-retracting lanyards comprising personal fall arrest systems for users within the capacity range of 59 to 140 kg (130 to 310 pounds).

Section 839 Descenders

Descenders are used to attach the worker to the working line and to control descent. Descenders should give the worker control over the speed of descent and should not cause undue shock loads to the working line when braking. If the worker loses control, the descender must stop the worker or allow only a slow, automatically controlled descent in the hands-off position. In addition, descenders should not cause significant abrasion of the rope sheath when suddenly clamped onto the working line. Descenders should be of a type that cannot be accidentally detached from the working line or become detached under any circumstances while supporting the worker’s weight.

For compliance purposes, the descender must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the descender meets the requirements of at least one of the listed standards. A descender bearing a CE mark is considered acceptable for the purposes of the *OHS Code*. The CE mark—*Conformite Europeenne*—indicates that the company manufacturing the product has met the requirements of one or more European directives.

Standard EN 341

Standard EN 341: 1997, *Personal protective equipment against falls from height — Descender devices*, specifies requirements, test methods, marking and instructions for use for descender devices as rescue equipment to be used in conjunction with personal protective equipment against falls from a height, e.g., full body harnesses, or rescue equipment, e.g., rescue harnesses. Descender devices are a means by which a worker can, at a limited velocity, descend from a higher to a lower position either on his or her own or assisted by a second person.

For a Class A descent device, the descent velocity must be maintained between 0.5 m/s and 2 m/s. In the case of hand operated devices, the velocity must not exceed 2 m/s after the control device is released. During the descent the descent velocity must be almost constant.

NFPA Standard 1983

Chapter 5 of the NFPA Standard 1983: 2006, *Standard on Fire Service Life Safety Rope, Harness, and Hardware*, specifies design labelling and performance requirements for descent devices. Descent devices must withstand a tensile test of not less than 1200 lbs-force without permanent distortion and not less than 22.2 kN (5000 lbs-force) without failure. Both tests must be performed in manner of function.

Non-industrial Rope Access Work

Non-industrial rope access work is defined in the *OHS Code* as work activities performed within a recreational or sport context that incorporates a working line and a sit harness or full body harness in combination with other devices during:

- (a) mountaineering, caving and canyoning activities requiring the use of rope access techniques; or
- (b) climbing on artificial structures designed and built for the purpose of sport climbing.

Non-industrial rope access work includes the work activities of mountain guides, professionally certified mountain guides (Association of Canadian Mountain Guides—ACMG), guides involved in caving, workers involved in delivering outdoor education courses in rock and ice climbing and glacier travel, and workers who work at sport climbing walls and gyms.

Section 840 Safe work practices

Safe work practices used in non-industrial rope access work must be approved by a Director of Inspection. A Director of Inspection is a member of the staff of the Government of Alberta, appointed by the Minister under Section 42 of the *OHS Act*.

At the time of publication of this Explanation Guide, the following publications were considered to present acceptable and appropriate safe work practices. Following the safe work practices does not mean that workers must be certified by one or more of the organizations that prepared the publications.

- (a) The Government of Alberta recognizes the *Technical Handbook for Professional Mountain Guides* (June 1999), published by the Association of Canadian Mountain Guides (ACMG) as providing a set of safe work practices suitable for safeguarding workers during mountaineering and canyoning activities that involve the use of rope access techniques while climbing on snow, ice, and/or rock. The techniques and skills described in the *Handbook* are intended to assist guides in decision-making and provide a variety of tools by which to guide within reasonable limits of safety.
- (b) The Government of Alberta recognizes the *Climbing Gym Instructor Technical Manual* (June 2003), published by the Association of Canadian Mountain Guides (ACMG) as providing a set of safe work practices suitable for safeguarding workers during rope access climbing on artificial structures such as climbing walls designed and built for the purposes of sport climbing. The *Manual* presents information that will help enhance the quality and safety of climbing at these facilities.
- (c) The Government of Alberta recognizes the *Cave Guiding Standards for British Columbia and Alberta* (March 2003) published by the Canadian Cave Conservancy, and the *British Columbia Cave Rescue Companion Rescue Workshop* (2005) published by British Columbia Cave Rescue as providing a set of safe work practices suitable for safeguarding workers during caving activities involving rope access techniques. Jointly, these publications present clear and simple standards for workers guiding groups through caves.

The referenced publications present safe work practices that have been approved by a Director or Inspection as providing workers with an appropriate level of safety. Other practices may be equally acceptable but must be reviewed by a Director of Inspection and then approved in writing. The referenced publications set the benchmark against which other safe work practices will be judged for approval purposes.

This approach has the advantage of government being able to recognize the safety practices of other organizations if those practices are considered to be equivalent to or better, in terms of worker safety, to those recommended in the referenced publications. A second advantage is that the legislation need not be amended in order to include another organization's or employer's practices—accepting other practices becomes a policy and administrative matter.

Copies of the ACMG publications can be purchased by contacting:

The Association of Canadian Mountain Guides
Box 8341
Canmore, AB T1W 2V1
Phone: (403) 678-2885 Fax: (403) 609-0070
acmg@acmg.ca

The other reference publications are available from the organizations responsible for publishing them.

Section 841 Worker competency

The employer is responsible for ensuring that workers performing recreational rope access work have the skills referred to in section 812, appropriate to the level of work assigned. The *OHS Code* considers a worker to be competent if the worker meets the following three conditions:

- (a) adequately qualified—the worker has some type of qualification, usually earned through a formal education program, training course, etc., or a combination of education and practical experience. With certain exceptions such as professional designations, e.g., professional engineer, nurse, physician, etc., or other legal requirement involving qualifications, the employer is responsible for evaluating and deciding if a worker is adequately qualified. The employer should be able to justify the basis on which a worker is considered to be “adequately qualified”;
- (b) suitably trained—the worker must have training that is appropriate to the tasks, equipment, etc., that will be performed or used. The employer is responsible for evaluating and deciding if a worker is suitably trained. The employer should be able to justify the basis on which a worker is considered to be “suitably trained”; and
- (c) with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision—determining whether a worker has sufficient experience to safely perform work is the employer’s responsibility. A worker’s qualifications, training and experience are no guarantee that work will be performed safely. The employer should be able to justify the basis on which a worker is considered to have “sufficient experience.”

An employer must ensure that a worker is trained in the applicable skills described in the referenced publications, appropriate to the activity being undertaken and the worker’s level of responsibility. The publications are briefly described in the explanation to section 840.

Sections 842 and 843 Fall factor, clearance, anchorage strength

Forces are created primarily by a falling climber and, while lead climbers generate the greatest forces, second falls can also produce significant loads. Since measuring the actual load is a complex process affected by many variable, means for measuring the relative severity of a fall rather than actual loads or force have been devised. Fall factor (FF) describes the relative severity of a fall.

Fall factor is a relationship between the forces generated in a fall and the shock absorbing qualities of the rope. Since climbing ropes are highly elastic they absorb tremendous amounts of energy as they stretch under load. Fall factor takes this stretch

into account when calculating the severity of a fall. Fall factor is expressed as the relationship between the total length of a fall divided by the amount of rope available to absorb the energy.

$$\text{Fall factor} = \text{length of fall} / \text{length of rope in service}$$

Referring to EN Standard 892 and UIAA Standard 101 for dynamic ropes (see the explanation to section 818 for more information about these standards), the peak forces generated in the rope cannot exceed:

- 12 kN in single ropes (single strand of rope);
- 8 kN in half ropes (single strand of rope); and
- 12 kN in twin ropes (double strand of rope).

These values are achieved with a rigid test apparatus. In real life situations, the rope system experiences slack and some degree of slippage and movement.

The dynamics of non-industrial rope access work and how an anchorage point may be used are far different from a worker using an anchor point for fall arrest. The anchor point(s) are under a constant and varying load depending upon the rope access technique being used. The maximum arresting force generated in a rope access environment can depend on many variables including, but not limited to, the length of rope in service, slack in the rope system, mass of the worker, type(s) of devices being used, slippage and movement of the rope in the system, and how secure the anchorage is against movement under load and the extent to which it might deform without failure. Combined, these factors make it extremely unlikely that the peak forces listed above would ever be experienced. A fall factor of 1.78 would, with the exception of lead falls, rarely be experienced.

Head Protection

Section 844 Headwear standards

Readers are referred to the explanation of section 831(1) for information regarding the referenced standards.

Section 845 Worker to secure headwear

The employer must ensure that workers secure their protective headwear according to the manufacturer's specifications.

Section 846 Headwear remaining in service

Protective headwear in good condition and meeting an earlier edition of the standards listed in section 844 may remain in service. However, the headwear should be replaced at the replacement interval recommended by the manufacturer.

Section 847 Sit harness

For compliance purposes, the sit harness must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the sit harness meets the requirements of at least one of the listed standards. A sit harness bearing a CE mark is considered acceptable for the purposes of the *OHS Code* as is a sit harness bearing the UIAA label. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the sit harness already bears a CE mark.

CEN Standard EN 813

CEN Standard EN 12277: 1998, *Mountaineering equipment—Harnesses—Safety requirements and test methods*, specifies safety requirements and test methods for harnesses for use in mountaineering including climbing. It is applicable to full body harnesses, small body harnesses (intended for persons up to 40 kg), sit harnesses and chest harnesses.

UIAA Standard 105

UIAA Standard 105: 2004, *Mountaineering and Climbing Equipment—Harnesses* requires that the sit harness meet all the requirements of CEN Standard EN 12277 plus an additional requirement for contrasting thread.

Section 848 Full body harness

For compliance purposes, the full body harness must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the full body harness meets the requirements of at least one of the listed standards. A full body harness bearing a CE mark is considered acceptable for the purposes of this Code. The CE mark—Conformite Européenne—indicates that the company manufacturing the product has met the requirements of one or more European directives.

CEN Standard EN 361

CEN Standard EN 361: 2007, *Personal protective equipment against falls from a height—Full body harness*, specifies the requirements, test methods, marking, information supplied by the manufacturer and packaging for full body harnesses. Drop testing involves both feet first and head first drops of a 100 kg mass through a free fall distance of 4 m.

ANSI Standard Z359.1

ANSI Standard Z359.1-2007, *Safety requirements for personal fall arresting systems, subsystems and components*, establishes requirements for the performance, design, marking, qualification, instruction, training, inspection, use, maintenance, and removal from service of connectors, full body harnesses, lanyards, energy absorbers, anchorage connectors, fall arresters, vertical lifelines, and self-retracting lanyards comprising personal fall arrest systems for users within the capacity range of 130 to 310 pounds (59 to 140 kg).

Section 849 Connecting components

In non-industrial rope access work, workers are allowed to use both locking and non-locking carabiners, appropriate for the working conditions. Non-locking carabiners are commonly used when connecting to protection during lead climbing and connecting slings to anchor systems. Locking carabiners can be self-locking and self-closing or use a locking screw-gate.

For compliance purposes, the connector must bear the mark or label of a nationally accredited testing organization such as CSA, UL, SEI, etc. as evidence that the connector meets the requirements of at least one of the listed standards. A connector bearing a CE mark is considered acceptable for the purposes of the *OHS Code* as is a connector bearing the UIAA label. The CE mark—Conformite Europeenne—indicates that the company manufacturing the product has met the requirements of one or more European directives. A UIAA label cannot be used unless the connector already bears a CE mark.

CEN Standard EN 12275

CEN Standard EN 12275: 1998, *Mountaineering equipment—Connectors. Safety requirements and test methods*, specifies safety requirements and test methods for connectors for use in mountaineering including climbing. The Standard defines “connector” as a device that can be opened, allowing a mountaineer to link himself or herself directly or indirectly to an anchor. Connectors are classified as type B (basic connector), H (HMS connector), K (Klettersteig connector), A (specific anchor connector), D (directional connector, excluding anchor connectors), Q (screwed gate connector—Quicklink), and X (oval connector). Depending on the type of connector, the minimum static strength required along the major axis of the connector with the gate closed ranges from 20 kN to 25 kN, although type X connectors require a minimum strength of 18 kN.

UIAA Standard 121

UIAA Standard 121: 2004, *Mountaineering and Climbing Equipment—Connectors*, requires that the connector meet all the requirements of CEN Standard EN 12275 and for type K connectors, additional strength and dimensional requirements are imposed.